Grazing of wild geese on grasslands at Damme, Belgium

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Introduction

Ecological investigations on the wintering geese at Damme, Belgium, have been concerned with two main problems. Firstly, there was the way in which weather and other environmental factors influence the numbers of geese present. Secondly, methods of measuring the impact of the grazing of the geese on the limited grassland areas were developed. This paper is concerned with the latter.

A better understanding of the interactions between geese and their food supply will aid the management of important wild goose reserves in the future.

The Wild Goose Reserve at Damme

Damme (51° 15′ N, 3° 17′ E) is situated in the 'Polders' of the Province of Western Flanders, only 5 km. NE of Bruges, 11 km. SE. of the North Sea and about 30 km. from the river Westerschelde (Zeeuws-Vlaanderen, Holland).

The Reserve was established about ten years ago, when, influenced by Count Leon Lippens, former President of 'De Belgische Natuur- en Vogelreservaten,' some conservation-minded hunters in the surroundings of Damme voluntarily stopped wildfowl shooting after the middle of December. An increase in the numbers of the geese year by year resulted, especially when an important haunt along the Westerschelde, 'De Braakman,' in the Netherlands, disappeared in 1961. From July 1968, the Department of Agriculture prohibited the hunting of wild geese in three municipalities: Damme, Oostkerke and St.-Kruis-Brugge (about 70 sq. km.).

In this region, the traditional wintering-grounds consist of only 350 to 400 hectares of pasture (860 to 990 acres), divided into two major parts of 135 and 100 hectares by the canal from Bruges to Sluis. Five smaller areas (between 20 and 40 hectares) around these central parts are important as buffer zones.

The landscape is very open, with only two rows of poplars along the canal and sparse pollarded willows along the many little ditches (Plate III, facing p. 48). Most of the grasslands are wet throughout the year, and sometimes partially flooded in winter. They are rather heavily grazed by cattle from early April until the end of November.

The grassland is of good quality, predominantly *Lolium perenne* and *Cynosurus cristatus*, together with *Phleum pratense*, *Poa trivialis*, *Trifolium repens*, etc. (= *Lolio-Cynosuretum* Ass.). Some lower parts, which are more often flooded, have an inferior vegetation, largely *Ranunculus repens* and *Alopecurus geniculatus*, plus *Glyceria fluitans*, etc. (= *Ranunculo-Alopecuretum* Ass.).

Occurrence of the geese

As shown in Table I, the maximum numbers increased from 2,300 birds in 1959-60 to 9,730 birds in 1966-67; during the last two winters, there was a decrease to 6,850 birds in 1968-69. These maxima are reached every year about the middle of January. In the same Table are given the average numbers of geese per day (G), calculated from rather large samples.

There is no correlation between the maxima and the average numbers each winter. This will be shown to be very important in considering the degree of grazing on the grasslands.

Recorded species

European White-fronted Goose *Anser a. albifrons*

Table I. Occurrence of the geese at Damme, Belgium, 1959-69.

Winter	*Maximum number of geese*	*Average number (per count) (G)*	*Wintering period (number of days) (t)*	*Number of counts*
1959-60	2300	804	?	22
1960-61	3000	596	120	23
1961-62	3550	1692	103	19
1962-63	(severe winter, no geese stayed in Jan. and Feb.)			
1963-64	5600	1569	100	30
1964-65	6000	2504	106	45
1965-66	5965	2477	125	62
1966-67	9730	2420	105	57
1967-68	8755	2027	128	83
1968-69	6850	1750	127	94

arrival: in the second half of November.
maximum: varying in the last five years from 5,500 to 8,650 birds in the period from 10th to 25th January.
departure: by the end of February, usually before 10th March.

Pink-footed Goose *Anser brachyrhynchus*

Damme is an important, isolated haunt for this species.

arrival: at the very beginning of November.
maximum: varying during the last half decade between 550 and 850 birds (once 1,090 birds, in 1966-67); occurring between the end of December and 10th January.
departure: almost one week before the Whitefronts.

