

THE UPLAND PLOVER AT FAVILLE GROVE, WISCONSIN

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THIS study was conducted on the Faville Grove Wildlife Area, a 2,400 acre tract composed of 10 farms, situated in Jefferson County, Wisconsin, two miles north of Lake Mills. It lies on the west bank of the Crawfish River, a glacial outwash stream meandering through wide level bottoms. The Upland Plovers (*Bartramia longicauda*) are confined in the Faville Grove area to these bottoms, 1,600 acres of which are within the plover range covered in this study.

Of this Upland Plover range, nearly half is pasture, nearly half is in corn, small grain, or hay; one quarter-section is ungrazed prairie hay meadow. The pastures include a few remnants of oak-hickory groves (*Quercus macrocarpa* and *Carya ovata*).

There are three soil types on this bottom: Clyde silt loam, Miami silt loam and peat. The plovers use only the Clyde and peat soils. We do not know whether this aversion to the Miami soils is due to the soil itself, or to the bush willows and oak-hickory groves which occupy it. In southwestern Wisconsin Upland Plovers are not confined to bottoms.

POPULATION TREND

From 1870 to 1890, old residents at Faville Grove remember that "prairie pigeons" or Upland Plover were very common and "running all over the hayfields." Between 1895 and 1920 the same men remember no plovers, but John Hooper, in his journal, mentions a nest with four eggs in 1904. In 1920, at least one pair was seen during haying season. Apparently the birds slowly increased from 1920 to 1935, at which time the first census showed eight nesting pairs.

The upward trend at Faville Grove is attested by our census counts:

Year	Spring Count (1,600 acres)	Fall Count
1935	8 pairs	24 birds
1936	10 pairs	32 birds
1937	16 pairs	50 birds
1938	25 pairs	61 birds
1939	22 pairs	80 birds

Roberts reports a similar trend for Minnesota. He says (1932): "It was during the period from 1895 to about 1900 that it disappeared so rapidly from the whole southern part of the state. Gradually . . . the depleted ranks were recruited, and since about 1920 it has been once more in evidence. . . . Reports received during the spring of 1931 show clearly that the Upland Plover is reappearing in steadily increasing numbers. . . ."

Beck (1938) is also "impressed by the apparent increase within the last ten years" in central Pennsylvania.

Wetmore (1926) found a corresponding decline on the winter range in South America.

PRE-NESTING PERIOD

Spring arrival dates for the Upland Plover vary little from year to year:

Year	Arrival Date	Year	Arrival Date
1935....	April 14	1938....	April 13
1936....	April 19	1939....	April 22
1937....	April 14		

The first birds to arrive always appeared in the same field during each of the past five years. Perhaps this field is the nesting territory of individuals that always come early. The successive arrivals settled upon the fields which later became nesting territories.

Censuses repeated every few days show that there is a gradual and steady infiltration of birds from the arrival date to about two weeks later, at which time all the local birds have arrived. We found no evidence that transient birds stop here in the spring.

Upland Plover separate into pairs and set up their home range soon after arrival; in fact, most of the birds are paired on arrival and exhibit courtship behavior when first seen. In 1938 all of the birds were paired within two weeks after the first arrival. The last birds to pair arrived as a group of six. We thought they were smaller than average and had less yellow on their bills. Could these be late hatches of 1937? (The physiological status of paired and unpaired plovers will be described in a later paper.)

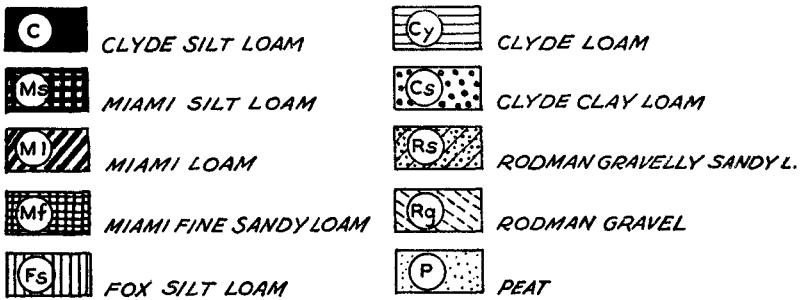
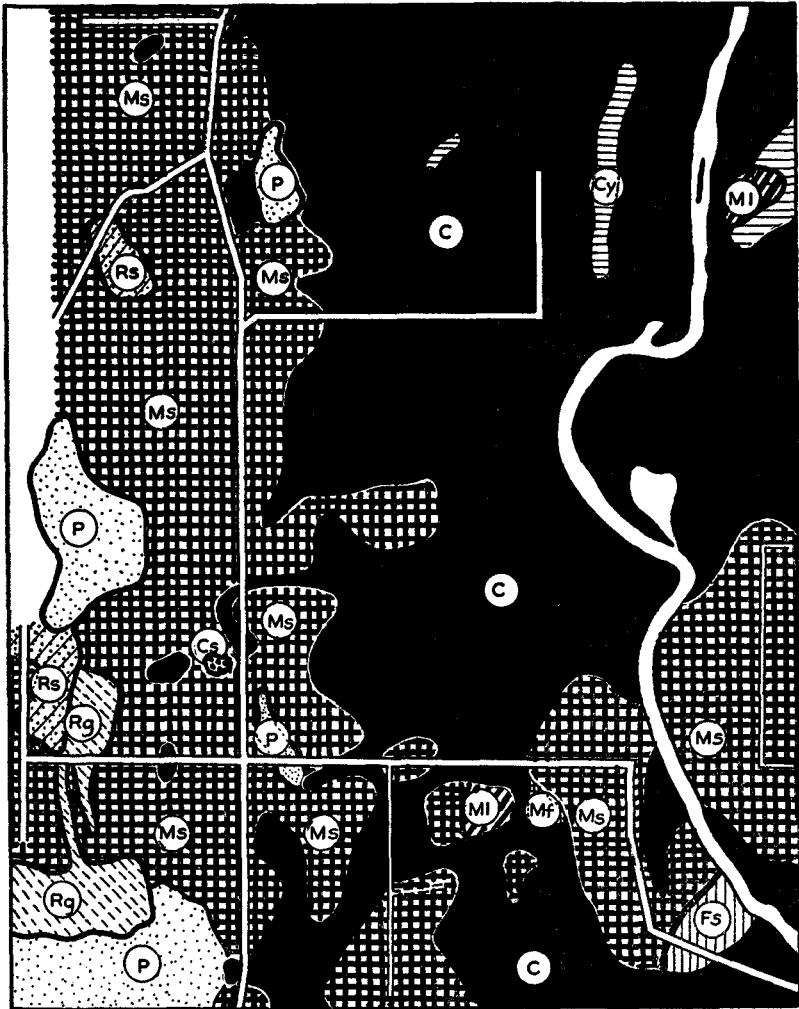
The nesting territories are usually grouped. Early in the season a paired male has been seen to resist and drive off another trespassing male. Such intrusion is believed to be accidental in some cases, the invader not seeing the pair in the tall grass. After all birds are paired and have established nesting sites, no fighting is seen.

