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Field selection of greylag geese (*Anser anser*): Implications for management of set-aside fields to alleviate crop damage

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Greylag geese (*Anser anser*) have been increasing in numbers in Europe during the last decades. They forage and roost in agricultural landscapes and may cause damage to sensitive crops. We studied field selection of greylag geese around lake Sörfjärden in south central Sweden where geese aggregate during the growing season. In this area a set-aside field was established in 2010, *i.e.*, a field where geese can graze undisturbed, with the aim to reduce damage in surrounding conventional fields. The goal of our study was to investigate the general selection of the different field types as well as the specific set-aside field. We used a point survey count to estimate goose numbers and regression analyses to evaluate the relationship between presence or absence of greylag geese and field characteristics such as crop type, distance to roost site and field size. According to the top-ranked model, the probability of presence of foraging greylag geese was higher in spring and in grass fields, while the probability decreased with distance to roost site. Our results also show that the set-aside field in general was used more than other fields in the area during spring and summer but not during autumn. We conclude that it is important to consider variables affecting the probability of field selection by geese, such as season, crop type and distance to roosts to understand the behaviour of geese when establishing set-aside fields.

1. Introduction

During the past 60 years the number of geese (Anatidae) has increased throughout Europe (McKay *et al.* 2006, Fox *et al.* 2010, Fox & Madsen 2017). Although the recovery from previously over-harvested and dwindling goose populations can be viewed as a conservation success, their increase also comes with a downside. Today's superabundant goose populations frequently cause conflicts between different human interests, such as conservation and farming (Eythórsson *et al.* 2017, Fox & Madsen 2017). Geese cause crop damage by grazing, grubbing and trampling when foraging, and this problem has increased particularly in agricultural areas where birds aggregate in large numbers for longer periods of time (Fox *et al.* 2017, Montràs-Janer *et al.* 2019).

To manage this conflict and to mitigate damage, a palette of both lethal and non-lethal preventive tools is available, such as culling, scaring, and altered farming strategies (Fox *et al.* 2017). However, given how widely these strategies are used worldwide, surprisingly few attempts have been made to scientifically evaluate their efficiency (Hake *et al.* 2010, Johnson *et al.* 2014, Koffijberg *et al.* 2017). One common non-lethal strategy is to attract and divert geese to set-aside fields, *i.e.* areas where they can graze undisturbed (also referred to as lure crops, alternative feeding areas, sacrificial crops, diversionary fields or accommodation fields in the literature) (McKay *et al.* 2001, Hake *et al.* 2010, Tombre *et al.* 2013, Nilsson *et al.* 2016, Koffijberg *et al.* 2017). It is key to adapt management in accordance with the selection patterns of geese, so that the latter are attracted to the set-aside fields and kept away from sensitive crops (Gill 1996, Hake *et al.* 2010). Set-aside fields can consist of protected natural grass fields, stubble fields left unplowed, but also conventional fields with crops managed to attract geese (Vickery & Gill 1999, Merkens *et al.* 2012). Other characteristics such as distance to roost and sward height, may also affect field selection. In Sweden set-aside fields are sometimes combined with scaring geese off sensitive crops, as scaring otherwise just tends to move the problem between fields and farmers (Hake *et al.* 2010). Still, quite few set-aside fields have been established on productive agricultural land in Sweden, a fact making their effectiveness hard to evaluate, and even more so because geese may select different crop types and fields in different areas and seasons (Montràs-Janer *et al.* 2019).

Crop type, nutritional content, and crop stage (*e.g.*, newly sown, growing crop, or stubble with spilled grain) are examples of variables affecting field selection of geese (Fox *et al.* 2017, McKay *et al.* 2006, Merkens *et al.* 2012, Vickery and Gill 1999). Generally speaking, geese prefer crops high in protein, digestibility, and energy, but low in fiber, in order to meet daily energetic needs, (Fox *et al.* 2017). Field selection may also change between seasons, as the nutritional demands of geese change over the year, as does the availability of different food types (Newton & Campbell 1973, Jensen *et al.* 2008, Fox *et al.* 2017). Moreover, previous research shows that flight distance between roost sites and fields also affects field selection by geese. There is a trade-off between energy gained from foraging in a certain field and energy lost when flying to and from it. Consequently, geese show a general preference for fields closer to roost sites (Newton and Campbell 1973, Gill 1996, McKay *et al.* 2006, Amano *et al.* 2007). Geese also prefer larger fields from where it is easier to spot and avoid predators and humans (Newton & Campbell 1973, Jensen *et al.* 2008, Wisz *et al.* 2008).

