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# The roost-feeding area complex of Taiga Bean Goose *Anser f. fabalis* in the Ume River Delta Plains, Sweden – foraging patterns in comparison with Greylag Goose *Anser anser*, Whooper Swan *Cygnus cygnus* and Eurasian Crane *Grus grus*

*Komplexet av rast- och betesmarker för taigasädgås* Anser f. fabalis *i Umeälvens deltaområde, Sverige – födosöksmönster i jämförelse med grågås* Anser anser*, sångsvan* Cygnus cygnus *och trana* Grus grus

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**Abstract**

In spring 2004, numbers of staging Taiga Bean Goose *Anser f. fabalis*, Greylag Goose *Anser anser*, Whooper Swan *Cygnus Cygnus*, and Eurasian Crane *Grus grus* were counted at the roost and at feeding grounds in and adjacent to the NATURA 2000 site Ume River Delta and Plains, Umeå, Sweden (SE0810475). For the Taiga Bean Goose a significant, negative relationship was found between total feeding time and the distance to the only roost. The most attractive feeding sites were stubble and non-harvested fields on moist or inundated soil within 2 km from the roost. The geese chose fields to minimize flight distances and disturbances from human activities. The Whooper Swan showed similar preferences as the Taiga Bean Goose, but it showed even a higher preference for inundated fields close to the roost. The Eurasian Crane showed a higher preference for the large central area of the plains, likely because of its sensitivity to disturbance. The Greylag Goose showed a very different foraging pattern with a greater preference for dryer uplands with cut hay fields.

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## Introduction

Estimates derived from counts at staging sites along the Swedish coast of the Bothnian Bay suggest that maximum 1500 pairs of the Taiga Bean Goose *Anser f. fabalis* breed in northern Scandinavia (Nilsson & Persson 1984, Skyllberg et al. 2003), corresponding to 2.7% to 3.3% of the world population of 90,000–110,000 individuals (Nilsson et al. 1999). Counts along migration routes and at wintering grounds suggest that the population of Taiga Bean Goose has declined in the last 40 years, both in Scandinavia (Nilsson & Persson 1984, Skyllberg et al. 2003) and globally (Nilsson et al. 1999). In order to secure a positive development of the Taiga Bean Goose population in Scandinavia, and to understand factors that may influence the status of the population, knowledge about the needs of the subspecies and how the most important staging sites are utilized prior to breeding is essential.

Studies of wintering Taiga and Tundra Bean Geese *Anser f. rossicus* in the Lower Rhine valley show that the geese are divided into smaller groups along the river valley, each group having one roost and several feeding sites close to the roost (Mooij 1993). The functional unit of a roost plus the surrounding feeding sites is called a "roost-feeding area complex" (Mooij 1993) or a "core-arena system" (Frederick et al. 1987). Most often there is only one roost within each "roost-feeding area complex", and according to Mooij the distance between the roost and feeding sites in the Lower Rhine area seldom exceeds 10 km. Furthermore, 40% of the main feeding sites are situated within 500 m from open water (for drinking), and less than 10% were situated more than 4 km away from open water. Similarly, studies in southern

Sweden have shown that the distance between the roost and feeding areas in no case (out of 21 sites) exceeded 10 km. At sites situated outside the large agricultural plains, having only one "complex", the distance often is 0–4 km (Nilsson & Persson 1984). The only information reported in scientific literature for spring staging sites in northern Sweden is that the Taiga Bean Goose generally moves only small distances between the feeding areas and the roost, which often is situated on ice (Nilsson & Persson, 1984).

Current knowledge about the habitats used and food requirement of the Taiga Bean Goose is highly restricted to conditions at autumn staging sites and at wintering grounds (e.g. Nilsson & Persson 1984, Mooij 1993), and at this point very little is known about pre-breeding requirements (Pirkola & Kalinainen 1984). Lampio (1984) reported the Taiga Bean Goose to utilize mainly stubble fields of hay and barley at the spring staging sites in Liminka, Oulo, NW Finland, and from NE Sweden Nilsson & Persson (1984) reported feeding mainly on stubble fields at Gärdefjärden, Lövånger, and on arable fields and grassland at Ostträsket, Skellefteå, and when the water was open possibly on *Equisetum spp.*

It is known from studies of Greater Snow Geese *Anser caerulescens atlanticus* that, in addition to quality and abundance of food, undisturbed conditions during spring staging prior to nesting is of significant importance for the breeding success (Gauthier et al. 1992, Féret et al. 2002). Studies of the Pink-footed Goose *Anser brachyrhynchus* at spring staging sites in northern Norway have shown a rapid increase in the abdominal profiles (fattening) of geese at sites without human disturbance, whereas at disturbed sites the fattening was significantly less. Subsequently, geese that had utilized undisturbed sites reproduced better than geese that were affected by disturbance (Madsen 1995). Thus, repeated disturbance at important staging sites during the period prior to breeding may result in decreasing breeding populations.

The Ume River delta plains is the most important last spring staging site for a number of wetland birds, before they reach their breeding grounds in northern Scandinavia. In addition to the Taiga Bean Goose, BirdLife International has recognized 27 bird species with IBA-status at the NATURA 2000 site Ume River Delta and Plains (SE0810475) (http://www.birdlife.net/index.html). During spring staging, maximum daily counts of 1500 to 2200 Taiga Bean Geese have been reported in the last eight years, and on the basis of conservative estimates of turnover rates, it is suggested that approximately 65% of the Scandinavian Taiga Bean Goose population use the Ume River delta plains in spring (Skyllberg et al. 2003). The food supply and undisturbed feeding conditions during spring staging likely is critical for the breeding success of the Taiga Bean Goose in Scandinavia, and therefore management of the NATURA 2000 site Ume River Delta and Plains should be optimized to meet the demands of the subspecies.

In this study the "roost-feeding area complex" of the Taiga Bean Goose is described and foraging patterns are reported for the spring staging period 2004. The main aim of the study is to get a relative measure of the importance of different feeding sites within the area and to identify factors behind the choice made by the geese. As a comparison, foraging patterns for the Greylag Goose *Anser anser*, Whooper Swan *Cygnus cygnus* and Eurasian Crane *Grus grus* also are presented.

## Materials and methods

### *Inventory of land use and counts of feeding and roosting birds*

After snowmelt and before the farmers started to plough their fields, the agricultural land use (crop) was inventoried. In Figure 1 crops and land use are illustrated for most fields in and adjacent to the NATURA 2000 site Ume River Delta and Plains (63°45´N, 20°17´E).

