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The management of grassland areas for wintering geese

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Introduction

Grass is an essential part of the food of most British wintering geese. There is no shortage of pasture in Britain, but much is unavailable to geese.

Most of the areas now used by wintering geese are managed solely for agriculture and in many cases the requirements of the birds conflict with those of the farmer. There is a decline in the area of semi-natural grassland, much being claimed for intensive agriculture or, particularly near estuaries, for industrial development. The creation and efficient management of refuges, albeit quite small, in areas of high goose concentrations can help to safeguard those populations and lessen conflicts with agricultural interests on surrounding land.

Research into the feeding behaviour and food requirements of geese on grassland has been carried out at the Wildfowl Trust for the past 5 years. The main study has been on White-fronted Geese *Anser a.albifrons* (Figure 1) at the New Grounds, Slimbridge, and the detailed results have been published (Owen, 1971, 1972a,b). This paper summarizes that work, current studies on the Barnacle Geese *Branta leucopsis* (Figure 2) at Eastpark, Caerlaverock, Dumfriesshire, and recent work by other authors, to suggest management procedures. The main aims of management are to increase the carrying capacity of refuge areas to a maximum and ensure that geese are provided with easily available food of good quality so that they can withstand adverse weather and attain optimal body condition for migration and breeding; it is also necessary to ensure that geese are available for observation as leisure time and interest in nature conservation increases.

It is essential to have suitable feeding grounds reasonably close to a safe roosting place. This has been discussed in detail for Greylag *Anser anser* and Pink-footed Geese *Anser brachyrhynchus*, two species normally associated with arable agriculture, by Newton, Thom & Brotherston (1973), and their conclusions apply to other goose species. The effect of disturbance or of a change in land use often overrides a traditional attachment to certain areas (Ogilvie, 1968). Barnacle and Brent Geese *Branta bernicla* are generally more sensitive in this respect than British grey geese.

Within this broad pattern, factors affecting the availability, quantity and quality of food are important influences on the attractiveness of goose haunts.

Figure 1. A group of White-fronted Geese *Anser a. albifrons* in the Tack Piece at Slimbridge, in the alert, head-up posture. *Philippa Scott*

Philippa Scott

Figure 2. Barnacle Geese *Branta leucopsis* feeding on arable land at Caerlaverock and drinking from the shallow scrapes left when excavating the screen banks. (Two birds have leg rings put on at least 10 years previously.)

Disturbance

Most British geese have long been quarry species and even those that are now protected are still occasionally shot. Thus, geese have a reinforced fear of human beings and the sights and sounds associated with shooting. Disturbance is the most important factor controlling the availability of feeding areas. White-fronted Geese used the least disturbed areas of the Slimbridge refuge early in the season and subsequently moved to other smaller fields closer to human activity. Newton & Campbell (1970) came to similar conclusions working on Greylag and Pink-footed Geese at Loch Leven, Kinross, Greylags being the less sensitive.

Disturbances can be separated into several types which elicit different reactions.

(a) *Shooting*

Occasional and limited shooting only causes local movements of the geese. At Slimbridge, when Whitefronts are shot on the refuge, they move to fields outside it, but soon return. Heavy shooting pressure does keep geese away from otherwise favourable habitat, and such areas are sometimes heavily used when the shooting season ends.

(b) *Other ground disturbances*

In agricultural areas these are usually related to stock management, but may also be due to recreational activities. Riders are less disturbing than men on foot and are sometimes able to approach to within 50 yards of a flock of wild geese. Geese also quickly become used to vehicles.

Stock on fields are no deterrent to most goose species. Greylag Geese walk among sheep while feeding on turnip fields and also take swedes scattered for outwintered stock (Kear, 1963). However, Barnacle Geese are frequently put to flight by advancing cattle and keep away from fields where stock is present.

Ground predators, such as foxes and stoats are usually kept under observation but do not often put the birds to flight.