Selection patterns by geese can be studied by comparing actual use of a certain crop type or habitat in relation to their availability in the landscape. By comparing the selection of set-aside fields and conventional fields it is also possible to evaluate whether the former are preferred compared to other fields in the surrounding landscape. Such knowledge is of value for management, as it can be used to increase the attractiveness of set-aside field and thereby reduce or prevent crop damage and conflicts (Gill 1996, Vickery & Gill 1999, McKay *et al.* 2006, Merkens *et al.* 2012).

In Sweden, the breeding and autumn staging population of greylag geese (*Anser anser*) has been increasing since annual September counts started in 1984, from 20,000 to approximately 170,000 in 2018 (Liljebäck *et al.* 2021, Nilsson & Haas 2019). During this period, the greylag goose population and crop damage have increased more or less in parallel (Montràs-Janer *et al.* 2019).

Barley, wheat and ley are the crop types most reported as damaged by greylag geese in the south of Sweden; ley in spring and barley and wheat during most of the summer (Montràs-Janer *et al.* 2020). Reimbursements paid to Swedish farmers for crop damage caused by large grazing birds have increased since 1995 and were *ca.* 550,000 euros in 2020 (Frank *et al.* 2021).

Farmers and other stakeholders are actively working to reduce crop damage and use several measures to accomplish this (Hake *et al.* 2010). Yet, the understanding of the effectiveness of certain measures is limited. We studied field selection patterns by greylag geese in an area where a set-aside field was established in 2010. By considering factors known to affect selection patterns by geese, such as crop type, distance to roost, season, and field size we were able to gain insights about general selection patterns, but also to compare selection of set-aside versus conventional fields. We predicted that the set-aside field would have a higher presence of greylag geese than other fields (crop types) in the study area. We also predicted that the set-aside area would be more frequently selected in spring than in summer and fall. Finally, we predicted that fields closer to roost sites and larger fields would have a higher presence of geese than distant and smaller fields.

2. Material and methods

2.1. Study area

The study was carried out 2010–2012 in south-central Sweden in the surroundings of lake Sörfjärden (59°25′52″N, 16°46′57″E; Fig. 1), situated in the boreonemoral biotic zone, which is a transition between the boreal and nemoral biotic zones, and characterized by a mosaic of coniferous and broad-leaved forest. The study area consists of agricultural land, forests, wet