As in other territorial species, stormy weather temporarily reverses the tendency to pair off. On May 3, 1935, a snowstorm caused all Upland Plover, paired and unpaired, to assemble into large groups which sought snowless spots on roads. After the storm subsided, the groups again broke up into pairs.

COURTSHIP

The Upland Plover has no less than four call notes, of which two are distinctive and diagnostic of breeding ground phenology. One of these will be referred to as the short whistle, and the other as the long whistle.

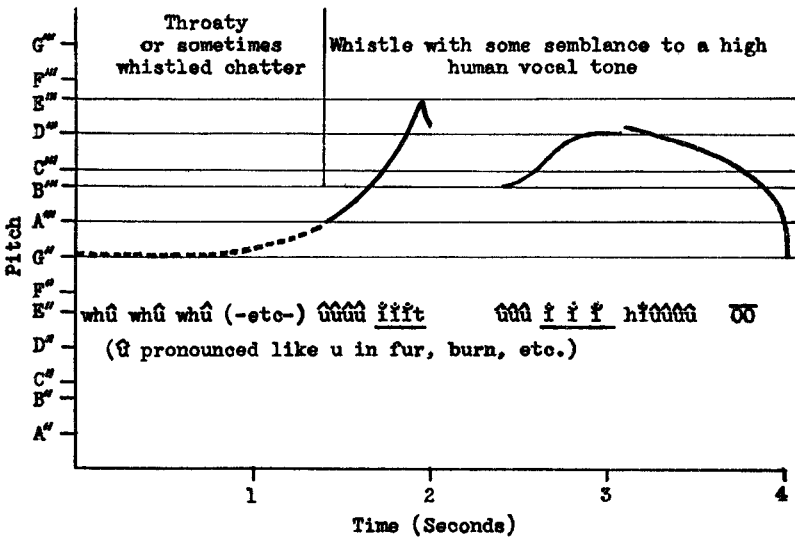
The short whistle consists of from six to ten short, very rapidly



Text Fig. 1. Soil types of Faville Grove wildlife area; 1½ inches equal one mile.

uttered syllables, all at the same pitch. This bubble-like *quip-ip-ip-ip-ip-ip-ip-ip* is given by both the male and the female from the time the birds arrive in the spring until they leave in the fall. Both birds give this whistle when flushed; after they have been sitting on a fence post for some time, while feeding or resting; or while in a straight a-way flight.

H. H. Axtell, after studying the long whistle at Faville Grove on May 20, 1937, wrote the following description: "It is introduced by a series of notes, all on about an even pitch, and delivered so rapidly as to form a sort of chatter, usually of a throaty quality but sometimes of a purer tone. After a second or so the chatter begins to rise in pitch and almost immediately becomes a smooth, unbroken whistled tone, slurring upward from the chatter which is pitched usually near the third G above middle C, through about three and a half tones to about the D above, where the tone is abruptly cut off with a quick grace note, like a 'catch in the voice.' In about two-fifths of a second the song continues with another gradual upward slur from about B to D where again there is a slight break in the voice, scarcely perceptible, after which the pitch descends in a long whistled wail." Axtell further describes the long whistle by syllabication, tone, quality, and time in Text figure 2. Both the male and the female give this whistle prior to the nesting season, either when alighting or when circling high in the



Text Fig. 2. Long whistle of the Upland Plover.

air. During the nesting season, after the female has flushed from her nest, the male will rise high over the nest and repeat this whistle until the intruder has left the vicinity. Such "protest" whistling by the male occurs only near its territory. No female has been known to give this

whistle during nesting season. This holds true for both incubating females and females which have lost their nests.

After the nesting season, both birds give the long whistle, but less frequently than prior to breeding. Both male and female use this whistle from arrival time in early spring until migration behavior begins in late summer.

The Upland Plover uses two characteristic wing beats while on the summer range: the "flutter stroke" and the long wing beat. The flutter stroke scarcely rises above the horizontal, and is followed by a long, slow glide. This stroke is too rapid for the eye to count accurately, but it has been timed at from six to nine strokes per second. The wing action seems mostly confined to the outer half of the wing. At the bottom of each stroke the outer wing seems curved downward at a considerable angle, like the wing of a duck which is dropping into decoys. The flutter stroke is used exclusively by both sexes from the time the first bird arrives in the spring until after the nesting season.

Immediately after nesting there is a gradual transition from the flutter stroke to the long wing beat. The long beat resembles the ordinary flight of the Killdeer or of the Yellow-legs, except that it is faster. It averages from three to five strokes per second. The up-stroke passes well above the horizontal. When at the bottom of the stroke, the wing does not appear curved as in the flutter stroke, and passes through a longer arc.