(c) *Aerial disturbance*

Large birds or birds of prey may cause some disturbance. Barnacles are put to flight by Kestrels and Sparrowhawks as well as Herons, whereas Pinkfeet in the same situation are relatively unconcerned.

Helicopters are extremely disturbing to all geese on their wintering grounds. Low flying small 'planes usually put geese to flight and in some cases cause them to seek the safety of the roost or refuge areas. Barnacle Geese at Caerlaverock are sometimes raised by small aircraft at a distance of 1–2 miles. Larger planes are usually less disturbing, and even Brent Geese can become indifferent to their taking off and landing.

(d) *Noise*

Noise is less important than visual disturbance, but sudden sounds such as the starting of an engine, and especially shots or bangs usually have an effect. The birds habituate to regular noises, and to be lastingly effective, scaring devices relying on banging must have their timing and position varied frequently.

Geese also keep away from unfamiliar objects, and from cover such as hedges, apparently because they are regarded as potential sources of danger. In undisturbed situations Whitefronts spend about 3% of their time in alert behaviour, but much more in relatively 'disturbed' situations. This increased vigilance takes place at the expense of feeding.

An attempt was made to quantify the effects of potential and actual disturbing influences on forty-seven fields at Slimbridge. 'Avoidance values' were calculated for each field, by allocating arbitrary points according to distance from roost (0–2), size of field (0–20), extent of hedges or banks (0–5), shepherding frequency (0–15), distance from roads or canals (0–10), distance of bordering roads or canals from field centre (0–30). The sum of the avoidance values for each field is the 'avoidance index', and this varied from 1 for the Dumbles, a large, open, undisturbed field, to 62 for a small field bordered on one side by a canal, on another by a farm track and on another by farm buildings. Plotted against the mean goose usage for the four seasons, 1968–69 to 1972–73 (Figure 3), the correlation coefficient is—0·809, which is significant at the 0·1% level. This is remarkably strong considering that there were

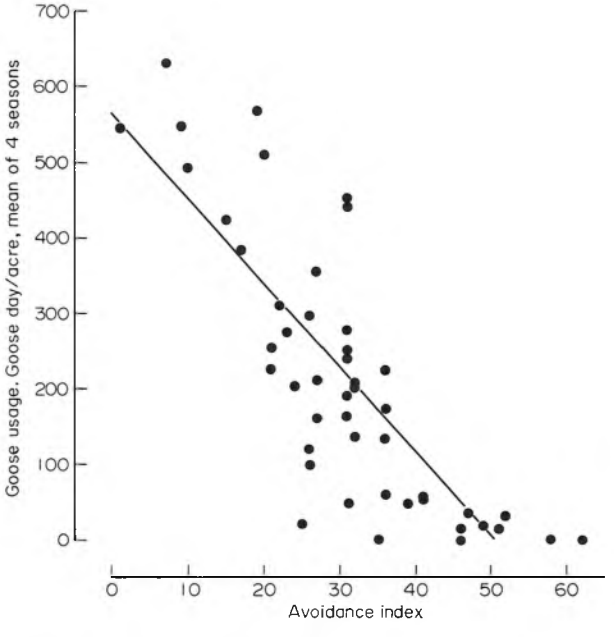

Figure 3. Regression of goose usage of forty-seven fields at the New Grounds refuge, Slimbridge, on the 'avoidance index' (see text).

considerable vegetational differences between the fields. It was calculated that disturbance at the New Grounds resulted in only half the potential usage of the refuge (700 goose days per acre on most favoured fields) being realized.

Feeding requirements

1. *Broad ecological characteristics*

It has often been stated (e.g. Markgren, 1963; Philippona & Mulder, 1960) that geese prefer the vegetation of marshy areas, because geese are associated with such habitats. However, many species, when given the choice, prefer to feed on the higher quality grasses usually found in better-drained situations. For example, Newton & Campbell (1970) found that both Greylag and Pink-footed Geese preferred recently sown, nutritious grasses, and no relationship was found between the wetness of fields and their use by White-fronted Geese at Slimbridge.