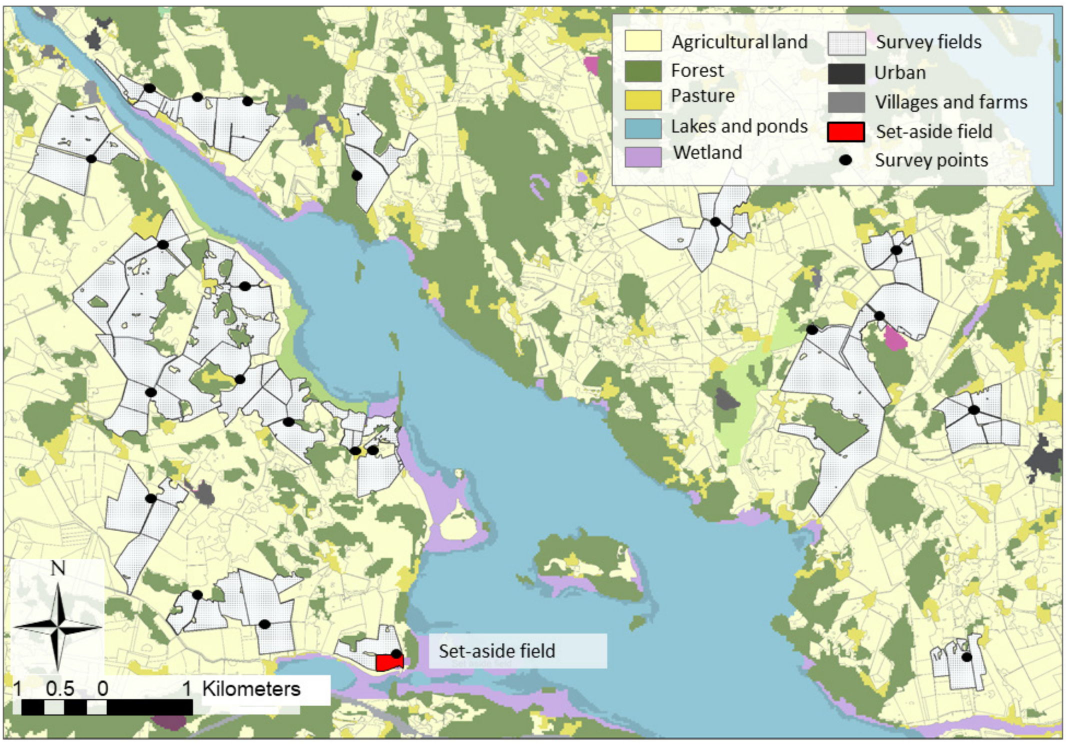

Fig. 1. Map of the study area. Grey fields were included in the study and the red field in the south is the set-aside field. Black circles show the survey points from which geese were counted. Only the fields or the part of a field that was visible from any survey point were considered.

meadows, dense reed-beds, and open water. The agricultural land is used for intensive farming of mainly cereals such as wheat, oats, barley, and rye, but also grass for hay and silage, potatoes, and oil rapeseed. Crops are sown in both fall and spring. Lake Sörfjärden and its surroundings have been partly protected since 2001 by the RAMSAR Convention since 2001 and hold several nature reserves (209 ha of reed beds and wet meadows) and Natura 2000 sites based on the European Bird Directive (SPA) and the Habitat Directive (SAC/SCI) (EC 2009). The area hosts a generally rich birdlife and many breeding species.

Lake Sörfjärden is usually covered by ice and snow from January to mid-March or early April. The growing season lasts from April to September. Annual precipitation ranges between 600 and 800 mm (Swedish Meteorological and Hydrological Institute, www.SMHI.se). Growing crop in spring such as wheat and ley fields are most sensitive to damage by geese. Harvest takes place from late June (ley fields) to September (ley, cereals, potatoes, and rapeseed). Spill grain from harvested fields is attractive to geese, however geese do not cause damage on these fields.

2.2. Data on goose numbers

Greylag geese in the agricultural landscape surrounding lake Sörfjärden were counted using a point survey method, in which the visible fields were scanned for geese at each point without any pre-set time limit for searching. Surveys were conducted by volunteers every week from March to October 2010–2012, with a two-week break in the beginning of June (during the molting period when most geese are flightless and remain on the lake). Geese were counted from sunrise to mid-day (latest 14:30 hrs) using a telescope from 22 points, from which a total of 65 agricultural fields were surveyed (1–6 fields per point; Fig. 1). The initial distribution of survey points along available roads was randomly selected, but the precise location was adjusted in some cases (<300 m) to maximize the number of fields visible from the car, to avoid unnecessary disturbance when leaving it. Points were visited in a different order on each survey occasion to avoid bias of daily movements/behavioural patterns. Other 'large grazing birds' such as Canada geese (*Branta canadensis*), barnacle geese, (*Branta leucopsis*), taiga bean geese (*Anser fabalis*), greater white-fronted geese (*Anser albifrons*), common cranes (*Grus grus*), and whooper swans (*Cygnus cygnus*) also occur in the area, although in lesser numbers than greylag geese (Ödman *et al.* 2013).

2.3. Set-aside field

The set-aside field was established in March 2010 with the aim to attract greylag geese and reduce crop damage, particularly in spring when most damage occurs to fall-sown cereals. The location of the set-aside field was based on previous observations of foraging geese in the area, indicating that this specific field was selected by many geese. The size of the field was 5.7 ha, and it was sown with a seed mix containing 25% alfalfa (*Medicago sativa*), 23% timothy (*Phleum pratense*), 15% bird's-foot trefoil (*Lotus corniculatus*), 12% meadow fescue (*Festuca pratensis*), 10% white clover (*Trifolium repens*), 10% chicory (*Cichorium intybus*), and 5% caraway (*Carum carvi*). The field was managed by harvesting to keep the grass sward low, in accordance with preference by geese (0–10 cm, Strong *et al.* 2021). In 2010, the set-aside field was harvested in August. In 2011 it was harvested in June, July, and August, and in 2012 once in June (Ödman *et al.* 2013, 2012, 2011). Manure fertilizer was applied in spring every year.