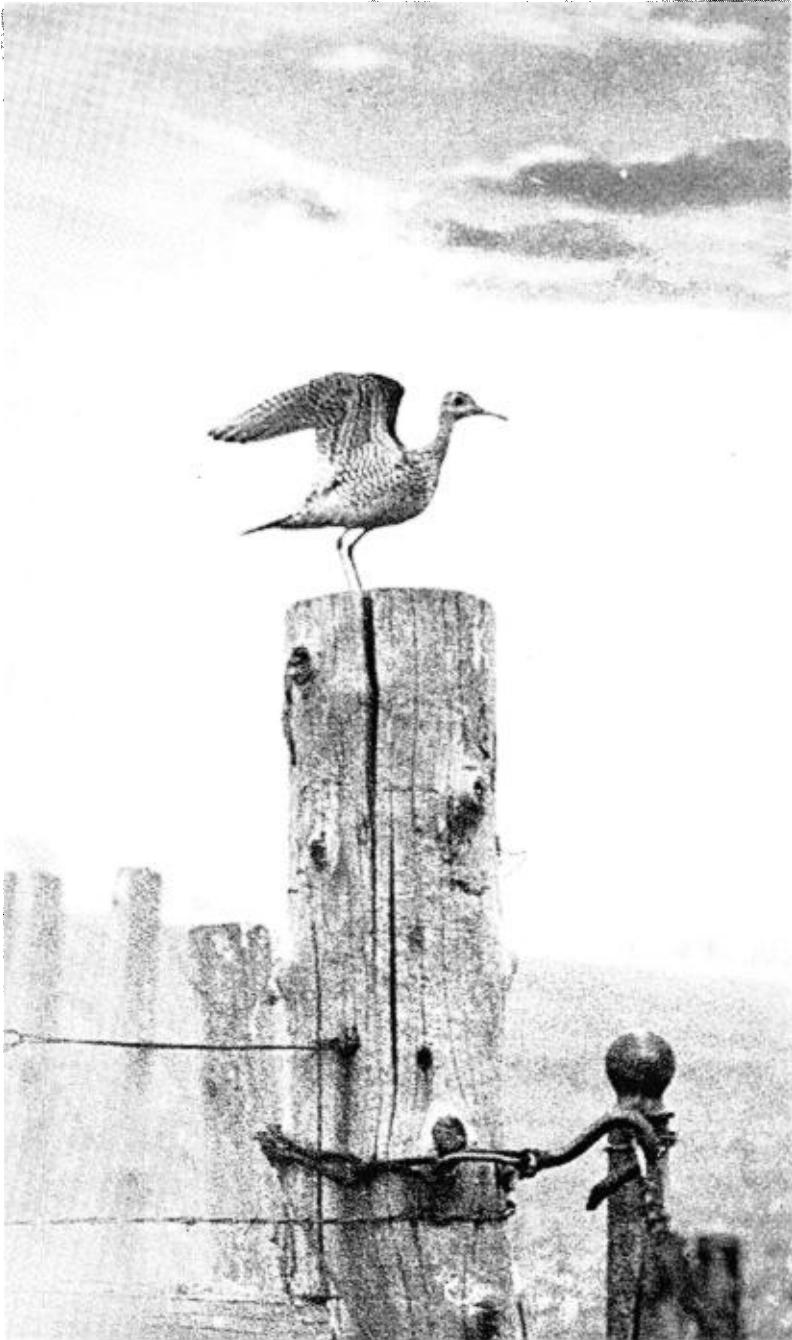
T. T. Waddell and H. R. Siegler (*letter*) remark of the flight habits in Colorado County, Texas: "Plover do not show mating flight upon arrival in spring. Near the time of departure they begin to hover over fence posts. Upon return in summer they do not demonstrate mating flight." Apparently the Upland Plovers leave their wintering grounds using the long wing beat and change to the flutter stroke before they arrive at the northern breeding grounds but after arriving in the Gulf States.

H. A. Hochbaum (*letter*) observed a single Upland Plover using the long wing stroke on May 2, 1939, at Delta, Manitoba. This was the first spring arrival he recorded for that region and may have been a bird migrating to its breeding ground farther north. The next day he saw three using the flutter stroke.

Weather affects the time plovers change to the long wing beat. A sudden drop in temperature causes an increase in the number of birds using the long wing beat.

NESTING PERIOD

From 15 to 20 days after the first Upland Plover arrives in the spring, whistling decreases conspicuously, and birds are seldom seen. These are our first clues that nesting has begun and that nest-hunting must begin at once, for the entire nesting season is spread over a period of not more than two months.



Upland Plover

We found while making this study:

Year	Number of Nests	Area cruised
1935-36	2	No definite area covered
1937	21	70 acres
1938	26	240 acres
1939	7	No definite area covered

Occupied nests were found in numbers only in 1938. Most of the 1937 nests were found after the eggs had hatched and while we were cruising cut-over hayfields for nests of other game birds.

Two methods of nest-hunting were used during 1938. In hay, the crew combed the field walking slowly abreast, each man parting the vegetation with a stick. The distance between individuals was 6 to 10 feet, depending upon the density of the cover.

In tussock pastures a drag method was found to be most efficient. The drag is either a piece of conduit piping 12 feet or more in length, closed at both ends and partly filled with stones, or two cane poles lashed together in such a manner that they rattle as they bounce from tussock to tussock. Someone walks behind the drag to mark the spot from which the bird flushes. We found that incubating Upland Plovers flushed only after the drag crossed the nest. We tried using chain and rope as drags but found they often failed to flush the plover.