Numbers of feeding Taiga Bean Goose, Greylag Goose, Whooper Swan and Eurasian Crane were counted systematically by covering all known feeding localities at five occasions during the staging period in late April. Between one and four persons covered the whole area during 2–3 hours time (in order to minimize redistribution of birds within the area and subsequent multiple counts of individuals) on 12 April (local time 14:00–16:30), 17 April (17:00–20:00), 21 April (19:00–21:00), 24 April (13:30–16:00), and 28 April (18:00–20:30). On 17 April and 28 April, simultaneous observations from the traffic tower at Umeå airport confirmed a minimal amount of redistribution of birds (less than 2–3%) between feeding localities during the complete period of counting. In addition, for the Taiga Bean Goose, total counts of incoming birds to the night roost were performed in the evening (often at 20:30–21:30).

Additional counts were made by individual ornithologists of one or several of the selected bird species at one or several feeding sites, at differ-

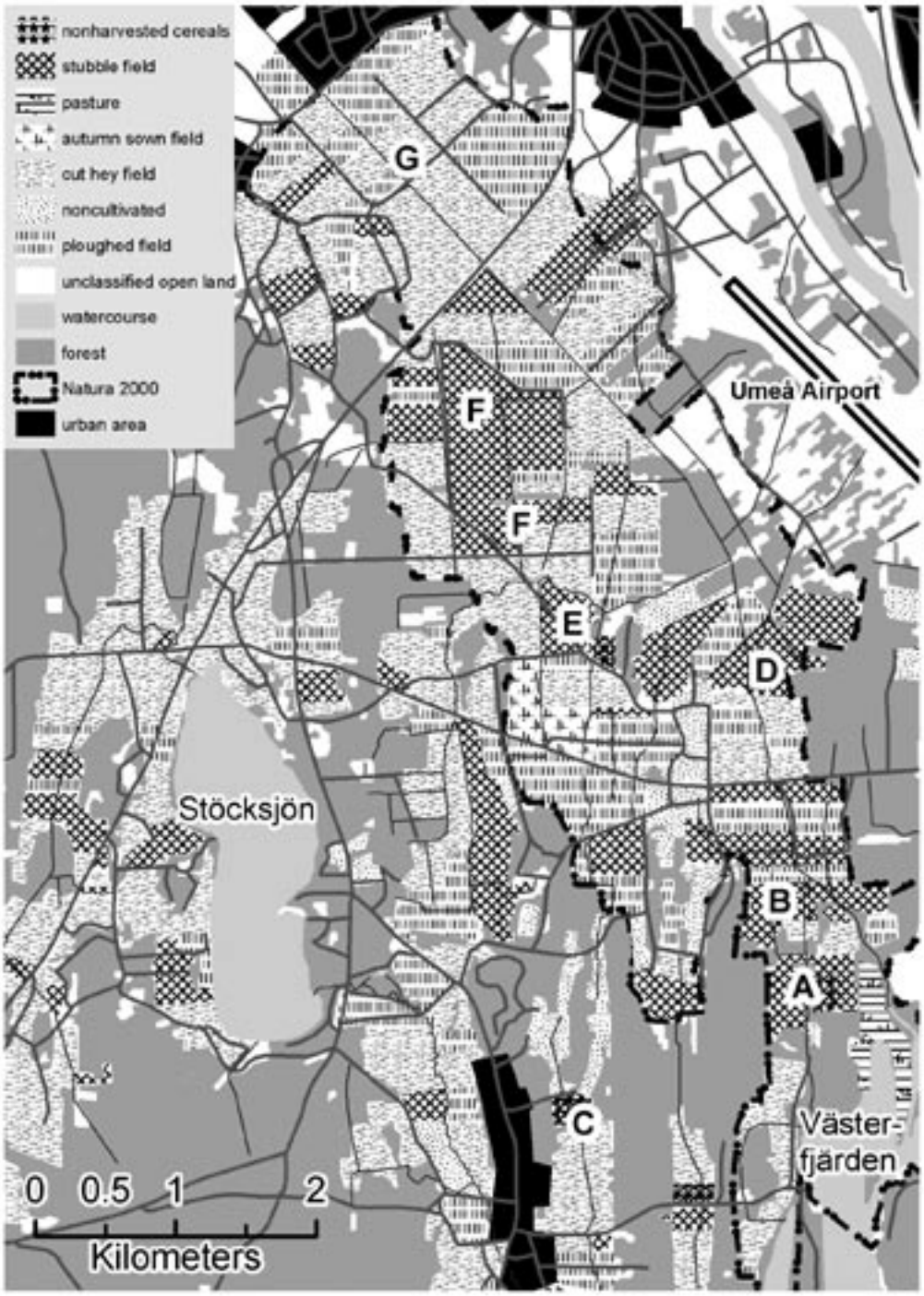


Figure 1. Agricultural land use in the Ume River Delta Plains in 2004. The seven feeding sites are indicated with letters A–G.
*Jordbrukets markanvändning in slättlandet vid Umeälvens delta 2004. De sju födosöksområdena indikeras med bokstäverna A–G.*

ent times of the day. These counts were reported directly to the authors or to the database "Svalan" (http://svalan.artdata.slu.se/rappsyst/index.htm), administrated and owned by the Swedish Environmental Protection Agency, the Swedish University of Agricultural Sciences and the Swedish Ornithological Society. These counts were used to calculate a daily average number at a certain feeding site during days not covered by systematic counts. For Taiga Bean Goose the total sum obtained for the whole area during days without systematic counts were compared with night roost counts. In the few cases when night roost counts deviated significantly from the sum of feeding birds the latter were adjusted proportionally at each feeding site to get a good match with the total count at the night roost. For sites without counts a certain day, linear inter- and extrapolations were made and numbers were rounded off to multiples of ten. In some cases information about changes (or no changes) in numbers at counted sites were used to estimate the most realistic number of birds on a non-counted site. Systematic counts, counts of individual feeding sites made by individual ornithologists and inter- and extrapolated values are reported for each day in Appendix.

Depending on factors such as cloudiness and disturbances, the swans, geese and cranes generally left the night roost between 4:00 and 5:00 (a.m.), and returned for the night at 20:30–22:00 (8.30–10.00 p.m.). An estimated mean night sleep of eight hours and one hour of day-time roost resulted in nine hours of "roosting" and 15 hours of "feeding". On the basis of these assumptions, the feeding time at a certain feeding site was calculated by multiplying the mean number of birds per day with 15 hours of feeding. The total feeding time for a given site was obtained by a summation of feeding time per day during the staging period. Even if the absolute number of feeding hours is not absolutely correct, the relative importance of different feeding sites can easily be compared and quantified.