Other species of geese

These are recorded irregularly, mostly as single individuals or in very small numbers: Greylag Goose *Anser a. anser*, Western Bean Goose *A. f. fabalis*, Russian Bean Goose *A.f. rossicus*, Lesser White-fronted Goose *A. erythropus*, Snow Goose *A. caerulescens*, Barnacle Goose *Branta leucopsis*, Canada Goose *B. canadensis*, Red-breasted Goose *B. ruficollis* and Dark-bellied Brent Goose *B. b. bernicla.*

Methods of estimating the amount of grazing

The area of the Reserve is small in comparison to the numbers of geese that regularly winter there. The part that is actually grazed does not exceed 300 hectares. Thus rather heavy grazing was expected, and an attempt was made to estimate its impact on the grasslands.

Intensity of grazing

Markgren (1963) gives a formula to describe what he calls 'actual pasturation':

$$\frac{\Sigma(gd)}{a}, \text{ i.e. } \frac{(g_1\ d_1) + (g_2\ d_2) + \ldots + (g_n\ d_n)}{a},$$

where g = number of birds of a grazing flock
d = number of days on which the flock grazed in the field
a = area of the grazed field (in hectares)

This formula has been changed for present purposes (Kuyken 1967) to simplify the calculations, to give the overall grazing intensity covering the whole wintering period and the whole grazed area, by using the formula:

$$\frac{G \cdot t}{A}$$

where G = average number of geese per day (Table I)
t = total duration of the wintering period (Table I)
A = total area grazed (in hectares)

Thus, instead of the daily fluctuations, we use G, the arithmetical mean of our counts, making the assumption that this number of geese is present every day. This is reasonable only when the number of counts is a reliable sample of the whole wintering period (see Table I). The calculations from both formulae give similar results:—