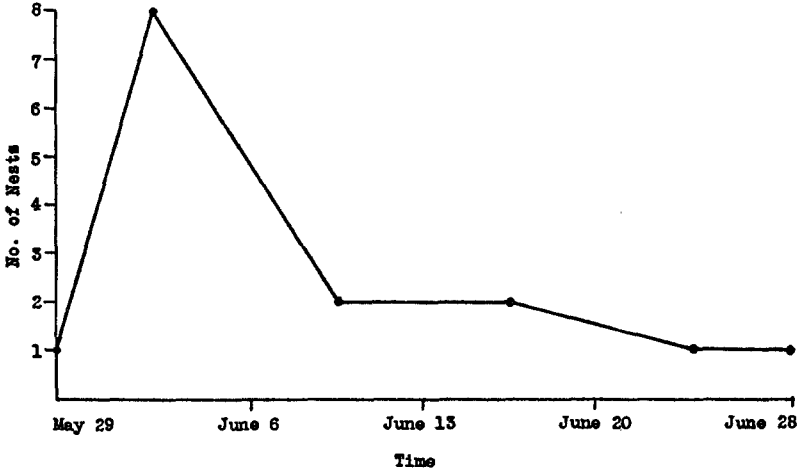
The actions of the male unmistakably reveal the whereabouts of the nest, provided the female has been flushed from it. He circles over the site, giving the long whistle. The flushed female usually flutters about 30 yards from the nest, giving the short whistle during the presence of the intruder. As the intruder comes nearer to the nest, the female comes in closer and whistles at shorter intervals.

In 1938 the first eggs were laid May 8 and hatched May 29. Text figure 3 shows the distribution of hatching dates for 15 nests. Hatching dates for 10 nests were actually observed, while for five the dates were deduced. Dates for 11 nests were discarded because hatching dates could not be interpolated closely. The steep initial rise of the curve supports the conclusion, first drawn in 1937, that Upland Plovers begin nesting almost in unison. The single peak shows that 53 per cent of all nests hatched within the first nine days of the hatching period. Hungarian Partridge (*Perdix perdix*) and Pheasants (*Phasianus colchicus*) using the same range showed, at least in 1937, a double peak. The second peak is believed to represent re-nesting of birds whose first attempts were unsuccessful.

The total spread of the hatching dates of Upland Plovers for 1938 was 31 days; for 1937 it was less, perhaps only 20 days. The total spread for Hungarian Partridge and Pheasants in 1938 was 100 days. The latter half of the plover curve may represent the later nesting of yearling birds and the re-nesting of a few others.

Evidently Upland Plovers began nesting earlier in 1935 and 1936 than they did in 1937 and 1938. On June 13, 1935, a nearly full-grown

plover was observed. In 1936, two broods of nearly full-grown plovers were seen on June 19.



Text Fig. 3. Distribution of Upland Plover hatching dates (1938).

Extreme individual differences have been observed in incubating birds. Seventeen incubating plovers were kept under observation during 1938; each nest was visited every other day until the 18th day, after which it was visited daily. During each visit the flushing distance was recorded. Invariably each bird had its characteristic flushing distance. Some would not allow the observer to approach closer than 6 feet. Others allowed the grass to be parted above their nests, and in several cases the observer actually touched the bird's back without flushing her. In two cases the incubating birds flushed regularly at about 4 feet, but on the day of pipping the birds refused to leave the nest in spite of our touching them.

Flushing Upland Plovers from their nests did not cause them to desert. Of the 17 nests periodically visited in 1938, not a single bird deserted. One bird was flushed 19 times. This unwillingness to desert is corroborated by Barton Sharp of Lancaster County, Pennsylvania, who tells us that he made a pull-string trap out of hardware cloth about 4 feet square and set it over the nest. When the plover was on the nest he tripped the trap and banded her. Even such rough treatment caused no desertion.

Damage to an egg, however, causes immediate desertion. At Faville Grove during 1938, a bird deserted after incubating for 14 days. All the eggs seemed in good condition and the nest was unmolested, but upon

closer examination a very small hole was discovered on the side of one of the eggs. On May 17, 1937, and in May, 1938, birds deserted their nests under nearly identical circumstances. In all three cases the hole appeared to be of the same size and when found occurred at the under side of the egg. What causes these punctures is unknown. Entomologists we have consulted know of no insect which punctures eggs.

The highest nesting density for any one field in 1937 and 1938 was $1\frac{1}{2}$ acres per nest. Other fields ranged from $2\frac{1}{2}$ to 15 acres per nest.

RE-NESTING

The first plover hatched in 1938 on May 29. Allowing three weeks for incubation and four weeks for the dependency of the young, a second brood could not reach mature size before September 1. Very few birds remain at Faville Grove until September 1; hence a second brood would have no time to prepare for migration. We therefore conclude that, at this latitude, the time-schedule alone precludes the possibility of second broods in this species.

We have strong evidence, however, that early nesting failures are sometimes followed by further attempts to nest. One evidence of re-nesting is that we found more nests than plovers. Thus in 1937 our census of breeding plovers was 20 pairs, and we found 19 nests. We also found remains of 10 broken eggs which probably represent three additional nests, and two broods so recently hatched that the chicks could be caught by hand. These were far from known nests and must represent two more nests. It is, of course, incredible that on a range of 1,600 acres all the nests should be found or accounted for. Since 20 pairs produced at least 24 nests, the Upland Plover must re-nest in some cases. A similar excess of nests over pairs was found in 1938.

Further, though less conclusive, evidence for re-nesting is found in the observed history of a pair occupying an isolated territory. On May 17 this pair was observed mating. Two days later a nest containing a complete clutch of eggs was found about 100 yards from the site of mating. Later this nest was deserted. On July 16 a nest containing three hatched shells was found within the territory of this pair. The instance is not conclusive, for we cannot prove that both nests were built by the same pair. L. E. Hicks tells us that Upland Plovers re-nest in Ohio if the season is not too far advanced.

While some pairs re-nest, there is evidence that not all nesting failures are followed by re-nesting. On May 3, 1938, a field which had been used regularly by eight plovers was plowed. The behavior of birds, both during and after plowing, indicated two nesting pairs. After plowing, two pairs remained for six weeks, but nesting behavior ceased. They did not whistle, they did not hide, they were not wary, and in general they displayed the behavior of birds whose family duties were over.