## Description of roosts and feeding sites

### *Roost at Västerfjärden*

In the beginning of April the estuary bay Västerfjärden is covered by more than half a metre of ice, often overlain by several decimetres of snow. Depending on weather conditions, the ice is getting porous with scattered potholes, providing drinking water for the geese and swans at earliest 15–25 April. During the period 25 April–5 May, the ice breaks up and larger areas of open water becomes available for the roosting birds. The mean water depth of the area used as roost is about 0.5 m and the maximum depth is rarely greater than 1 m. Because of the late snow and ice melt, potentially important food supply provided by plants such as *Scirpus, Carex, Equisetum* spp. are seldom available for grazing on land before the majority of the geese have left for their breeding areas. However, observations of feeding swans and geese in the shallow water at the roost late in the staging period suggest that they may feed on shoots of these and related species under water.

Västerfjärden is the only roost in the area for the Taiga Bean Goose and the Eurasian Crane during spring staging. Young cranes spending the summer in the Ume River delta plains (maximum numbers of 400) use several other roosts, which are covered by snow during early spring. Västerfjärden is also the major roost for the Greylag Goose, but in 2004 unusually high numbers of this species followed Whooper Swans to their major roost in Österfjärden. Occasionally also small groups of Taiga Bean Geese and Eurasian Cranes may follow Whooper Swans to Österfjärden. This may occur in the very beginning of the spring staging period, but when the number of Taiga Bean Geese increases, practically all birds of this species use Västerfjärden as day and night roost throughout the rest of the spring staging period. Västerfjärden has been used as the only major roost by the Taiga Bean Geese as long as any living ornithologist knows (back to at least 1930). Taiga Bean Geese have never with certainty been seen staying in flooded feeding fields at night, even if they some evenings may fly to the night roost when it is dark.

### *Roost at Österfjärden*

The roost is located east of the island Tuvan, where the current of Ume River is as strongest and creates an ice-free area at a water depth of several meters. Some years open water is available already in the first week of April. In spring 2004 this was the major roost for the Whooper Swan, and the Greylag Goose was split between this roost and the roost in Västerfjärden. In the springs of 2001–2003, however, a majority of the Whooper Swans and all Greylag Geese used Västerfjärden as their major roost. The reason for this could have been thicker ice at Österfjärden and lack of open water when the Whooper Swans arrived, concen-

trating all four species of this study to the roost at Västerfjärden.

*Feeding site A – Skäret*

Because of the low-lying position in the landscape, the agricultural fields at site A (Figure 1) are partly inundated during spring snow melt. This holds mainly for the western part of the area where the soil surface is positioned only a couple of decimetres above the average water surface level in the Ume River estuary. Thus, high water levels in the estuary due to strong southern winds and spring flood have a profound effect on the ground-water table at Skäret. During extensive flooding this area may be used by up to several thousands of dabbling ducks. Due to the rise of the land (approximately 0.8 cm every year), this area was a wetland about 70 years ago, and before that it was part of the bay Västerfjärden. Aerial photographs show that the whole area of 21 ha was cultivated in 1954. In spring 2004 the area was covered by stubble fields after barley, except in SE where some plots (in total approximately 75 by 75 m) with non-harvested barley were left. The site is free from disturbance from human activities and is the only agricultural area of the Ume River delta having an intact connection with the estuary without barriers such as roads and other infrastructure.

*Feeding site B – Degernäs SE*

The low-lying southwestern part of this area is annually inundated to a similar extent as the western part of site A. During springs with a rapid snowmelt, a pond of several hectares extension is formed here. During spring 2004 the pond reached an intermediate extension, in comparison with the springs 2000–2003. The rest of the area is generally very moist throughout the staging period of swans and geese. The area is used for agricultural production of cereals and hay. In spring 2004 more than half of the area was covered with stubble fields after barley (Figure 1). The area with the pond in southwest was used as a hay field and the rest of the area was ploughed. Sources of disturbance of the site are mainly traffic at the paved road in the north and activities at houses along the gravel road to the western part of the area.

*Feeding site C – Stöcke*

In spring 2004, cut hay fields covered the southern two thirds of the area, and the northern one third was covered by mainly non-harvested hay mixed with oats (Figure 1). There was a small plot of pasture with grazing horses close to the fields in the western part. The area close to the small stream was partly flooded during the peak staging period in spring 2004. The site is narrow in east-west direction, but quite extensive in north-south direction. The disturbance is restricted to activities by the farmer living west of the site. Forest edges and a small ridge shelter the area from houses in the village Stöcke.

*Feeding site D – Degernäs N*

Only occasionally, during springs with a rapid snowmelt in short time, the fringes along the stream Degernäsbäcken are inundated at this slightly higher positioned area. In the northern part about half of the area was covered by stubble fields after harvesting barley and the other half was covered by ploughed fields (Figure 1). Closer to the road in the south, hay fields were mixed with ploughed fields. The fields in the area are situated quite far away from gravel roads and houses along these roads, and the human disturbance is considered low. The eastern part may be negatively impacted by noise from Umeå airport.

*Feeding site E – Degernäs W*

This upland is almost never inundated. The area was covered by mainly cut hay fields and autumn sown cereal fields north of the paved road, and ploughed fields south of the road (Figure 1). There were some small plots of non-harvested hay fields mixed with oats in the northern part of the area. The area is quite large and except from disturbance from traffic on the paved road, and some smaller gravel roads with occasional human activity, the absence of nearby houses results in a quite small rate of disturbance from humans.