However, there is still an advantage to the birds in having standing water on fields. Geese require to drink during the day, and in situations where water is constantly available, White-fronted Geese spend more than 2% of their daytime drinking (up to 25% of non-feeding activity). In situations where water is not freely available, the birds have to fly, usually to the roost, in order to drink and bathe. This may mean travelling long distances (Pink-footed Geese at Loch Leven travelled several miles to the roost at midday). Geese which rely on grass in mid-winter and spend up to 95% of their daytime feeding can ill afford such expenditure of time and energy. In general, however, the occurrence of geese in marshy situations is probably due to the fact that farm stock is not outwintered in such areas, and there is thus little disturbance.

Geese like to feed in open fields with a clear view on all sides. Vegetation more than 30 cm in height discourages usage, and fields with tall rushes are generally avoided by White-fronted Geese at Slimbridge. Similar areas, where the rushes have been cut in late summer, are visited.

2. *The quantity of food*

Most geese when on pastureland feed mainly on grass. Other items are important, especially the stolons of white clover *Trifolium repens*, and, exceptionally, other items such as seeds (Owen & Kerbes, 1971). 'Grass' includes other low herbs whose leaves or shoots are obtained by the goose's normal rapid pecking.

(a) *Grass*. The quantity of grass available on fields in winter is affected by the amount of grazing by farm stock in autumn and by the amount of grass growth during winter. Other grazing animals (such as hares) are usually at too low a density to have much effect on goose foods.

The agricultural management of the New Grounds at Slimbridge was monitored in 1969–70 and 1970–71. There were no obvious differences between grazing and hay cutting as forms of summer management, but stock grazing intensity in early winter was very important. The effect of different grazing regimes on goose usage of five favoured fields in shown in Figure 4. These fields are close to observation facilities and goose usage was accurately determined. The goose usage figures were weighted to take account of different disturbance pressures. It was then calculated that if farm stock were removed from the New Grounds during winter then the goose-carrying capacity could be increased by 30%. This took into account disturbance from shepherding activities as well as quantity of food.

In 1971 the farming tenant died and in April 1972 the management of some 380 acres (154 hectares (ha)) of the New Grounds was taken over by the Wildfowl Trust. About 300 acres (120 ha) of this, the inner refuge, was now managed primarily for the benefit of the geese. Table 1 shows the goose usage of the whole refuge and of the inner refuge area over five seasons, in terms of 'goose days'. This figure is based on a daily count of the geese through most of the season. The table shows that the proportion of goose time spent on the inner refuge is much higher in the last two seasons and especially in 1972–73 when management for geese was fully effective; the usage per acre has almost doubled. The main management change was the withdrawal of stock from the fields most favoured by geese (Dumbles) at the end of September and from nearby fields (those shown in Figure 2) at the end of October. No stock were allowed on any fields after the end of November. Goose usage of both the previously undisturbed areas and disturbed areas has been greater, indicating that increase in food supply and decrease in disturbance were jointly responsible.