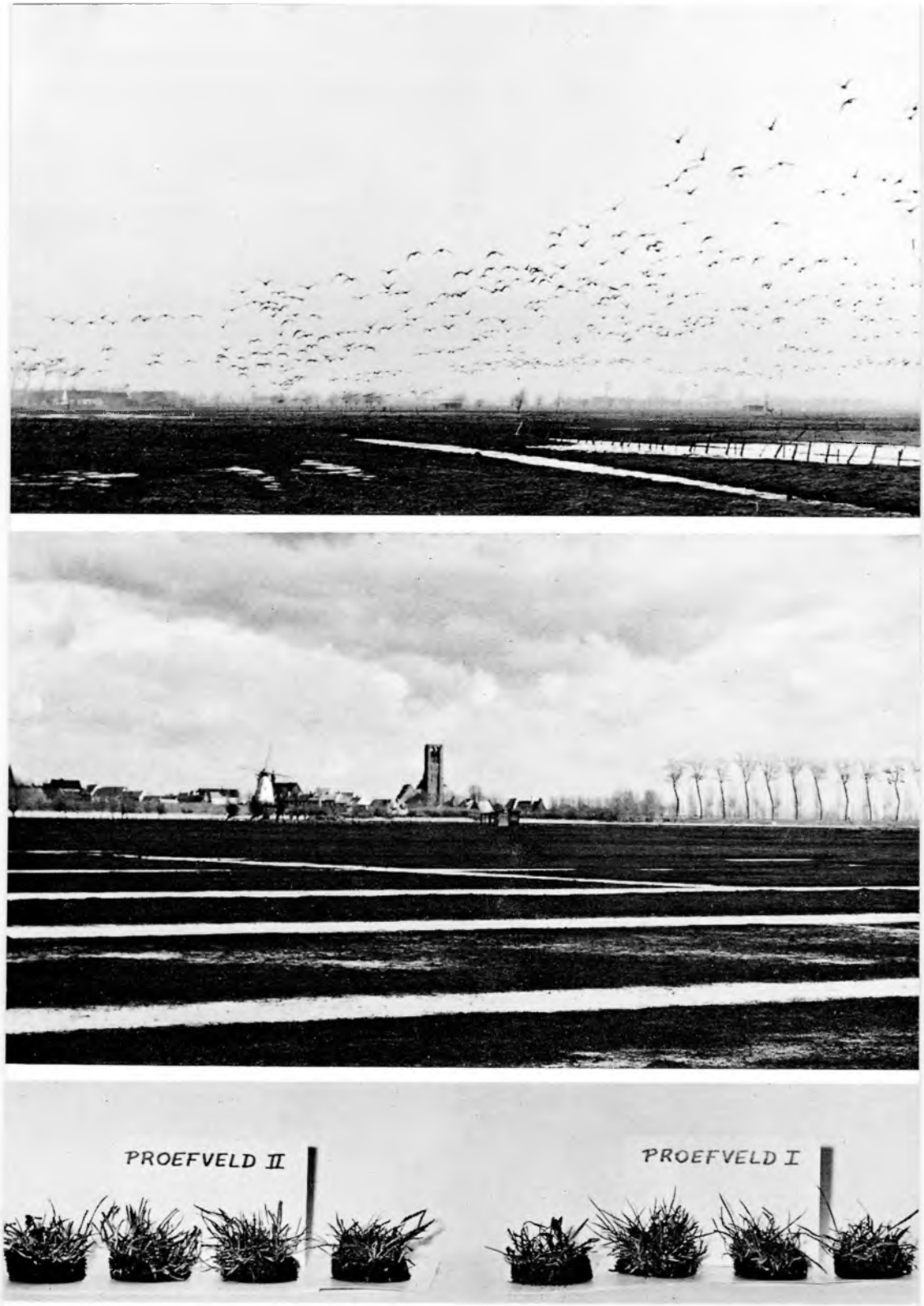
	Markgren	Kuyken
1966-67:	$\frac{245423}{290} = 852$;	$\frac{2420 \times 105}{290} = 876$
1967-68:	$\frac{284852}{300} = 830$;	$\frac{2027 \times 128}{300} = 865$
1968-69:	$\frac{219374}{300} = 731$;	$\frac{1750 \times 127}{300} = 741$

The latter figures can thus be used with confidence to express the intensity of grazing in all winters.

However, we must make one important proviso. An overall grazing intensity of 741 '*goose-days*' *per hectare*, corresponding with a coverage of $\frac{1750}{300} = \frac{741}{127} = 5.8$ *geese per hectare per day*, presupposes that on each of the 127 days each of the 300 hectares is grazed. Therefore, we can only use this (easily calculated) figure as a first theoretical approach.

Markgren (*op. cit.*), investigated winter rye fields in southern Sweden, grazed by rather small flocks of Bean Geese. He found 'actual pasturations' from 50.5 (= 'comparatively low') up to 276 (= 'very heavy grazing'). At Damme, we find much higher values, with some even exceeding 1,000. This is probably caused by the relatively small amount of disturbance in the Reserve.

Figure 1 gives the values of the overall grazing intensity during the decade 1959-68, compared with the maximum number of the geese in each winter. This shows that there is not necessarily correlation between very high maxima (often present for a short time) and the overall intensity



E. Kuyken

Plate III. The Damme Wild Goose Reserve, Belgium. European White-fronted Geese *Anser albifrons albifrons* feed in the wet pasture land. The effect of their grazing was studied (see p. 47). By the early spring there was little difference between grazed (II) and ungrazed (I) samples.

of grazing. Figure 1 shows that the intensity of grazing in 1965-66, for example, was much higher than in the following winter when we recorded the highest number of geese ever seen at Damme. The geese stayed that season for only 105 days, against 125 days in the previous one (Table I).