*Feeding site F – Obsladan/T-vägen*

This is a large area that is highly exposed to wind and sunshine, and therefore its soils become bare early in the staging period. Often there is an extensive flooding in the central part of the area, along a major ditch, and up to several thousands of dabbling ducks may use the area during early spring. Often the wet fields cannot be ploughed in autumn, and therefore stubble fields and/or hay fields in general cover the low-lying terrain. This was also the case in spring 2004 (Figure 1). The

Table 1. Total feeding time (number of birds multiplied by 15 hours of estimated feeding time per day) at seven sites at the Ume River Delta Plains.
*Total födosökstid på sju födosöksplatser i Umedeltat.*

| | | *A. f. fabalis* | | *C. cygnus* | | *G. grus* | | *A. anser* | | Total "bigfour" | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | km[a] | 1000 hours | % | 1000 hours | % | 1000 hours | % | 1000 hours | % | 1000 hours | % |
| Locality (ha[b]) | | | | | | | | | | | |
| A Skäret (21) | 0.9 | 91.6 | 32 | 47.3 | 33 | 35.2 | 31 | 8.2 | 12 | 182.3 | 30 |
| B Degernäs SE (46) | 1.4 | 58.5 | 21 | 37.1 | 26 | 26.2 | 23 | 4.1 | 5.8 | 125.9 | 21 |
| C Stöcke (7) | 2.1 | 51.3 | 18 | 23.5 | 16 | 0 | 0 | 5.6 | 7.9 | 80.4 | 13 |
| D Degernäs N (8) | 3.0 | 12.2 | 4.3 | 0.7 | 0.5 | 16.4 | 14 | 5.5 | 7.9 | 34.8 | 5.7 |
| E Degernäs W (16) | 3.1 | 7.4 | 2.6 | 8.8 | 6.2 | 0.09 | 0.1 | 5.6 | 8.0 | 21.9 | 3.6 |
| F Obsladan /T-vägen (91) | 4.8 | 47.7 | 17 | 12.6 | 8.8 | 36.2 | 31 | 22.1 | 32 | 118.5 | 20 |
| G Röbäcksdalen (4) | 7.6 | 10.1 | 3.6 | 13.4 | 9.3 | 0.9 | 0.8 | 18.9 | 27 | 43.2 | 7.1 |
| | | | 100 | | 100 | | 100 | | 100 | 606.9 | 100 |

[a] Distance to night roost in Västerfjärden. *Avstånd till nattplatsen i Västerfjärden.*
[b] Estimated area in ha utilised for feeding during spring staging 2004. *Beräknad areal i hektar som nyttjades för födosök under vårrastningen 2004.*

exposure to wind and sun restricts the flooding generally to a very short period of time and in the second half of the staging period the land is generally quite dry. The site is the by far largest open area without major roads in the whole Ume River delta plains, and except for farming activities the rate of disturbance from humans is low.

*Feeding site G – Röbäcksdalen*

This upland area situated north of the E4 highway is the first to show snow-free patches in spring, but it is never inundated. Because the area is large and highly exposed to wind and sun it dries up early. In spring 2004 cut hay fields and ploughed fields highly predominated, with only a couple of small stubble fields close to the village of Röbäck (Figure 1). Apart for the high noise level from the highway, the major source of disturbance is riding and hiking people along the gravel roads.

## Results

In Table 1 numbers of total feeding hours for the four studied bird species are reported for the seven most important feeding sites (A–G). The locations of feeding sites are illustrated in Figure 2. The most important site for the Taiga Bean Goose (32% of total feeding time), the Whooper Swan (33%) and the Eurasian Crane (31%) was Skäret (site A). For Greylag Goose the site F (Obsladan/T-vägen) was most important (32% of total feeding time).

*Taiga Bean Goose*

The total number of spring staging Taiga Bean Geese in spring 2004 was quite similar to the springs of 2002–2003, and a conservative estimate suggests that at least 2500 individuals used the area in 2004 (Skyllberg et al., unpublished material). The Taiga Bean Goose showed a strong preference for feeding sites A, B, C and F (Table 1). In Figure 2, these numbers of feeding hours at different sites are illustrated.

During the first week of staging, a maximum of 115 Taiga Bean Geese were feeding at site G. The geese utilize this area since it gets snow free early, but later, when bare ground is visible at sites A, B and F, they abandon site G. As can be seen in the Appendix (Table A), locality F was the most important feeding site on 17–18 April, but numbers dropped quite dramatically during the period 21–24 April. This pattern, with larger number of Taiga Bean Geese at the major northern feeding site (F) in the first half of the staging period, followed by a concentration to the southern sites (A and B) when the spring proceeds, is more or less pronounced every year. The reason is that the snow melts first at the northern, more open and exposed feeding sites. Flooded areas appear at site F when the snow cover is still quite deep at fields of