Our aim was to relate the probability of goose presence to explanatory variables such as field size, crop type, and distance to roost. We measured distance to water from the center-point of each field to the nearest water edge by using the function "Near" in ArcGIS version 10.5. The distance from surveyed fields to the surrounding roost sites varied from 150 to 3,100 meters. We obtained data on crop type and field size from the database "SAM" provided by the County Administrative board of Södermanland and the Swedish Board of Agriculture. This database builds on farmers´ annual reports of used crop type for obtaining EU and government subsidies (in accordance with the European Common Agriculture Policy, CAP). We pooled some crop types to obtain eight categories for our analyses (wheat, barley, rye, rapeseed, oats, set-aside, grass, and other). Potatoes, linseed, fallow land, and mixed cereal were merged into the category ‘other’ and pasture, ley, meadows, and mowed pasture into the ‘grass’ category.

2.4. Data analysis

Presence (1) or absence (0) of greylag geese was used as a binary response variable, whilst field and landscape characteristics were explanatory variables (Table S1). To estimate relationships between the presence of geese and field characteristics (crop type, distance to roost, and field size; Table S1) we used multiple regression analysis, with season added as covariate (see below). Three years of survey data were merged into one data set. We also grouped data into three seasons: spring, summer, and fall (Table S1). Spring (March–May) refers to the period when geese return from wintering areas and feed to restore muscle mass after the migration flight, build nutrient reserves, and start breeding (Fox *et al.* 2017). The main crops available in spring are those sown the previous autumn (fall-sown cereals and rape seed), spring sown crops, and ley fields. Summer (June–August) is when geese rear goslings and adults molt; hence they forage more in wetlands in June but start visiting the fields again in mid-July (Fig. 2). There is a larger variation in the availability of preferred forage during summer. At this time, crops in the area are either growing, being harvested, or growing for a second/third harvest (*e.g.*, ley fields). Fall (September–October) is when geese build up reserves for migrating south again, and most crops have been harvested and stubble fields with spilled grain are available (Fox *et al.* 2017).

Field id was set as a random factor to account for dependency of repeated observations within individual fields (Zuur *et al.* 2010). The response variable was over-dispersed with an excess of zeroes, so we used a zero-inflated binomial model with a logit link function, in the glmmTMB package (Bolker 2019) in program R (R Core Team 2021).

We used the Akaike Information Criterion (AICc) for small sample size, ΔAICc and AICc weights (w_i) for model comparison to find the most parsimonious models by using the dredge function in the package MuMIn (Barton 2022). We used the conditional R-square (Nakagawa *et al.* 2017) as a measure of the overall model fit.

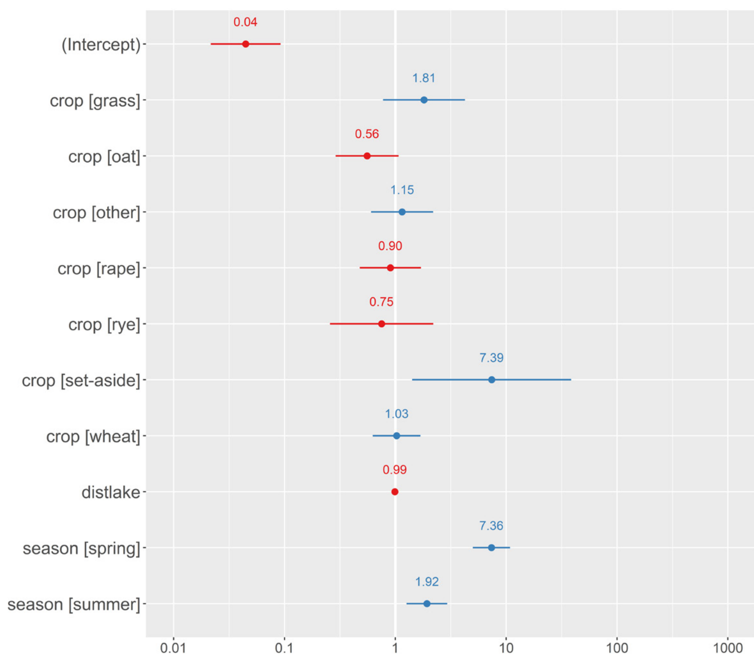

Fig. 2. Forest plot of the probability of goose presence, based on the top model estimates. Intercept corresponds to barley and fall. Whiskers are 95% confidence intervals. The vertical intercept (x=1; thick white line) is the neutral line which indicates no effect. Odds ratios greater than 1 indicate positive associations (blue dots), whereas odds ratios smaller than 1 indicate negative associations (red dots).