Grazing frequency

If the frequency of grazing can be calculated, we are able to indicate rather precisely which are the heaviest grazed parts of the wintering resort. During 1966-69 as often as possible the grazing positions of the flocks of geese were plotted on a detailed map of the reserve (scale 1 :

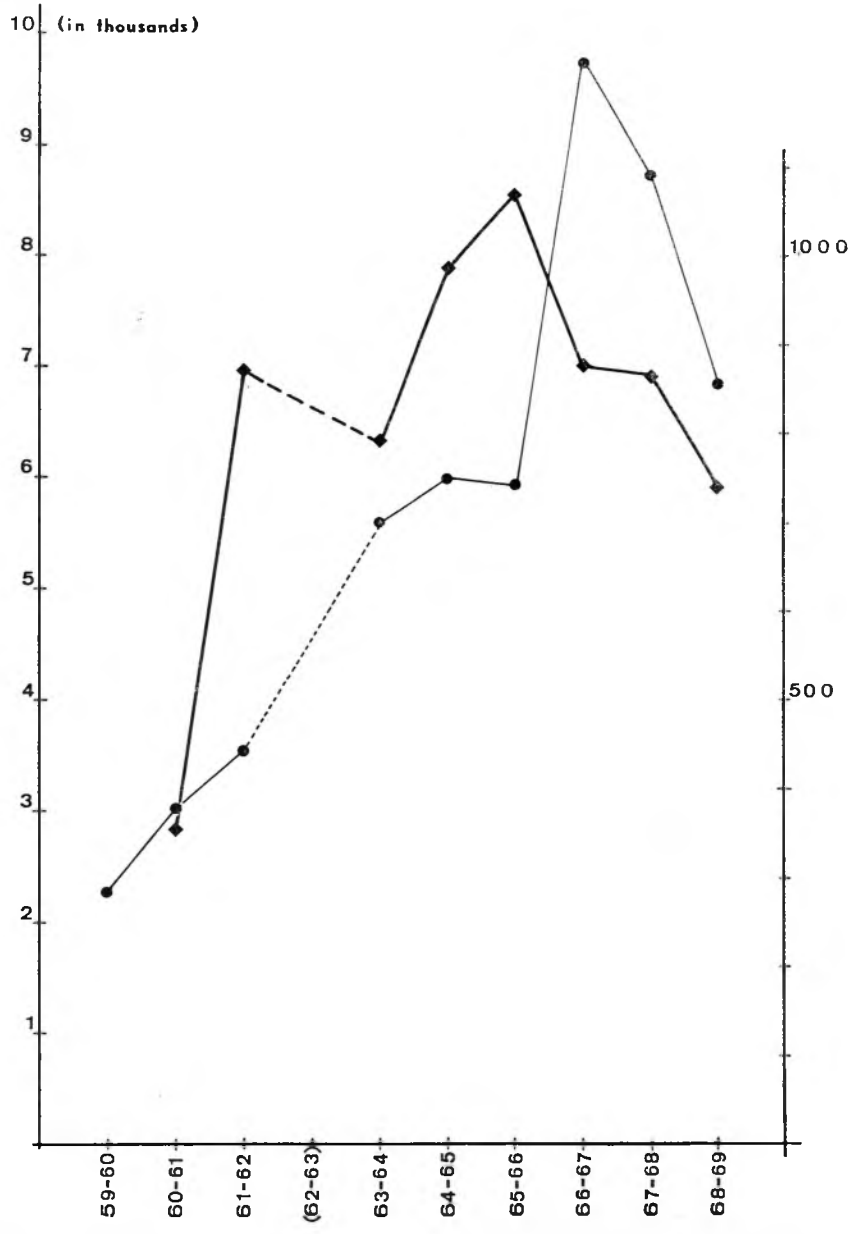


Figure 1. The maximum numbers of geese at Damme (dots, thin line, left hand scale) **compared with the overall intensity of grazing** (diamonds, thick line, right hand scale) **for the last decade.**