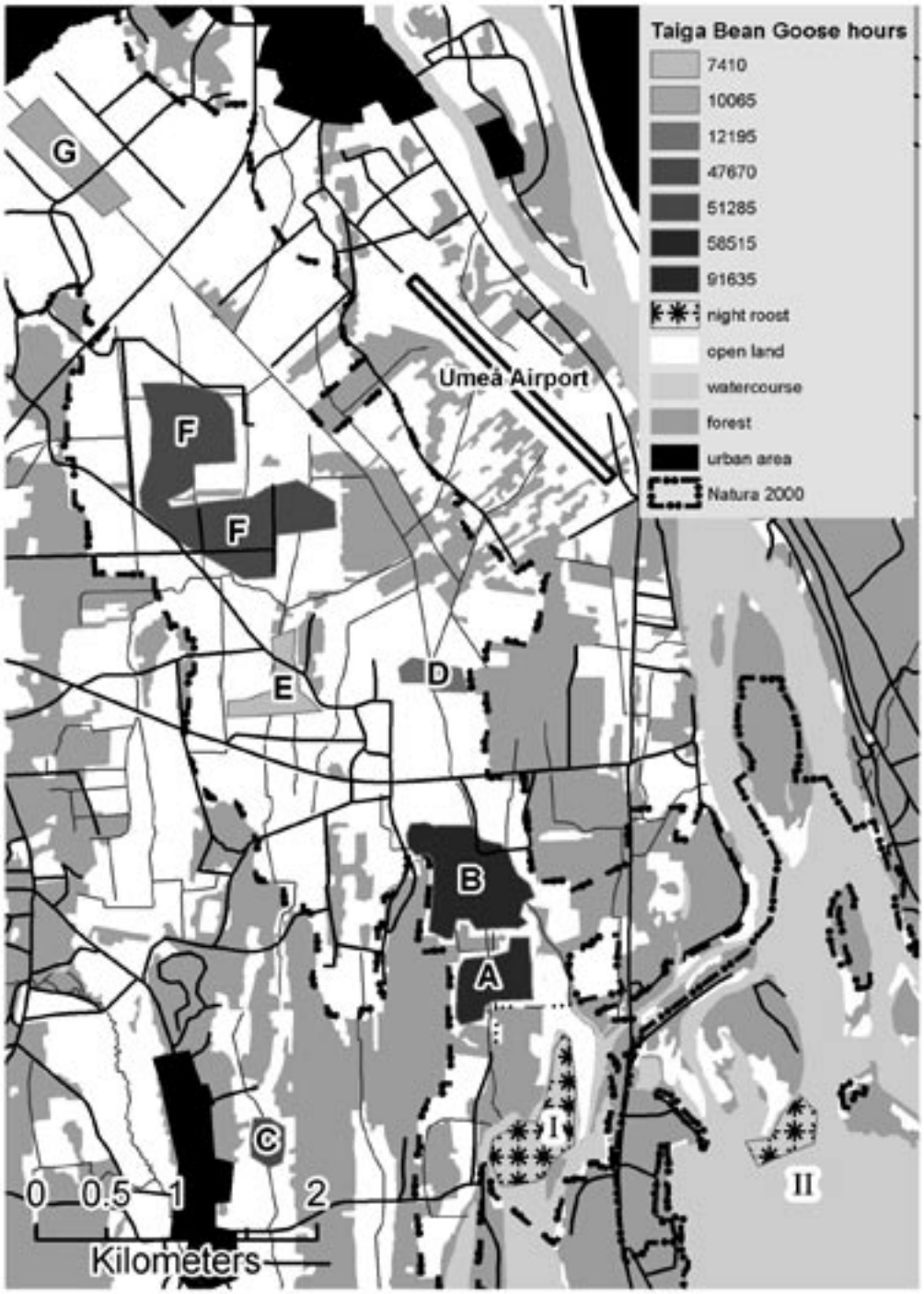


Figure 2. Roosts in the Ume River Delta: Västerfjärden (I) and Österfjärden (II), and feeding sites (A–G) in the plains used by Taiga Bean Goose, Whooper Swan, Greylag Goose, and Eurasian Crane during spring staging in 2004.
*Nattplatser i Umedeltat, Västerfjärden (I) och Österfjärden (II) samt födosöksplatser (A–G) för taigasädgås, sångsvan, grågås och trana inom det angränsande slättlandet.*

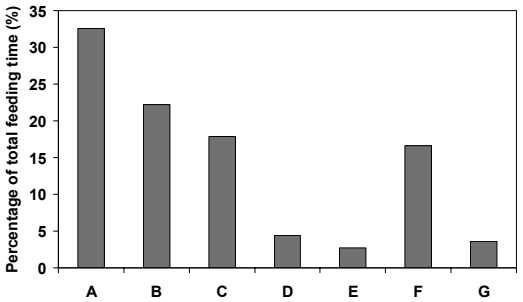


Figure 3. Relative importance of the different sites A–G for feeding Taiga Bean Goose. A = Skäret, B = Degernäs SE, C = Stöcke, D = N. Degerbäcken, E = Degernäs W, F = Obsladan/T-vägen, and G = Röbäcksdalen.
*De olika födosöksplatsernas (A–G) relativa betydelse för taigasädgås. A = Skäret, B = Degernäs SE, C = Stöcke, D = Degernäs N, E = Degernäs W, F = Obsladan/T-vägen, and G = Röbäcksdalen.*

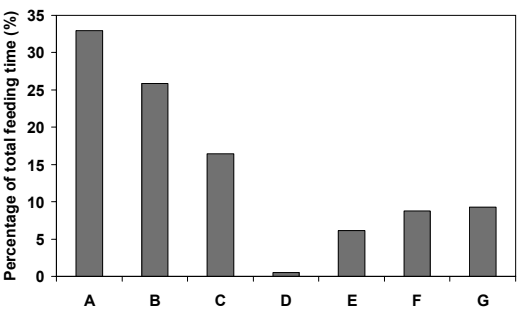


Figure 4. Relative importance of the different sites A–G (explained in Figure 3) for feeding Whooper Swan.
*De olika födosöksplatsernas (A–G; förklarade i Figur 3) relativa betydelse för sångsvan.*

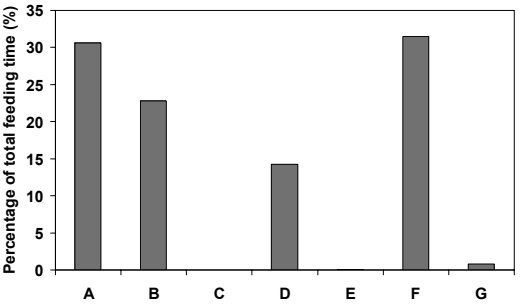


Figure 5. Relative importance of the different sites A–G (explained in Figure 3) for feeding Eurasian Crane.
*De olika födosöksplatsernas (A–G; förklarade i Figur 3) relativa betydelse för trana.*

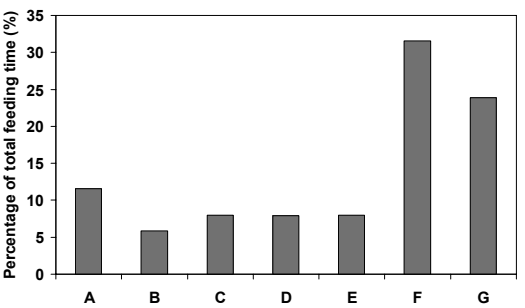


Figure 6. Relative importance of the different sites A–G (explained in Figure 3) for feeding Greylag Goose.
*De olika födosöksplatsernas (A–G; förklarade i Figur 3) relativa betydelse för grågås.*

sites A and B which are shadowed by forest edges. Also site E could be frequently used early in the staging period in some years. After some time the frost in the soil disappears at the northern sites and the sun and wind dries up the ground, making the sites less attractive, especially for the Taiga Bean Goose and the Whooper Swan. These two species therefore concentrate their foraging to the southern parts, where the late snow melt keeps parts of the fields moist and partly flooded a longer period of time. Despite this general pattern, it should be noted that localities A and B hold a significant portion of Taiga Been Geese throughout the whole staging period (c.f. Appendix, Table A).

At site B the geese utilized the stubble fields with a marked concentration to the southwest part which is quite inundated. This part of feeding site B is quite remotely situated and sheltered from possible sources of disturbance (roads and houses). Note that the stubble fields in the northern part of site B, which was situated within 200 m from the paved road, were not utilized by any of the four species. At site C the number of Taiga Bean Geese (as well as of Whooper Swans) was greater than normal in 2004. The reason for this was probably local hydrological variations, resulting in more extensive flooding than normal. Part of the area in addition had non-harvested hay mixed with oats that might have been attractive for the birds. The geese were, however, mostly seen on the inundated parts of the cut grassland (cf. Figure 1 and 2). The relative importance of the different sites for the Taiga Bean Goose is illustrated in Figure 3.