3. Results

3.1. Distribution and number of greylag geese

The number of greylag geese at Sörfjärden in September varied between 1,200 and 5,000 in 2010–2012 (mean number 4,060 individuals, mainly non-local staging birds) according to local counts (Ödman *et al.* 2013). The number of breeding greylag geese at Sörfjärden was estimated at an average of 175 pairs in 2007–2009. A total of 21,573 greylag geese were counted in the surveyed fields during the three years of study, with peaks in April and September (Fig. S1). In most cases (92%) of the survey events, there was no geese on the observed fields. The highest number of geese counted in one field was 2,100. The median number of greylag geese on the fields, when excluding the zero counts, was 12.

3.2. Factors influencing goose presence

The top ranked model to explain probability of goose presence included crop type, season, and distance to roost (conditional R^2 = 0.42; Table 1). Field size was not included in the top ranked model. The top ranked model predicted that the probability of geese presence was higher in the set-aside field than for the rest of the crop types, but it also had a larger error with a higher uncertainty (Fig. 2 & Fig. 3). There was a negative relationship between goose presence and distance to nearest roost site (Fig. 2 & Fig. 3). The model showed that geese were more likely to be present in surveyed fields in spring than in summer and fall (Fig. 2 & Fig. 3).

3.3. Probability of goose presence

To illustrate how the distance to roost affects the probability of goose presence, we here compare the probability of goose presence for fields at two different distances, 150 meters representing the shortest distance to roost, and 1,300 meters representing the average distance. According to the prediction of the top ranked model, the probability of goose presence on the set-aside field, during spring and at a distance from 150 meters from the roost site, was 0.68 (CI: 0.31–0.91). At the same distance and season the probability was lower for the category grass fields (second highest probability; 0.34 (CI: 0.21–0.49) followed by the category other 0.25 (CI: 0.15–0.37). At 1,300 meters from the roost site the probability for goose presence in spring was again highest for the set-aside field 0.39 (0.12–0.76), second highest for grass 0.14 (0.07–0.24) followed by other 0.09 (0.06–0.14) and wheat 0.08 (0.06–0.11).

In fall, the predicted probability to find geese on the set-aside field (150 meters from the nearest roost site) was 0.22 (0.6–0.58) and in summer for the same distance 0.35 (0.10–0.72). Grass fields ranked second in fall, 0.07 (0.03–0.12) and summer, 0.12 (0.07–0.20), at the same distance from the roost site. At 1,300 meters from the roost site in fall the set-aside was more prone to host geese 0.08 (0.02–0.30), second was grass 0.02 (0.01–0.04). In summer at 1,300 meters from the roost, set-aside had a predicted probability of goose presence of 0.14 (0.03–0.45), the second highest probability was for grass, 0.04 (0.02–0.08).

4. Discussion

Our results show that field selection of foraging greylag geese in the study area is influenced by a combination of factors such as crop type, season, and distance from the roost site. This implies that all these variables need to be considered when deciding where to place and what agricultural practices to use when establishing set-aside fields. Though our study concerned only one set-aside field it still indicates that its management made it more attractive to geese than were the adjacent conventional fields.

We found a low predicted probability for greylag goose presence on grass crops, but higher than for barley and wheat. A preference for ley grass and harvested root crops over cereals was found in migratory greylag geese in England (Newton & Campbell 1973). Wisz *et al.* (2008) modeled the probability of goose presence along the north European flyway and found an increased probability of pink-footed goose (Anser brachyrhynchus) occurrence on grassland compared to other crop types. Similarly, Strong *et al.* (2021)

Table 1. Multiple regression models used to evaluate field and landscape characteristics in relation to greylag goose presence at Sörfjärden in 2010–2012. Models are ranked according to Akaike's Information Criterion (AICc). The number of parameters (NP), AICc, changes in AICc (Δ AICc) relative to the top model and AICc weights (w_i) are listed for the 16 models considered as well as log likelihood. All models include field id as random effect. Only the top ranked model is considered in the results.