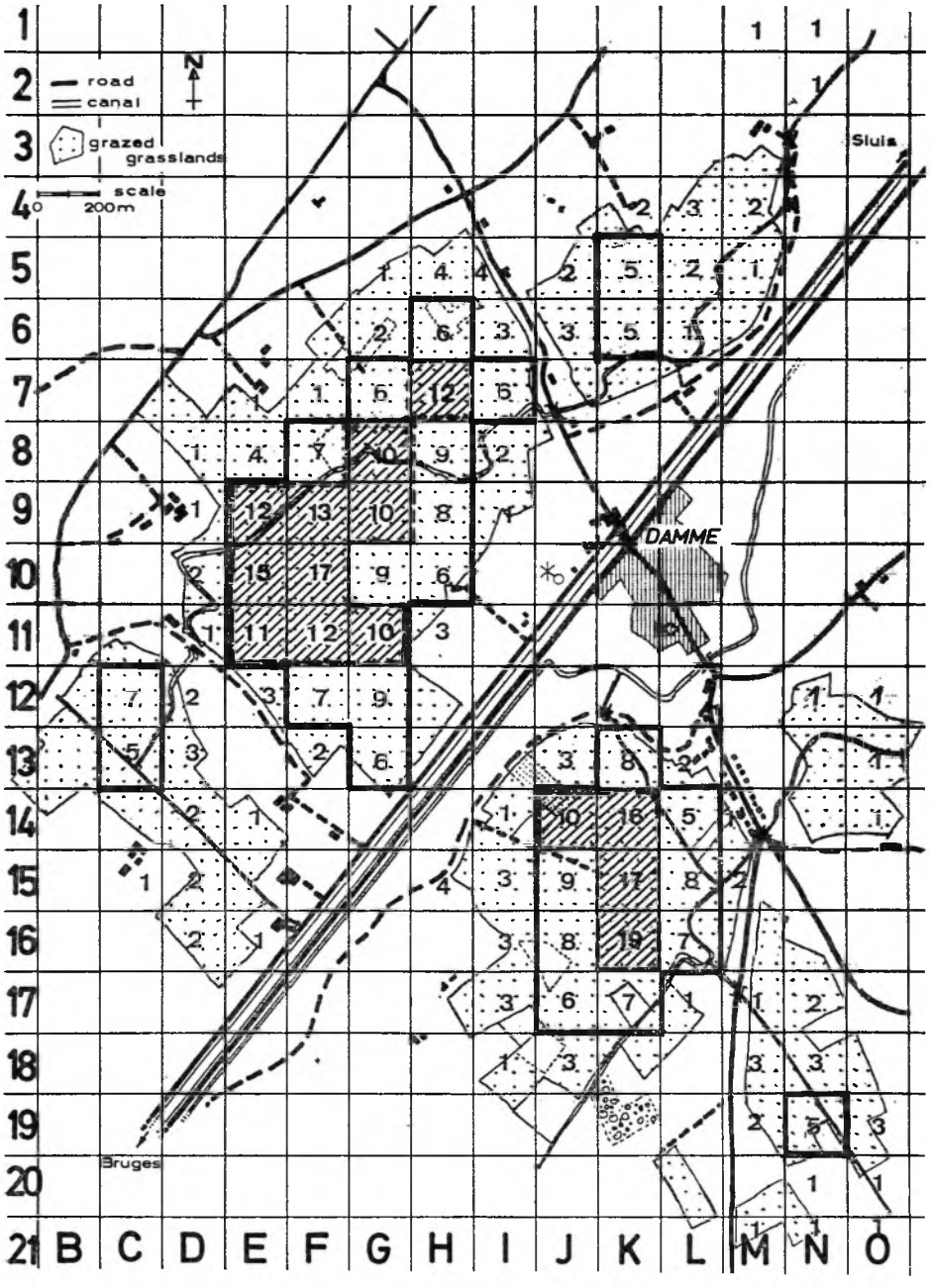


Figure 2. Map of the Wild Goose Reserve at Damme, divided into quadrats of 4 hectares. The figures indicate the total frequency of grazing per quadrat, on 52 half-day-observations in 1966-67.
Hatched area = heavily grazed.
Enclosed by the heavy line = moderately grazed.
Outside heavy line = lightly grazed.