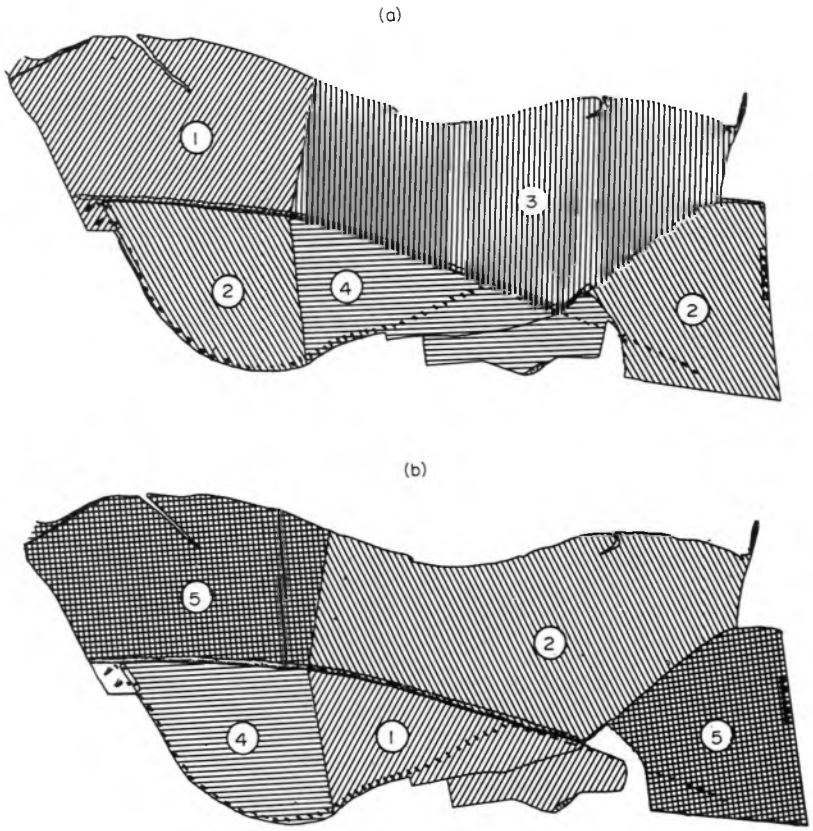

Figure 4. Stock grazing pressure and goose usage of the favoured fields at the New Grounds, Slimbridge. Usage increases with increasing field number. Goose usage values are corrected for disturbance (see text). Data adapted from Owen 1972b. (a) Stock grazing pressure, Oct.–Dec. 1969; (b) total goose usage 1969–70.

Table I. Goose usage of the whole of the New Grounds and of the 'inner refuge' in five seasons

Season	New Grounds		Inner Refuge		
	Total goose days (thousands)	Approximate goose days/acre	Goose days (thousands)	Approximate goose days/acre	Proportion of total of inner refuge
1968–69	397	310*	133	470	34
1969–70	417	300*	104	370	25
1970–71	321	260	139	490	43
1971–72	211	170	143	510	68
1972–73	324	260	238	780	74

* Some of the total usage was outside the main refuge area.

(b) *Clover stolons.* White clover stolons in grassland can be very important goose food. For example, they constitute up to 60% of the food of Barnacle Geese during their stay at Caerlaverock. Pink-footed Geese feeding on the same salting pasture also feed on stolons. White-fronted Geese take substantial quantities of stolons especially during wet weather.

The quantity of stolons in pasture depends on several factors, but on the Caerlaverock saltings the height of the vegeta-

tion is the most important. Figure 5 shows the vegetation height on a typical transect through a relatively little-grazed part of the area and the number of clover leaves in the same quadrats (the weight of stolons is closely correlated with the number of leaves $r = 0{\cdot}8$–$0{\cdot}9$). In order to even out local variability, the running mean of five adjacent quadrats is used. A clear inverse relationship can be seen between vegetation height and clover abundance. Increased grazing by farm animals of areas previously little grazed resulted in an increase in clover stocks from an estimated 3·6 tons–16·8 tons dry weight on 240 acres (97 ha).

When reseeding, the strain of white clover used is important. Hunt, Harkess & Martin (1965) found that the stolon yield of S184 was more than double that of other varieties in terms of length per unit area although the weight per unit stolon length was somewhat lower.

3. *The quality of food*

From the goose's point of view, the most important characteristic of vegetation is the metabolizable energy contained per unit wet weight. This depends on the dry matter content, nutritive value and digestibility. These in turn vary with the species composition, the stage of growth and the soil fertility.