Model variables	NP	Log likelihood	AICc	ΔAICc	w_i
Crop + Distance to roost + Season	12	–1123.30	2270.7	0.00	0.456
Distance to roost + Season	5	–1130.85	2271.7	1.06	0.268
Size + Crop + Distance to roost + season	13	–1123.30	2272.7	2.01	0.167
Size + Distance to roost + Season	6	–1130.74	2273.5	2.84	0.110
Crop + Season	11	–1140.69	2303.4	32.78	0.000
Size + Crop + Season	12	–1140.37	2304.8	34.15	0.000
Season	4	–1152.86	2313.7	43.07	0.000
Size + Season	5	–1152.82	2315.6	44.99	0.000
Crop + Distance to roost	10	–1220.74	2461.5	190.86	0.000
Distance to roost	3	–1227.79	2461.6	190.92	0.000
Size + Distance to roost	4	–1227.68	2463.4	192.71	0.000
Size + Crop +Distance to roost	11	–1220.74	2463.5	192.87	0.000
Crop	9	–1238.52	2495.1	224.42	0.000
Size + Crop	10	–1238.21	2496.5	225.82	0.000
Null	2	–1250.06	2504.1	233.47	0.000
Size	3	–1250.01	2506.0	235.38	0.000

found that ley fields, and particularly those with short swards, were preferred by greylag geese in spring and summer in the surroundings of lake Hornborga (Sweden). Fox *et al.* (2017) concluded that geese prefer grass in spring, a pattern also reported from Scotland, where greylag geese appeared to select grass fields more often in spring than in fall and winter (Newton & Campbell 1973). Montràs-Janer *et al.* (2019) found that ley fields were one of the most reported damaged crops, second to barley, by geese in south-central Sweden.

In line with previous studies showing increased field selection and grazing pressure closer to roost sites (Gill 1996, McKay *et al.* 2006, Amano *et al.* 2008, Baveco *et al.* Nolet 2011), probability of presence of graylag geese in our study increased close to the roost. We found a 5 % decrease in probability of goose presence 1 km away from the roost site, compared to fields closest to it. Fox *et al.* (2017) concluded that fields with minimal disturbance and close to roosts are a success recipe for set-aside fields. Amano *et al.* (2007) showed that damage-prone crops such as wheat should be placed farther away from roosts to avoid damage. Vickery & Gill, (1999) recommended placing set-aside fields within a preferred distance of 2–5 km from the roost site for Icelandic greylag geese. However, we saw a continuously decreasing predicted probability for fields with distance to the roost site, with no such threshold.

Undisturbed sites in the agricultural landscape where geese can forage have been pointed out as important for conservation purposes, but also to reduce damage and thereby manage possible conflict between conservation and agriculture (McKenzie 2014, Fox & Madsen 2017). In areas where geese are simply scared away to prevent crop damage, set-aside fields are even more important in order to avoid just 'moving the problem around' (Jensen *et al.* 2008). Previous studies have shown that set-aside fields can attract geese if managed in the right way; *e.g.* by ensuring short sward height, using a preferred crop, and by