INCUBATION PERIOD

Bent (1929) wrote, "The incubation period is said to be 17 days, but this needs confirmation."

In 1937 Cleveland Grant observed an Upland Plover nest near Chicago in which the last egg was laid at 4:00 P.M. on one day and incubation had started the morning of the next day. It may have started during the night. This nest hatched on the 21st day after the beginning of incubation.

On May 11, 1938, at 3:00 P.M., an incubating bird was flushed from her nest of four eggs. At 5:00 P.M., a second incubating bird was flushed from her nest of four eggs. This same ground had been carefully cruised the day before, but no birds flushed from their nests; hence it is assumed that we flushed the birds on their first day of incubation. The nest found at 3 o'clock hatched on the 21st day at 10:00 A.M.; the nest found at 5 o'clock hatched on the 21st day at 6:00 P.M.

The period of incubation seems established at 21 days. The period of pipping, however, may be prolonged for as much as three days. In 1938 two nests pipped on the 21st day, but neither of them hatched until the 24th day. Other nests began hatching within an hour after pipping. The reason for prolonged pipping possibly lies in the negligence of the parent; in the two observed cases the incubating bird was absent from the pipping eggs during each of nine visits made at different hours during three days. In both cases all the eggs hatched, and the chicks appeared strong. Not all individuals are negligent during pipping. One incubating Upland Plover, after flushing during each of 10 visits, allowed herself to be touched while her eggs were pipping, yet she did not flush. Gallinaceous game birds are supposed to "sit tighter" during pipping.

NEST AND EGGS

Our observations conform to the nest description given by Bent (1929): "The nest was on a knoll in a sheep pasture where the grass had been cropped except for scattered tufts. . . . In one of these tufts, about a foot in diameter, a hollow had been scratched, 4 or 5 inches in diameter and nearly 3 inches deep; it was lined with small bits of dried grass and held four handsome eggs. Since then I have found several nests in Saskatchewan. These nests were all similarly located on the dry, grassy prairies, in slight hollows in the ground, about 4 inches in diameter and 2 inches deep, generally well hidden in rather long, thick grass; they were lined with pieces of dry grass, and the growing grass was artfully arched over them for protection."

Upland Plover nests are well hidden. We are not certain that the growing grass is artificially arched over the nest, but if it is not, then the old bird is usually careful to select only a site that will render the nest invisible from above. At the time nesting begins, such sites occur in

pastures largely in the tufts of tall grass fertilized by last year's cow dung. A high percentage of pasture nests was found in these tufts. In hayfields, nests were located in clumps of timothy or June grass, and had one side-opening only. Actual construction of the nest may not begin until after the first egg has been laid. In prairies, nests were usually located at the leafy base of an herb or shrub which obstructed vision from above. A late nest was placed beneath a prairie rose (*Rosa setigera*), which bloomed just as the eggs hatched. The flowers overhung the nest, and supplied under-cover which at that season was lacking in the rank vegetation surrounding the nest site. Roberts (1932) describes a similar case. He found one in early June "most beautifully placed beneath a bunch of pasque flowers, the leaves and fruiting plumes of which completely covered and embowered it, leaving only an entrance on one side."

Among American game birds, the Upland Plover has one of the largest eggs in proportion to the bird's size. Bent gives the measurements of 66 eggs in the United States National Museum as averaging 45 by 32.5 millimeters. Pheasant eggs at Faville Grove average 44 by 34 millimeters. A mature Pheasant weighs about six times as much as an Upland Plover, yet their eggs are similar in size. Bob-white (*Colinus virginianus*) eggs at Faville Grove average 32 by 19 millimeters. A mature Bob-white and a mature Upland Plover each weigh about 200 grams, yet the plover's egg is much larger. Plate 8 shows the comparative egg size and egg shape of these three species.

All completed clutches at Faville Grove consisted of four eggs, but there are reliable records that clutches of five sometimes occur. The American Museum of Natural History contains 11 sets of eggs taken by H. B. Bailey at Vermillion and Flandreau, South Dakota, in 1882. One set consists of five eggs, measurements of which show that its total volume was not much greater than the total volume of four normal-sized eggs. Of 30 other sets in the American Museum, 3 are incomplete and 27 consists of four eggs each. B. L. Sharp found four nests during the summer of 1938, one of which contained five eggs. Bent says, "The Upland Plover lays four eggs, rarely five. . . ."

Clutches containing less than four eggs are difficult to appraise, since the occurrence of three or two eggs may represent an incomplete clutch, or predation, or even the work of egg collectors. A nest under observation in 1938 contained four eggs from May 26 to June 4, but on June 5 only three. Incubation continued and no clue was found to the disappearance of the egg.

Like gallinaceous birds the Upland Plovers sometimes drop eggs in locations other than the nest. Two such "dropped eggs" were found, one of which had a "soft" (incompletely calcified) shell.

FERTILITY AND PIPPING OF EGGS

Of 104 eggs followed through to hatching, only three were infertile,

and none contained dead embryos. This indicates a higher fertility than Pheasants or Hungarian Partridge eggs showed on the same area during the same period.

The Upland Plover's manner of pipping is unusual. Both the Bob-white and the Pheasant pip the egg at right angles to its major axis, whereas the Upland Plover pips its egg parallel to the major axis, thus emerging from the side instead of the end. Plate 8 shows the hatched shells of a Pheasant, a Bob-white quail and an Upland Plover.

The shell is so fragile that the hatched chick often tramples and breaks the empty shells before it leaves the nest. The absence of a "cap" makes it hard to distinguish hatched shells from eggs broken before hatching. Moreover, it was found that empty shells had disappeared from 54 per cent of the hatched nests, evidently carried away by the mother bird. All three peculiarities make it difficult to interpolate the history of a hatching from egg shells.

Generally only the shell from the first-hatched chick is removed from the nest, but in two cases the shells from two hatched chicks were removed. The distance removed varied from 35 to 100 yards. This discovery of shell removal accounts, we believe, for some of the scattered stray shells found during previous nesting studies.