*Whooper Swan*

The choice of feeding sites of the Whooper Swan followed a similar pattern as the one for the Taiga Bean Goose, but with an even more pronounced concentration to the southern part of the plains. At the feeding sites A, B and C, 75% of all "Swan hours" were encountered (Table 1). The relative importance of the different sites for Whooper Swans is illustrated in Figure 4.

*Eurasian Crane*

The Eurasian Crane mainly utilised two parts of the plains: sites A+B and site F. The Eurasian Crane is easily disturbed by man and therefore chose large, open fields like sites F and B, or intermediately sized fields surrounded by sheltering trees/forests, like site A and site D. Interesting to note is that site C did not attract any cranes at all, except for a pair of local breeders. This field likely was too small for the cranes, thus making them feel insecure when feeding. The sensitivity of Eurasian Cranes for disturbance by roads and human activities is clearly seen by the low number of feeding time at sites E and G. The relative importance of the different sites for the Eurasian Crane is illustrated in Figure 5.

*Greylag Goose*

The Greylag Goose had very different preferences when it comes to foraging in the Ume River delta plains, as compared to the other three species. The Greylag Goose is the only species of the "big four" that is concentrated to the northern part of the area throughout the staging period. It apparently prefers to feed on relatively dryer land, preferentially with cut hay fields. Furthermore, the Greylag Goose is not so easily disturbed by human activities and may use fields closer to houses and roads. These demands and tolerances made sites F and G most attractive for the Grey-lag Goose (Figure 6).

**Discussion**

*Comparison with previous springs*

The high concentration of the Taiga Bean Goose at feeding sites A and B, as well as at the roost Västerfjärden, was even more pronounced in the three preceding years 2001–2003 (Skyllberg & Hansson 2001; Hansson & Skyllberg 2002; Skyllberg et al. 2003; Skyllberg & Hansson 2004). Even if systematic daily counts of feeding birds were not conducted on a regular basis 2001–2003, complete counts were conducted each year during the peak migration (Table 2), as well as regular counts at the night roost.

The unusually warm spring in 2002 dried up the northern and central parts of the plains quickly. Because of that almost no Taiga Bean Geese were using the northern feeding sites during the peak of the staging period (Table 2). As a matter of fact, the latest observation of foraging Taiga Bean Geese at site F was seven individuals as early as on 20 April in spring 2002. In 2003, the staging period was later and extended longer than in 2004, due to variable and cold weather, and 1020 Taiga Bean Geese were counted at the night roost as late as on 2 May (Skyllberg et al. 2003). In the beginning of the staging period the geese were spread out and 238 were counted at site F on 17 April, 500 at site E on 18 April, and 204 at site D on 18 April. After that date, however, almost all Taiga Bean Geese were concentrated to feeding sites A

Table 2. Maximum day-counts of Taiga Bean Goose *Anser f. fabalis* in the Ume River Delta Plains during the peak migration in spring 2001–2003. Percentage of individuals using sites A, B, and the roost at Västerfjärden is given in parenthesis.
*Dagsmaximum av taigasädgäss i Umedeltat under sträcktoppen vårarna 2001–2003. Procent individer som nyttjade födosökslokalerna A, B och nattplatsen i Västerfjärden anges inom parentes.*

| | April 28 2001[a] | April 23 2002[b] | April 26 2003[c] |
|---|---|---|---|
| Västerfjärden roost | 30 | 930 | 823 |
| A Skäret | 360 | 675 | 303 |
| B Degernäs SE | 272 | 310 | 118 |
| C Stöcke | 110 | ? | ? |
| D Degernäs N | 68 | 0 | 0 |
| E Degernäs W | 360 | 0 | 0 |
| F Obsladan /T-vägen | 195 | 0 | 26 |
| G Röbäcksdalen | 0 | 0 | 0 |
| Total | 1395 (47) | 1915 (100) | 1270 (98) |

[a] Inventory by the regional ornithological society VOF 6:30–8:00 local time. *Inventering utförd av Västerbottens Ornitologiska Förening 6:30–8:30 lokal tid.*

[b] Inventory by 3–4 persons 11:00–13:00 local time. *Inventering utförd av 3–4 personer 11:00–13:00 lokal tid.*

[c] Inventory by the regional ornithological society VOF 6:30–8:00 local time. *Inventering utförd av Västerbottens Ornitologiska Förening 6:30–8:30 lokal tid.*

and B, and to the roost at Västerfjärden. Thus, the pattern reflected by the count at peak migration during 2003 (26 April) was quite representative for two thirds of the staging period. In 2001 the weather was colder and the Taiga Bean Goose utilised a larger area of the plains also during peak migration. Note especially that site E was used in 2001 to a larger extent than the other years, due to moister conditions (late snow melt and several days with rain) and presence of more stubble fields in that area.

Another major difference in the geographical distribution of the Taiga Bean Goose between 2004 and previous springs was the more intensive use of the roost in Västerfjärden during daytime in 2001–2003 (Table 2). During spring 2004, the roost at Västerfjärden was covered with ice (without potholes) and cold snow during most of the staging period, and Taiga Bean Geese were only occasionally seen at the roost during daytime. Only in the very end of the staging period, when maximum 500 birds were left, Västerfjärden was used for longer stays during daytime. This was quite different from springs in the period 2001–2003, when large numbers of Taiga Bean Geese were seen roosting and drinking at Västerfjärden several times a day during peak migration (Skyllberg & Hansson 2001; Hansson & Skyllberg 2002, Skyllberg et al. 2003).

*Selection of feeding crops by the Taiga Bean Goose*

Results from spring 2004 suggest that the Taiga Bean Goose prefers stubble fields during its springtime roost in the Ume River Delta, but also non-harvested, partly flooded fields of barley and hay mixed with oats attracted the Taiga Bean Goose. At feeding site A, a small plot (approximately 75 by 75 m in size) with non-harvested barley was left. This plot was the first to be exposed during spring (snow melting was enhanced by the standing straws), and there was a concentration of mainly Whooper Swans and Eurasian Cranes to the spot initially. However, when the snow disappeared from the rest of the feeding site A, no difference in feeding intensity could be observed between the area with non-harvested barley and ordinary stubble fields.