White-fronted Geese are very selective when given a choice of feeding zones, other factors being equal. Figure 6 shows the early season usage (1968–69) of five vegetation zones on the Dumbles in terms of the density of droppings in marked plots. Nutritive value figures for vegetation clipped from the same zones are also given. The index:

$$\frac{\%\text{Protein} \times \%\text{ Soluble Carbohydrate}}{\%\text{ Fibre}}$$

gives a guide to the nutritive value, as protein and soluble carbohydrate are beneficial, and high fibre is detrimental. Apart from the *Festuca* (F) zone, which has a high proportion of red fescue *F. rubra*, the preference of the geese is related to nutritive value, and inversely to the proportion of dead grass in the sward. As differences in protein and fibre content are small, the main determinant of food value is the amount of soluble carbohydrate. Other factors such as the physical properties of leaves and their digestibility, also affect goose preferences.

Differences in nutritive value of grass on the same pasture are mainly due to species composition and summer grazing by stock. Bent *Agrostis stolonifera*, saltmarsh grass *Puccinellia maritima* and other species on the most preferred zone are more nutritious than red fescue, barley grass *Hordeum secalinum* and other species which grow on the less preferred areas. A species also shows differences in nutritive value when growing on the different zones. Figure 7 shows the nutritive value index of bent (including some foxtail *Alopecurus bulbosus* in the *Agrostis* (A) zone) collected from the five zones, and also the vegetation height in autumn on each zone. This shows that the large variability between zones can be related to the amount of summer grazing by stock since this affects the stage of growth of the plants and the age of leaves.

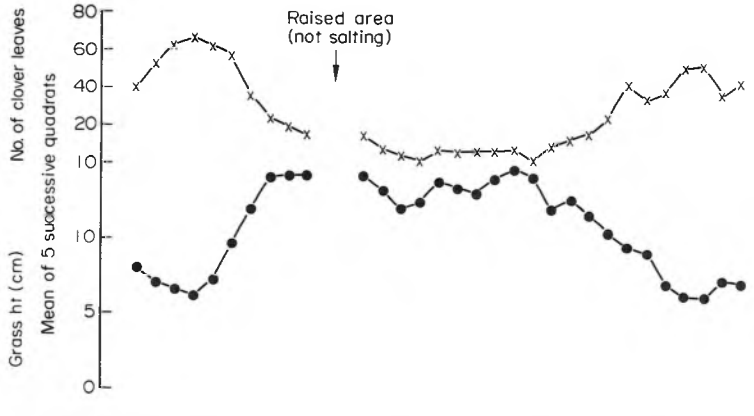

Figure 5. Eastpark Merse, Caerlaverock, the number of clover leaves per 1/20 m-quadrat along a typical transect and the height of vegetation at the same sites, October 1972.

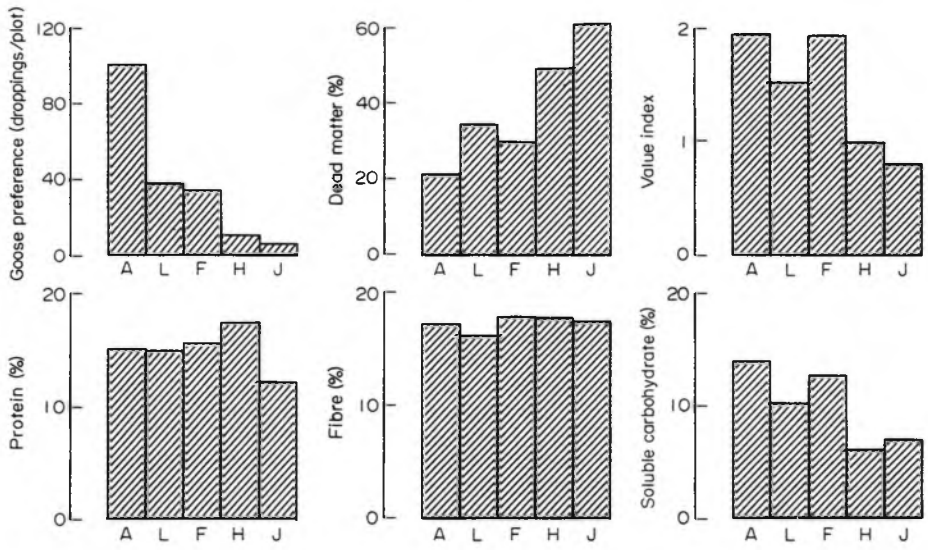

Figure 6. Goose usage of vegetation zones on the Dumbles, Slimbridge, in 1968, and the nutritive values of the vegetation of the five zones. Vegetation zones: A = *Agrostis*; L = *Lolium*; F = *Festuca*; H = *Hordeum*; J = *Juncus* (see Owen, 1971).

$$\text{Value index} = \frac{\%\ \text{protein} \times \%\ \text{carbohydrate}}{\%\ \text{fibre}}.$$

Grass height on F and H zones was more variable than on others.