Upland Plover eggs of a given clutch do not pip or hatch simultaneously. The elapsed time from the first piped shell to the last hatched egg varied from 18 hours to three days. The usual time was 24 hours. After the first chick hatches, the others follow at intervals of about two hours. Although this interval between chicks varies in different clutches, in any one clutch it seems to be very uniform.

Once a chick is out of the shell, it loses no time getting out of the nest. The first chick to hatch is usually out of the nest before the last chick has freed itself from its shell.

Eggs always hatched less than a day apart, and no incubating plover was ever flushed from an incomplete clutch. These facts indicate that incubation in this species never begins before the clutch is complete.

CHOICE OF NESTING SITES AND SUCCESS OF NESTS

Table 1 shows the prevalence of nests in different cover types. The data represent the actual choice of sites, for in each of the two years we found as many nests as pairs, so there is no chance that the data show where we happened to find nests, rather than where the plovers nested.

The single nest found in 1938 in a hayfield of alfalfa and sweet clover is the first nest we have so far recorded in leguminous hay, and the second that we know of. Hess (1910), of Champaign County, Illinois, says he found a nest of four eggs in a clover patch on May 16, 1906.

Legume hays are exotics. Can the plover have an aversion for exotic plants? Hardly, for they nest in quack grass, June grass and in

canary grass. It seems possible, however, that some plants fail to fit the "innate perceptory pattern" of the plover, and thus are "avoided" as nesting sites.

TABLE 1.

CHOICE OF NESTING COVER SHOWING MORTALITY IN EACH TYPE OF COVER

Type of nesting cover	No. of nests	Unsuccessful nests	Predators
1938:			
June grass pastures	11	6	4 by cattle; 2 by skunks
June grass, timothy and quack hayfields	7	2	1 by Crow; 1 by mink
Ungrazed prairie	4	2	1 by Crow; 1 by skunk
Canary grass pasture.....	2	1	1 by cattle
Timothy hayfield	1	0	
Alfalfa-sweet clover hayfield....	1	26	0 11(42%) (5 by cattle, 3 by skunks, 2 by Crow, 1 by mink)
1937:			
June grass pastures	7	5	
June grass, timothy and quack hayfields	14	21	5(31%) Predator not known
		47	16(34%)

The choice of nesting sites possibly changes as the season advances. As between a pasture and an adjacent similar ungrazed prairie hay meadow, simultaneous cruising revealed only early nests on the former and only late nests on the latter.

The Upland Plover nest mortality (34 per cent) shown in Table 1 is only half that usual in gallinaceous game birds. Pheasants at Faville Grove lost 68 per cent of their nests in 1938. Mowing caused no mortality in plover nesting, but is one of the causes of high nesting mortality in Pheasants.

The loss by cattle arises from trampling, not exposure. The nests are built in ungrazed tufts about old dung. Such tufts are seldom cropped by cattle.

It is impossible to relate predation loss to nesting site. The short season, narrow range of cover conditions, and small number of nests all combine to prevent this.

In 1939, the shells from 15 eggs were collected from the ground beneath trees in which Crows (*Corvus brachyrhynchos*) had perched while eating the eggs. These shells represent at least four nests. Since our census showed there could be not more than 22 nests, Crows caused at least a 14 per cent nesting mortality in 1939.

TERRITORY

Each Upland Plover territory consists of a nesting site plus a loafing

and feeding ground. The nest belongs to the pair; the loafing and feeding ground is a community affair. The feeding and loafing field must be near the nesting site; a field occupied by plovers prior to the nesting season usually has one or more nesting sites close to or bordering it.

Observations at Faville Grove suggest a delicate distinction between acceptable and unacceptable nesting sites. A slight change in an accepted field may cause it to become unacceptable. We had the impression that heavy grazing, early grazing, standing water, burning and manuring all reduced or excluded nesting from fields accepted the previous year. Weeds and brush exclude plover.

These are reasons for rejection which we thought we could see; in other cases fields were rejected for no reason visible to us. A three-acre June grass and timothy hayfield was occupied by two pairs of nesting birds in 1937 and again in 1938; an adjoining June grass pasture of more than 30 acres did not attract nesting birds.

At Faville Grove grassy hay meadows or tussock pastures were usually selected as nesting sites.

The loafing ground consists of a pasture with low tussocks, a prairie meadow with sparse vegetation not taller than the plover's back, or a hayfield containing open patches that allow freedom of vision. The loafing ground must be adjacent to the nesting site to make it acceptable.

Plovers are hard to see in the nesting site until the eggs have hatched. During feeding and loafing hours the birds are easy to see on the loafing ground.

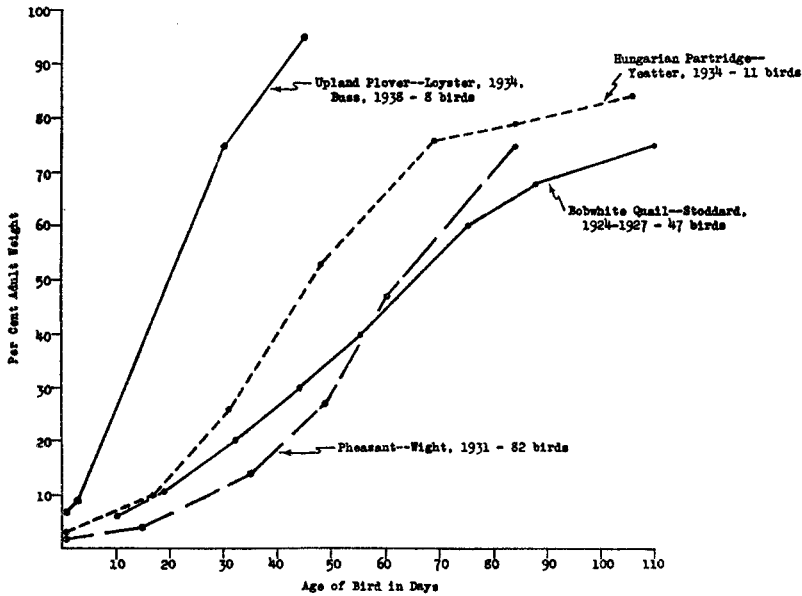
On one occasion we noted an attempt of the plover to keep its nesting site exclusive. On May 27, 1937, one bird of a pair repeatedly repulsed the attempts of another pair to enter its territory. On the loafing ground, however, there is no exclusiveness. We repeatedly saw pairs of plovers feeding, resting, flying or dusting peaceably side by side.