Even if the Taiga Bean Goose seems to prefer stubble fields and non-harvested fields, the composition of the actual food intake at the fields is still uncertain. Very little is known about the food demand of Taiga Bean Goose prior to the breeding period (Pirkola & Kalinainen 1984). In a study from lake Tåkern, Sweden, stubble fields (27%), fields with autumn sown cereals (35%) and fields with wheat that had not been harvested (36%) were the most frequently used feeding habitats in spring (Nilsson & Persson 1984). At lake Östen, southern Sweden, stubble fields (10% one year 57% the following year), fields with non-harvested oats (44% and 0%), autumn sown cereals (22% and 16%), and grassland (8% and 24%) were the most commonly used habitats in spring. Based on these results, Nilsson & Persson (1984) concluded that the Taiga Bean Goose seems to adapt to the feeding habitats available, even if the food itself has not been identified. Furthermore, the big variation (seasonal and spatial) in types of sites available for the geese, in the material from Nilsson & Persson (1984), makes generalisations very difficult. Also, more recent studies at wintering sites confirm that the Taiga Bean Goose is very adaptive and may feed on different crops depending on what is available (Nilsson & Persson 2000). However, these results cannot easily be extrapolated to northern spring staging sites since the food requirement for the geese may be very different in the crucial period prior to breeding.

*Distance between feeding sites and roost of the Taiga Bean Goose*

Given that stubble fields were quite evenly spread all over the cultivated part of the Ume River delta plains in 2004 (Figure 1), the significant ($r^2=0.42$, $p<0.05$), negative relationship obtained between the distance of feeding site to roost and the total number of feeding time (Figure 7) reflects other needs or demands of the Taiga Bean Goose. On the basis of the results from 2004, as well as of observations in 2001–2003, we hypothesize that these needs are:

1) a minimum distance between feeding sites and the night roost
2) a minimum of disturbance by man
3) a certain degree of moisture or flooding at feeding sites

All three properties are very well expressed at Skäret (feeding site A). Also sites B and C are situated quite closely to the roost, both sites are quite undisturbed, and parts of the fields at both sites were inundated in 2004. Based on subjective, visual observations, the inundation should not necessarily create large flooded areas. Better is a patchy, mosaic structure with small areas or pools of open

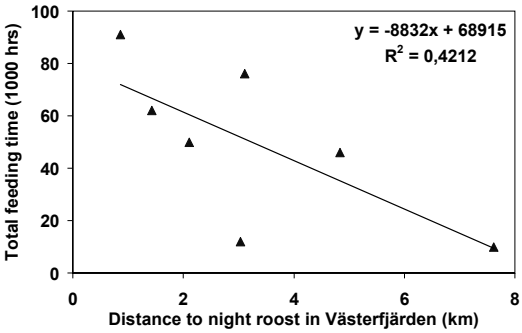


Figure 7. Relationship between total feeding time for Taiga Bean Goose and distance to the roost in Västerfjärden.
*Samband mellan total födosökstid för taigasädgås och avstånd till nattplatsen i Västerfjärden.*

water mixed with moist and dryer parts on the stubble fields. Likely, the lack of inundated, moist soils was the main reason for only small numbers of Taiga Bean Geese using feeding site D, despite its large area of stubble fields (Figure 1). Another factor at site D may be noise impact from Umeå airport. Apart from temporary inundation, the large size, with a good overlook, likely makes site F advantageous from a disturbance point of view. The fact that this feeding site is abandoned when it dries up clearly indicates that the distance and/or the wetness are crucial factors. Maybe the absence of feeding Taiga Bean Geese in the area south-west of feeding site E and west of lake Stöcksjön is the best indication for the distance to the roost being a critical factor. In both these areas there are many stubble fields with varying moisture. Perhaps the fields west of lake Stöcksjön are too small for species sensitive for disturbance such as the Taiga Bean Goose, and surrounded by to many houses? It should be noted that the utilized site at greatest distance from Västerfjärden (feeding site G) is located 8 km away from the night roost. Again, this site is only used when there are few other sites available due to snow cover.

The importance for the geese to minimize the distance between feeding site and roost has been verified in several studies. In the Vombsjön-Krankesjön wintering areas in Skåne, south Sweden, Nilsson & Persson (1984) found that the Taiga Bean Geese not only adjusted the feeding according to availability of food supply, but also selected feeding areas depending on the distance to the night roost. On average the distance was shortest in spring and longest in winter. In May, the mean distance was 2.5 km, in April 3.2 km, and in January–February 7.4–10.6 km. Out of 20 areas in southern Sweden with wintering and spring staging Taiga Bean Goose, all except one had major feeding grounds within 2 km from the roost. Eight areas showed a maximum distance of 4 km between roost and feeding grounds, and only eight areas showed a distance to the most remotely situated field of 8–10 km. No area had an identified feeding site situated more than 10 km away from the roost. In a recent study from lake Tåkern, conducted during spring staging in 2003 and 2004, the distance between the lake and the feeding site for Taiga Bean Geese was maximum 3 km for 15 out of 17 feeding sites. The remaining two feeding sites were situated 3.5 and 6 km from the lake (Anon. 2004). The distance was on average slightly longer in autumn. Based on these data, it can be concluded that the distances between the roost and feeding areas is a key factor for the selection of roost/feeding areas. One obvious reason for this is that the loss of time for feeding is smaller the shorter the distance the birds need to cover between roost and feeding areas. Furthermore, longer flights cost energy. This holds both for flights caused by disturbances and flights caused by needs (for water and rest).

As stressed by Mooij (1993), the night roost is probably the single most important factor for the geese in a staging and wintering area. Based on the very strong link between roost and neighbouring feeding sites Mooij states: "Any kind of human disturbance at the night roost can chase the geese away for weeks. Because there are very few sites suitable for roosting geese, disturbing the goose roost means that a whole area will be deserted by the geese. Several complexes have only one roost. Every kind of human activity must be forestalled". Based on these experiences, it is obvious that proper management of the roost site at Västerfjärden and the frequently used feeding sites close to the roost is of utmost importance for the Taiga Bean Goose in the Ume River delta plains, as well as for maintenance of the population.

### *Disturbance and local movements*

In this study, movements of the birds during the day were not considered. Of course, giving each feeding site one number of feeding birds each day is a simplification of a more complicated pattern. Even if birds were observed to move during daytime, mainly because of disturbances, the number of birds using a certain feeding site over time was

quite stable, as reflected by counts made several times during a day, or subsequent days. After strong disturbance, Taiga Bean Geese and Eurasian Cranes most often fly to the roost and stay there for a period of time (often 20–30 minutes), and then return to the feeding site again. Thus, the birds most often return to the same feeding site after disturbance, a pattern also seen for Taiga and Tundra Bean Geese in the Lower Rhine area (based on studies of 2 million geese in 800 flights; Mooij 1993). A similar pattern has been observed for Brent Geese feeding on pasture (Riddington et al. 1996). Whooper Swans and Greylag Geese are not as easily disturbed as the other two species, and movements among or within feeding sites, especially for the Whooper swans, are therefore often only for short distances. Thus, based on several years of experience from our area, we believe that even if data on the diurnal variation had been incorporated and used to determine an integrated number for each feeding site each day, the results of the relative importance of the different feeding sites would not have changed significantly.