10,000) using one map per half day. The number of the geese in each separate flock was also indicated if possible. The geese also roosted at Damme, but the positions of such roosting flocks were left out of account in calculating the grazing frequency.

To standardize these half-day sketches, the maps were divided into quadrats of 4 hectares (200 × 200 m.), each one characterized by a letter and a figure, for example D 8, K 17 (Figure 2).

The grazing frequency per quadrat was found by totalling the number of occasions on which geese were seen therein. (The actual number of geese involved is left out of account.) Figure 2 shows the situation at the end of 1966-67, based on 52 half-day sketches. In that season, 102 different squares were grazed, some of them only once, others up to 19 times. On the other hand, the sum of all grazing frequencies was 470, giving an average grazing frequency of 4.6. This index is our second approach to the problem of the impact of grazing. The higher this figure, the more likely is any possible damage.

At the end of the winter, we are able to divide the grazed area into three categories with an increasing frequency of grazing: *lightly grazed*, with grazing frequencies below or equal the average; *moderately grazed*, with frequencies up to twice the average; *heavily grazed*, with frequencies exceeding twice the average (Figure 2). With the aid of a planimeter, the exact area of these three categories of grazed grasslands was measured as 110, 68 and 42 hectares respectively from the 290 hectares of available and grazed grasslands (A in the formula on p. 000). The remaining 70 hectares were not covered in our sample.

The grazing frequency was clearly greater in quadrats situated in the centre of the area than it was in those marginal quadrats near fields, roads and farms. In the 1966-67 winter 36 different central quadrats were grazed 323 times, giving an average grazing frequency of 9.0, against an average of only 2.2 on the marginal ones (66 different quadrats, grazed 147 times).

For each period of ten days, the quadrats grazed, both marginal and central, were totalled separately and plotted into histograms (Figure 3). The average numbers of geese present in the same periods (solid line) were also plotted. Although an increase in the area grazed when geese arrive in larger flocks is obvious, this correlation is not linear. This possibly results in crowding on some central quadrats during days with maximum numbers of geese. In 1966-67 these quadrats were F 10, K 14, K 15 and K 16 (Figure 2).

Generally speaking, we may state that the central quadrats were preferred

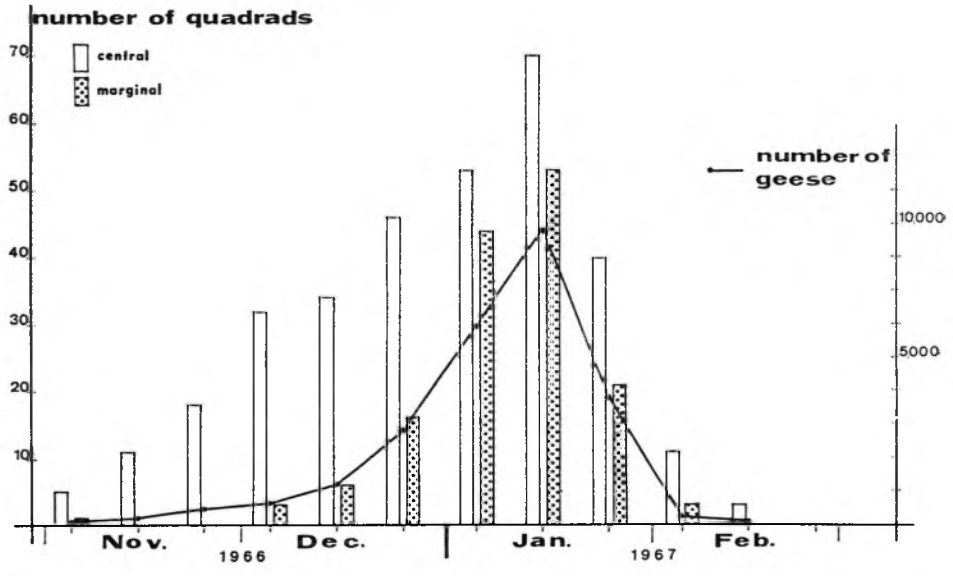


Figure 3. Relation between the numbers of geese and the numbers of grazed quadrats, per period of ten days. Marginal quadrats are only grazed at a higher rate in the middle of the wintering period.