The distribution of nests in an accepted field is sometimes puzzling. In 1937, seven nests were found in a 17-acre timothy field. The nests were grouped into two well-defined areas which strongly suggested colonial nesting. This same field contained five nests in 1938, but there was no grouping. Single nests are seldom found in any field.

POST-NESTING PERIOD

Text figure 4 compares the rate of development of the Upland Plover with the rate of development of three other species. The curves for pheasants, Bob-white and Hungarian Partridge all are similar in shape and are nearly parallel. The abrupt rise of the curve for plovers indicates the rapid development of this bird. More weights are needed to make this curve accurate, but the general direction is unmistakable. The per cent of adult weight of the young plover is considerably higher than that for the other three species at hatching. The average weight

of the young plover at the time of hatching is about 14 grams. Within three days the weight increases to about 17 grams. Earl Loyster, studying Upland Plover raised by Mrs. Taylor in Milwaukee County, found that in 25 days tail feathers were emerging from their quill sheaths, in 30 days the young birds showed complete plumage and appeared full-grown, and in 45 days the characteristic short whistle was developed. Our observations also show young plover reaching mature appearance within 30 days.



Text Fig. 4. Growth rate of Upland Plover compared with Pheasant, Bob-white quail, and Hungarian Partridge.

Very few species are able to carry a band at the time they hatch. The young plover has such large legs that it can carry a band as soon as it leaves the shell. During 1938 we banded 18 such newly-hatched birds. Although at least two other persons have banded young Upland Plovers, we know of no one who has banded them immediately upon hatching. In 1938, Barton Sharp tells us that he "banded four young which (he) found running at large" in a pasture. "They were about four to five days old." On July 6, 1934, Loyster banded four young plovers which were raised in captivity and released in Milwaukee County. These birds were 18 days old at the time they were banded and released.

The first nest hatched in 1938 on May 29. Twenty-four days later, June 22, we saw 15 birds in a single group. Some of these appeared to be full-sized young. As the plovers gather into groups, each group begins what looks like training for fall migration. During July the character of flight is gradually altered; the flutter stroke characteristic of nesting birds being replaced by the long stroke. Power and speed now characterize the plover's flight.

The flight transition is clearly visible. Thus in August most individuals were already using the long stroke, but a few were still using the flutter stroke. Some started a flight with one but changed to the other in mid-air. Fluttering birds were still solitary or in pairs, alighted on fence posts, occasionally gave the long whistle, and in general exhibited breeding behavior. Birds using the long stroke did none of these things.

During the fall migration Upland Plover populations at Faville Grove fluctuated in numbers. This is in marked contrast to the steady increase during spring migration. The fluctuations presumably arise from the arrival or departure of transient birds which stop in the fall but apparently not in the spring.

Migration from Faville Grove usually begins about August 1, and may continue as late as September 25. In southwestern Wisconsin, during 1939, the last plover of a known breeding group had migrated from its region by July 21. In central Illinois, during 1939, plovers were beginning to migrate by July 9. The last birds to leave Faville Grove were recorded for four years:

Year	Last bird seen on
1935	August 14
1936	August 10
1937	September 25
1938	September 10

FOOD HABITS

W. L. McAtee (1912) examined 163 stomachs, finding nearly one-half the food to be grasshoppers (Locustidae), crickets (Gryllidae), and weevils (Curculioninae); 97 per cent of its food is animal matter. The vegetable food comprises the seeds of buttonweed (*Abutilon theophrasti*), foxtail grass (*Setaria* spp.) and sand spurs. The animal foods included:

Insects

- Bugs (Hemiptera)
- Flies (Diptera)
- Moths (Lepidoptera)
- Ants (Formicidae)
- Other Hymenoptera
- Leaf Beetles (Chrysomelidae)
- Horseflies (Tabanidae)

Grasshoppers (Locustidae)
 Crickets (Gryllidae)
 May Beetles (Scarabaeidae)
 Click Beetles (Elateridae)
 Bill Bugs (Calendrinae—at least 9 species)
 Weevils (Curculioninae)
 Greater Clover-leaf Weevil (Curculioninae)
 Lesser Clover-leaf Weevil (*Hypera nigrirostris*)
 Clover-root Weevil (*Sitona hispidula*)
 Cowpea Curculio (*Chalcodermus aeneus*)
 Cottonboll Weevil (*Anthonomus grandis*)
 Short-snouted Weevil (*Tanymecus confertus*)
 Bison Snout Beetle (*Thecesternus humeralis*)
 Imbricated Snout-beetle (*Epicaerus imbricatus*)
 Grapevine Colaspis (*Colaspis brunnea*)
 Southern Corn Leaf-beetle (*Diabrotica duodecimpunctata?*)

*Insect Larvae**Other Animal Foods*

Wireworms (Elateridae)	Snails (Pulmonata)
White Grubs (Scarabaeidae)	Spiders (Araneida)
Cutworms (Noctuidae)	
Sawfly Larvae (Tenthredinidae)	Millepeds (Diplopoda)
Crane-fly Larvae (Tipulidae)	Centipeds (Chilopoda)
Horsefly Larvae (Tabanidae)	
Army Worm (<i>Cirphis unipuncta</i>)	Cattle Tick (<i>Margaropus</i> <i>annulatus</i>)
Cotton Worm (<i>Alabama</i> <i>argillacea</i>)	Earthworm (<i>Lumbricus terrestris</i>)
Cotton Cut-worm (<i>Anthonomus?</i>)	

Aughey (1878) examined 22 stomachs in Nebraska, finding an average of 37 locusts and 16 other insects in each.