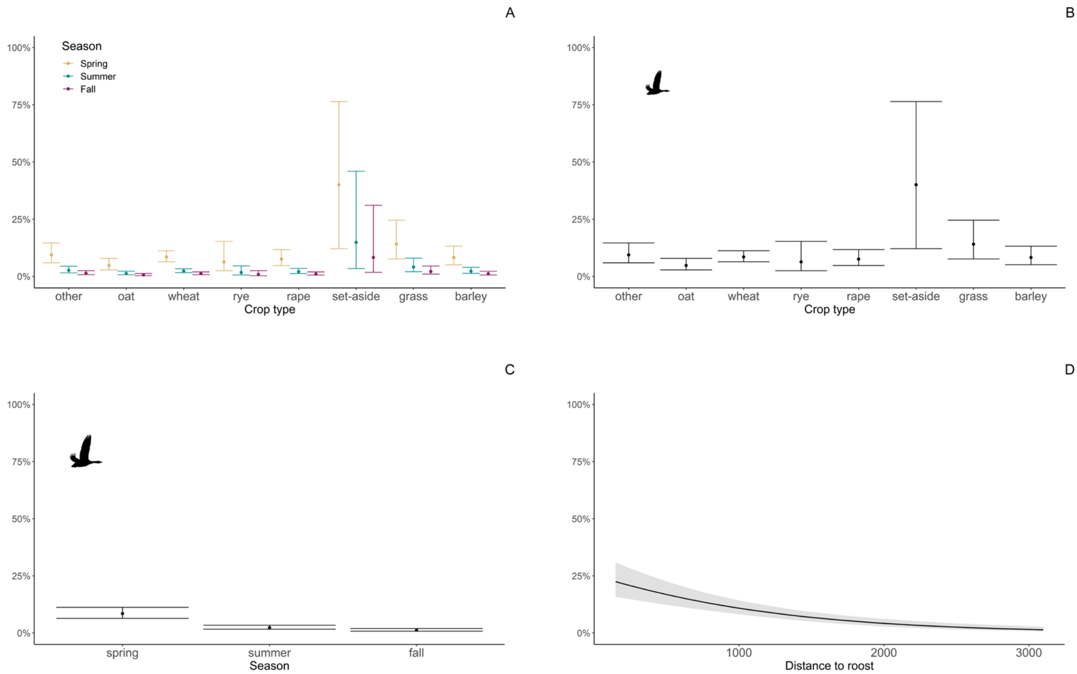

Fig. 3. Predicted mean probability of greylag goose presence (y axis) in study fields based on the top ranked model estimates, relative to crop type and season (A), crop type for all seasons (B), seasons (C), and distance to roost site (D). The error bars in the A, B, and C graphs and the grey area in D show confidence intervals (CI). Distance to roost site is held constant in the predictions to its mean (1300 meters) in plot A, B and C, and for plot D barley is the crop type held constant.

applying fertilizer (Aerts *et al.* 1996, Merkens *et al.* 2012, Fox *et al.* 2017). In our study area, most damage from geese occurs in spring and early summer, during the early growth phase of many crops. Later in summer and in autumn more stubble fields are available, where geese can feed without affecting unharvested fields. The aim with the set-aside field in our study was to divert greylag geese from conventional fields in spring and early summer by using a seed mix with grass and herbs known, from practical experience, to attract geese. According to our results and in line with our prediction, the probability of goose presence was higher on the set-aside field in spring compared to the other seasons. This indicates that the management of this field was appropriate.

Even though the set-aside was preferred compared to other available fields, it attracted only 28% of the total number of counted geese in the surveyed area during spring, and 12% for the whole period. One reason could be that the food availability on the set-aside field was limited in relation to the number of geese present in the area so that they needed to forage elsewhere. Another possible reason, as also shown in our study, is that the probability of geese visiting the fields decrease with distance to roost. Additional set-aside fields evenly distributed within the study area may therefore be needed to attract a larger proportion of geese. Increasing the size of the existing set-aside field might be another way to divert a higher proportion of geese from conventional fields. The size of the set-aside field in relation to the overall number of geese in the area should therefore be considered (Vickery & Gill 1999). Scaring efforts to reduce goose presence on surrounding fields could decrease their attractiveness in relation to the set-aside field. Scaring, open hunting and derogation shooting were indeed carried out in the study area to reduce crop damage, but the extent and frequency are unknown and thus not possible to consider when interpreting our results.

However, they are all likely additional factors affecting the distribution of geese and a reason for the high use of the set-aside field where geese are allowed to graze undisturbed

Our study did not reveal any increased selection for wheat and barley fields in late summer and fall, when the cereals have been harvested. Such an increase has previously been shown by Nilsson & Persson (1992) who found that geese foraged on cereal stubble fields during autumn. The energetic return from spilled grain is substantial (Clausen *et al.* 2018) and it should be an ideal food resource for geese at a time when they need to prepare physiologically for autumn migration (Fox *et al.* 2017). These results underline the importance of considering season when choosing crop type for a set-aside field. During spring and early summer, a well-managed ley field seems to work for attracting greylag geese in our study area, but cereal stubble fields may be a better option for set-aside fields in late summer and fall.