mainly in the beginning and at the end of the winter, when the number of geese does not exceed an average of 1,000 birds per day. During the middle of the wintering period the geese themselves try to exploit the outlying grasslands. Disturbances, which usually occur on the edge of the Reserve, oblige the flocks of geese to fly to the centre of the plain. This is, we think, one of the principal causes of the crowding mentioned above.

Only on the most frequently grazed areas (42 out of 290 hectares) can there possibly be any damage by the geese. The extent of this damage, if it exists, cannot simply be assessed from the maximum numbers of geese present in a season. Moreover, to assess damage financially, it is necessary to investigate the composition and the productivity of the grasslands themselves.

The effect of grazing by geese on grasslands

In the Netherlands, van Dobben (1953, 1956) studied the grazing of winter wheat plots by captive geese. In Britain, Kear (1969) has done considerable work investigating several types of feeding grounds by means of different methods, such as artificial clipping, fences to protect crops and grazing trials with captive birds. In Sweden Markgren (1963) investigated the feeding grounds of Bean Geese, comparing grazed and ungrazed fields. While more attention has been paid to the possible damage to crops such as winter wheat, turnips, and spring cereals, most of the investigations have also dealt with grassland and concluded that usually no damage occurs. Only in exceptional situations when geese stay late in spring is there competition with domestic stock.

In 1966-67, we measured the effect of the grazing at Damme, as some farmers had complained about damage and were disturbing the geese. Areas grazed by flocks of wild geese were compared with ungrazed experimental fields. Both plots were on the same meadow, being as close together as some 100 or 150 m. In this way it was hoped that comparison would be made with two areas having very similar plant composition and productivity.

At the end of November, an area of 400 sq. m. was denied to the geese for grazing by stretching ropes across in a zigzag line, at 0.5 m. from the ground. Nets, wire-netting and the like could not be used to protect such experimental fields, since they shelter the area and can stimulate the growth of grass by up to 15%. (Ir. A. Andries, pers. com.) The area open to grazing was marked only with four small corner posts.

In December, January and February, 200 samples of the sward from both areas were taken, all vegetable matter being clipped, dried (at 105°C.) and weighed. The results are given in Table II.

Already by 19th December, before the arrival of the main flocks of geese, there was a marked difference between the two plots. This could hardly be due to the grazing of the geese and suggests that there was a difference in productivity or previous treatment of the two plots, despite their proximity.

Between December and January the yields from both grazed and ungrazed fields were reduced by a similar amount, respectively 27.5% and 30.7%. This indicates that the natural dying back and frosting of the vegetation was the most important factor. Between January and February there was a further small decrease in the yield of the grazed area while that of the ungrazed area remained unchanged. Even so the total decrease in the grazed area, 33.8%, was so similar to that of the ungrazed area, 30.4%, that the difference cannot be considered significant.

Grazed and ungrazed experimental fields were again sampled on 5th May. (Eight samples, each of 5 sq. m., were clipped by means of a mowing machine. This could not be done in winter as the vegetation was much too short.) This last sample could not therefore be compared directly with the previous series. However, taking the ungrazed value as 100%, the grazed area now yielded 108%, instead of, on 15th February, 81% of the

Table II. The grassland productivity on experimental fields at Damme, 1966-67. Figures indicate total yields (dry weights) expressed as a percentage of the ungrazed yield in December. Figures within brackets express the grazed yield on each date as a percentage of the December value for that area.