In 1972–73 the effect of fertilizing (with nitrogen only) and cutting the vegetation of the Dumbles was investigated. The experiment will be published in full later, but preliminary results, based on counts of droppings, indicate that the geese used the cut and fertilized plots ten times as much as the uncut unfertilized control plots.

The Dumbles are semi-natural pastures in the sense that the grass has been long established, but similar effects can be seen on arable or sown pastures. One field at Slimbridge was reseeded in 1969 with a mixture mainly consisting of perennial ryegrass *Lolium perenne*. An adjacent field of the same size and similar in other respects was untreated. Droppings counts per square metre early in the winter were 10·35 ± 0·49 in the reseeded field and 0·66 ± 0·12 in the old pasture (t = 19·0 d.f. 99, $P <$ 0·001). The amount of food available was much greater on the old pasture so the pre-

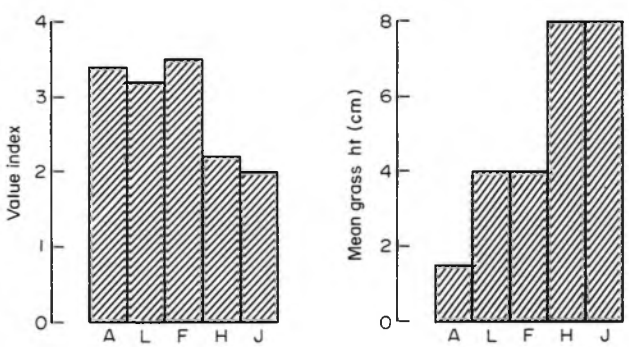

Figure 7. The nutritive value of *Agrostis stolonifera* and vegetation height on five Dumbles vegetation zones, December 1970. Vegetation zones: A = *Agrostis*; L = *Lolium*; F = *Festuca*; H = *Hordeum*; J = *Juncus*.

$$\text{Value index} = \frac{\%\ \text{protein} \times \%\ \text{carbohydrate}}{\%\ \text{fibre}}.$$

N.B. Some *Alopecurus bulbosus* is included in *Agrostis* from A zone.

ference can be attributed solely to the difference in vegetation composition and probably in its nutritive value.

Not much is known about the quality of clover stolons. This certainly varies as starch is laid down in autumn and used up for leaf growth in spring. The weight per unit length, which varies with clover varieties, has an important bearing on intake rate. Barnacle Geese at Caerlaverock do not usually eat stolons when on reseeded grassland, although stolon density there may be higher than on saltings. This suggests some difference in stolon quality.

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Summary

Basic management policies for semi-natural and agricultural grassland to improve them as goose habitats are set out.

Disturbance is the most important single factor, and various types are listed and their relative importance considered. A relatively objective 'avoidance index' was computed, which showed a negative correlation coefficient greater than 0·8 with actual goose usage over four seasons.

The presence of standing water, at which they can drink, preen and bathe, on the feeding grounds is beneficial to grazing geese in mid-winter when up to 95% of their daytime must be spent feeding.

The quantity of grass in winter is affected by farm stock grazing pressure in autumn and early winter. The quantity of clover stolons, another important goose food, on salting pasture increases as summer stock grazing pressure, which affects vegetation height, increases.

The selection of feeding sites and food by Whitefronts was shown to be in part determined by the nutritional quality of that food. Quality can be increased by proper summer grazing management, cutting, fertilizing and reseeding.

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