Our study shows that the probability of goose presence in the fields varied among seasons. There was a higher probability of goose presence in spring compared to in fall and summer, even though the total number of geese was lower in spring. As we used a binary predictor in our models, we interpret this as geese being more scattered in the landscape in spring than in summer and fall (Fig. S1). Other studies of geese have shown a similar pattern *i.e.* a more aggregated distribution and larger flocks in fall and winter than in spring and summer (Newton & Campbell 1973, McKay *et al.* 2006). We find two possible explanations for this pattern; greylag geese may be more prone to occur in pairs than in flocks during the breeding period, and/or food resources are less clumped in spring.

Contrary to earlier studies showing that field selection by geese increases with field size (Newton & Campbell 1973, Nilsson & Persson 1991, Gill 1996, McKay *et al.* 2006, Vickery & Gill 1999) our study did not find any such effect. Fox *et al.* (2017) recommended that set-aside fields should be larger than 5 ha, whereas Gill, (1996) concluded that smaller fields than 6 ha were never selected by pink-footed geese. The conventional fields we surveyed were 1–45 ha and the set-aside field was 5.7 ha. However, the mere size of fields can have different effect on the selection by geese depending on other landscape features such as hedges, ditches with reeds, trees etc. These features may block the view for geese and smaller fields with an open view may still be as preferred as larger fields. According to McKay *et al.* (1996) field size was of less importance to brent geese (*Branta bernicla bernicla*) when they were using pastures compared to when they were using crop fields. In that study, pasture fields differed from crop fields by being surrounded by lower hedges, located closer to water, and having less disturbance than crop fields. The multitude of factors influencing the selection of geese could be an explanation for why field size did not play an important role in our study.

We decided to present the results of the top ranked model according to AICc (Fig 2 & 3), however the ΔAICc of the second best model was <2, indicating that these two models are comparable in predicting goose presence. We motivate to present the top ranked model, which included the variable crop, as previous studies point out the importance of this variable explaining field selection of geese (Fox *et al.* 2017, McKay *et al.* 2006, Merkens *et al.* 2012, Vickery and Gill 1999). On the other hand, field size has also been pointed out as an important variable, however in our study, field size was not included in the models with ΔAICc <2 and also explained less variation than the null model as a single variable (Table 1).

Our study was based on one set-aside field and one species. This might limit the generality of the results. However, we are confident that our findings still may be useful in terms of crop protection because: a) there are very few previous studies evaluating the effect of established set-aside fields and b) our results are largely in line with previous studies on field selection patterns by geese in general. We did not assess the actual damage level caused by goose grazing but is reasonable to assume that when geese are foraging in a field, they indeed impact crops. Estimating and comparing damage levels could be an important next step to evaluate the effectiveness of preventive measures such as set-aside fields.

We found that field selection by greylag geese in the Sörfjärden study area was influenced by several factors such as distance to the roost site, season, and crop type. We argue this knowledge is important to understand selection patterns when managing geese in agricultural landscapes to minimize damage and conflict.

Fältval hos grågäss (*Anser anser*): implikationer för anläggande och skötsel av avledningsåkrar för att minska skador på gröda

Antalet grågäss (*Anser anser*) har ökat i Europa under de senaste decennierna. De söker föda och rastar i jordbrukslandskapet och kan orsaka skador på känsliga grödor. Vi studerade fältval av grågäss i området kring sjön Sörfjärden i södra Mellansverige och där gässen samlas under växtsäsongen. I detta område anlades en avledningsåker 2010, det vill säga en åker där gässen tillåts beta ostört, i syfte att minska skadorna på konventionella grödor. Målet med vår studie var att studera gässens fältval med fokus på avledningsåkern. Vi räknade antal gäss på fält i området och använde oss av regressionsanalyser för att utvärdera sambandet mellan sannolikheten att grågässen besöker ett fält och fältegenskaper som gröda, avstånd till övernattningsplats och storlek. Enligt den högst rankade förklarandemodellen, var sannolikheten för förekomst av grågäss på fält högre på våren och i vall, medan sannolikheten minskade med avståndet till övernattningsplatsen. Våra resultat visar också att avledningsåkern generellt sett användes mer än andra fält i området under våren och sommaren. Avledningsåkern var dock mindre attraktiv i förhållande till andra grödor under hösten. Vi drar slutsatsen att det är viktigt att överväga variabler som påverkar gässens val av fält såsom årstid, gröda och avstånd till övernattningsplatser för att förstå gässens beteende och på så sätt kunna anlägga effektiva avledningsåkrar.

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Online supplementary material

Supplementary material available in the online version includes Fig. S1 and Table S1.