Date	*19th December 1966*	*23rd January 1967*	*15th February 1967*
I ungrazed	100.0	69.3	69.6
II grazed	85.2 (100.0)	61.9 (72.6)	56.4 (66.2)

ungrazed value at that date. The point at which the yields became equal is obviously of great interest, since if it were before the cattle were put out, the farmer would have no justification in claiming damage. If it were after that date, and the stock had to be kept inside for several days and artificially fed, then there would be a clear case for compensation at the local rate of about 5/- per beast per day.

Unfortunately the present data do not permit the decision on the date when yields became equal to be made with any assurance. If the undoubtedly erroneous assumption were made that the closing of the gap between grazed and ungrazed yields proceeded in a linear fashion, a graphical method would indicate 11th April as the break-even date. On the other hand, when samples were taken on 21st March there was already no visible difference between those from grazed and ungrazed areas (Plate III, facing p. 48). Moreover, as these detailed measurements of grassland productivity were carried out in only one wintering period, we cannot generalize any conclusions

It is possible, however, to get some idea of when the grass starts growing in any particular year and hence, by checking when the geese depart, determine whether they could be reducing the valuable 'early bite' grass.

In Holland, Jagtenberg (1966) pointed out that grass starts growing when the summed mean daily temperatures (°C.) from 1st January reach a total of 200 (only positive temperatures are considered in calculating this 'warmth-sum'). This moment of growth is compared for the last five years with the mean departure of the geese from Damme in Table III.

Table III. The sum of mean daily temperatures related to the departure of geese from Damme. Grass growth begins when the sum is 200.

	Sum of temperatures (from 1st January) in °C		
Winter	*First departure*	*Latest record*	*Average departure*
1964-65	128.0	155.7	141.8
1965-66	226.3	373.3	299.8
1966-67	131.1	171.0	151.0
1967-68	89.7	270.7	180.0
1968-69	205.6	235.1	220.4
Average	156.1	241.1	198.6

The first decrease in numbers generally occurred before the grass started growing. The averages show that usually the main flocks of geese have also left Damme before the growth of the pastures started. In only two years, 1965-66 and 1968-69, did geese stay for a longer time, and could have reduced the early yield on some areas of heavy grazing. The last geese often remained later than the point at which the 200 sum was reached but then only numbered at most some hundreds of birds.

Lastly, it is frequently alleged by farmers that geese pull up grass plants by the roots. Van Dobben (1956), Markgren (1963) and Kear (1966) agree that this did not occur, or only very occasionally after periods of frost. Sterbetz (1967), reviewing investigations on goose damage in Hungary, does not mention such a harmful feeding behaviour.

In the course of the present studies, large samples of goose droppings were examined, and only once were remains of some small roots found among the fragments of grass leaves. Thus, we think that geese either do not like these roots, or that they are not able to pull up plants out of the sward.

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Summary

The effects of grazing wild geese on grassland were investigated at the Wild Goose Reserve at Damme, Belgium. A high maximum of geese did not always mean a high intensity of grazing. The average number staying each day, and the duration of the wintering period were more

important. A formula to calculate the overall intensity of grazing for the whole reserve was proposed.

Samples of the daily distribution of grazing flocks led to calculations of grazing frequency. There was a preference for the central pastures, with marginal fields being subject to grazing only when larger flocks were present. Three categories of increasing grazing frequency were drawn up. Heavy grazing only occurs in the most central parts.

The effect of grazing is measured by sampling the sward on grazed and ungrazed experimental fields. Decrease of the yield through the winter was very similar on both fields, indicating that factors other than grazing by geese were most important. The date in spring when yield of grazed fields were wholly comparable with those for ungrazed ones would be of importance in determining whether any financial compensation is justified. The time when grass growth begins, depending largely on the warmth of the season, usually occurred after the large flocks of geese have left the reserve, and damage to 'early bite' was therefore unlikely.

Finally, it was concluded that the geese do not pull up grass by the roots.

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