Howell (1907) examined 48 stomachs from Texas, finding them filled with weevils of various species.

Forbush (1912) reports the Upland Plover feeding extensively on crowberries (*Empetrum nigrum*) while in Labrador.

Bates (1907) reporting from Nebraska, says, "After the wheat is out, and during migration, it frequents the wheat stubble and gorges itself with waste grain."

Loyster helped raise four young Upland Plovers in 1934, feeding them chopped night crawlers, cracked grain, raw beef, and meal worms. When 18 days old they ate a tablespoon of this mixture every hour. He says, "Most of their time was spent in the rose bed catching bugs and worms. With the approach of the migrating period, their appetite greatly increased."

On several occasions we observed one or more plovers standing about fresh cow dung catching insects attracted to it. On April 30, 1938,

a pair was feeding in a calf pen in a farmyard under trees. Apparently the dung attracted insects so palatable to the plover as to outweigh their usual reluctance to approach trees and buildings. Cattle had not yet been turned into the pastures; hence fresh dung was not available there.

It is conceivable that there was a symbiotic relationship between buffaloes and plovers similar to that which now exists between cattle and plovers.

Plovers often feed in newly-mown hayfields, apparently attracted by insects.

During spring the Upland Plover delights in chasing insects in green fields, but as soon as the grass gets taller than the plover's back it deserts the fields.

MANAGEMENT

Spring shooting was especially damaging to the Upland Plover due to the bird's tameness during this season. H. L. Stoddard tells us that plovers increased in numbers on an area west of Chicago after the practice of spring shooting ceased in 1913. Prior to this date hunters kept the plover's numbers very low.

Our present generation of Wisconsin hunters has no great appetite for hunting shore birds. Some shorebirds are killed unlawfully by duck hunters, but few people pursue them for sport. The plover gains by this and by the further fact that it has gone south before the hunting seasons of other species begin.

Protection from trampling may be given to plover nests in pastures by building a fence about the nest. The plover's reluctance to desert makes it possible to do this. Low stakes or "tepees" over the nest were tried at Faville Grove, but they attracted cattle as "rubbing posts" and thus invited nest destruction.

The plover's concentrated nesting period, as well as the late maturity of the lowland hays, exempts the bird from heavy losses in hay mowing. The first peculiarity, however, sometimes induces some nest mortality during spring plowing. Loyster's success in raising young plovers from wild eggs shows that eggs from destroyed nests may be salvaged and artificially propagated.

CHRONOLOGY

- April 13 to 22: First birds arrive on area. (Most of them are paired and exhibit breeding behavior.)
April 30: Last birds reach area. (A few remain unpaired.)
May 1 to 8: First eggs laid. (Whistling decreases and birds become difficult to see.)
May 22 to 29: First eggs hatch. (After incubating 21 days.)
May 29 to June 6: Most frequent hatching dates.

- June 21 to 28: Last eggs hatch, probably re-nestings or late pairings. (Entire nesting spread over only two months. Average nest mortality of 34 per cent is half the rate common in other upland game birds.)
- June 22 to 30: First mature-appearing young noted in groups with adults. (Have reached full size in 30 days, which is less than half the growth period of gallinaceous game birds.)
- July 1 to 20: Birds preparing for migration. (Flutter stroke replaced by long wing stroke, long whistle by short whistle, tameness by wariness, and pairs by groups.)
- July 21 to 31: First birds leave area. (Local population begins fluctuating due to arrival of transient birds from farther north.)
- August 10 to
September 25: Last birds leave area.

REFERENCES

- AUGHEY, SAMUEL.
1878 Notes on the nature of the food of birds of Nebraska. *U. S. Entomological Commission, 1st rept., Appendix II, Hayden Survey of Territories, unclassified publ. No. 14.*
- BATES, J. M.
1907 The Bartramian sandpiper. *Bird-Lore*, 9: 84.
- BECK, H. H.
1938 Status of the upland plover. *Cardinal*, 4: 165.
- BENT, A. C.
1929 Life histories of North American shore birds. *U. S. Nat. Mus. Bull.*, 146 (pp. 58, 59).
- FORBUSH, E. H.
1912 A history of the game birds, wild-fowl and shore birds of Massachusetts and adjacent states. Mass. State Board of Agric., Boston (p. 347).
- GRANT, CLEVELAND
1937 Unpublished paper given at Kumlien Ornithological Club, Madison, Wisconsin.
- HESS, I. E.
1910 One hundred breeding birds of an Illinois ten-mile radius. *Auk*, 27: 21.
- HOOPER, JOHN.
Personal journal, 1890—. Unpublished.
- HOWELL, A. H.
1907 The relation of birds to the cottonboll weevil. *U. S. Biol. Survey Bull.*, 29: 20.
- MCATEE, W. L. and F. E. L. BEAL.
1912 Some common game, aquatic and rapacious birds in relation to man. *U. S. Dept. Agric., Farmers' Bull. No. 497*, pp. 15-16.
- ROBERTS, T. S.
1932 The birds of Minnesota. Univ. Minn. Press, Minneapolis, 1 (pp. 488, 490).
- STODDARD, H. L.
1924-1927 Unpublished by author. Quoted by Leopold in "Game Management," p. 372.

WETMORE, ALEXANDER.

- 1926 The birds of Argentina, Paraguay, Uruguay, and Chile. *U. S. Nat. Museum Bull.*, 133 (p. 146).

WIGHT, H. M.

- 1931 Unpublished by author. Quoted by Leopold in "Game Management," p. 372.

YEATER, R. E.

- 1934 The Hungarian partridge in the Great Lakes region. *Univ. Mich. School of Forestry and Conservation, Bull.*, 5: 37.

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