The distribution pattern of the Taiga Bean Goose in the Ume River delta plains may be interpreted in terms of minimizing the distance to the roost and maximizing the distance to the nearest source of disturbance. In the Lower Rhine valley, the White-fronted Goose *Anser albifrons* and the Bean Goose actively select feeding sites situated as far away as possible from disturbances such as regularly used roads and buildings (Mooij 1993), with a threshold at approximately 800–900 m. At the Ume River delta plains this distance is fulfilled at site A and F, and largely at site B, C and D. The distance to nearby houses is only approximately 600 m at site C, but forest edges in between may function as a shelter. An inspection of the map in Figure 1 reveals that there are very few fields with a distance of 500 m and more from regularly used roads and houses that are not already utilised by the geese in the Ume River delta plains. If also the need for the geese to minimize the flight distance is taken into consideration, the demand for proper management and protection of the area from new sources of disturbance is obvious.

## Conclusions

On the basis of the results from 2004, as well as from observations in 2001–2003, we conclude that the Taiga Bean Goose choose stubble fields, non-harvested fields, and occasionally cut hay fields that are: (1) located at a minimum distance from the roost, (2) have a certain degree of moisture (inundation), and, most importantly, (3) is affected by a minimum of human disturbance. Based on the detailed inventory in spring 2004, as well as on experiences from previous years, we conclude that sites A and B for many reasons are the most important localities for the Taiga Bean Goose and the Whooper Swan in the NATURA 2000 site Ume River Delta and Plains. For the Eurasian Crane sites A, B and F are of equal importance, and for the Greylag Goose, site F is the single most important feeding area. A recommendation of the cultivation activities in the Ume River Delta plains should be directed towards maintenance of sufficient availability of stubble fields in these localities, and that no action is taken to improve the drainage. On the opposite, it would be very beneficial for wetland birds if the drainage is temporarily restricted during spring staging. The limited number of non-disturbed feeding sites requires that no additional sources of disturbance should be allowed in the NATURA 2000 site.

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## References

Anonymous, 2004. *Habitatval hos tranor, gäss och sångsvanar kring Tåkern.* Rapport 2004:14, Länsstyrelsen Östergötland. (In Swedish).

Féret, M., Gauthier, G., Béchet, A., Giroux, J.-F. & Hobson, K.A. 2003. Effects of spring hunt on nutrient storage by greater snow geese in southern Quebec. *Journal of Wildlife Management* 67: 796–807.

Frederick, R.B., Clark, W.R. & Klaas, E.E. 1987. Behaviour, energetics and management of refuging waterfowl: a simulation model. *Wildlife Monographs* no. 96: 1–35.

Gauthier, G., Giroux, J.-F. & Bédard, J. 1992. Dynamics of fat and protein reserves during winter and spring migration in greater snow geese. *Canadian Journal of Zoology* 70: 2077–2087.

Hansson, P. & Skyllberg, U. 2002. Inventering av Umeälvens deltaområde våren 2002. *Fåglar i Västerbotten* 27: 80–84. (In Swedish)

Lampio, T. 1984. On the spring migration of the bean goose, *Anser fabalis*, in Finland. *Swedish Wildlife Research* 13 (1): 59–72.

Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. *Ibis* 137: 67–74.

Mooij, J.H. 1993. Development and management of wintering geese in the Lower Rhine area of North Rhine-Westphalia/Germany. *Die Vogelwarte* 37: 55–77.

Nilsson, L. & Persson, H. 1984. Non-breeding distribution, numbers and ecology of Bean Goose *Anser Fabalis* in Sweden. *Swedish Wildlife Research* 13 (1): 107–170.
Nilsson, L.& Persson, H. 2000. Changes in field choice among staging and wintering geese in southwestern Scania, south Sweden. *Ornis Svecica* 10: 161–169.
Nilsson, L., van den Bergh, L. & Madsen, J. 1999. Taiga bean goose (*Anser fabalis fabalis*). Pp. 20–36 in *Goose popluations of the Western Palearctic. A review of status and distribution.* (Madsen, J., Cracknell, G.S. & Fox, A.D., eds.). Wetlands International Publication No. 48.
Riddington, R., Hassall, M., Lane, S.J., Turner, P.A. & Walters, R. 1996. The impact of disturbance on the behaviour and energy budgets of Brent Geese *Branta b. bernicla. Bird Study* 43: 269–279.
Skyllberg, U., Bernhardtson, P., Naudot, E. & Hansson, P. 2003. Taigasädgåsen (*Anser f. fabalis*) i Umedeltat och Norra Norrlands kustland. *Fåglar i Västerbotten* 28: 54–64. (In Swedish)
Skyllberg, U. & Hansson, P. 2001. Inventering av Umeälvens deltaområde våren 2001. *Fåglar i Västerbotten* 26: 93–98. (In Swedish)
Skyllberg, U. & Hansson, P. 2004. Umedeltat – viktig rastplats för Skandinaviens taigasädgäss. *Vår Fågelvärld* 63 (2): 18–22. (In Swedish)
Pirkola, M.K. & Kalinainen, P. 1984. The status, habitats and productivity of breeding populations of Bean goose, *Anser fabalis fabalis*, in Finland. *Swedish Wildlife Research* 13 (1): 9–48.

## Sammanfattning

Både den skandinaviska populationen och världspopulationen av taigasädgås *Anser f. fabalis* har under de senaste 50 åren visat en vikande trend (Nilsson m fl. 1999), även om kunskapen om storleken på den skandinaviska populationen begränsar sig till kvalificerade gissningar. Under ca tre veckor i april och maj hyser Natura 2000-området Umeälvens delta och slätter regelbundet ca 65% av de taigasädgäss som under vårsträcket rastar i norra Norrlands kustland (Skyllberg m.fl. 2003). Kunskapen om de krav som taigasädgåsen ställer på de rastplatser som nyttjas under vårsträcket, speciellt på nordliga latituder, är mycket knapp. Det gäller både födokrav, krav på nattplats samt störningskänslighet. Studier av spetsbergsgås *Anser brachyrhynchus* och snögås *Anser caerulescens atlanticus* under vårperioden innan häckningen har visat att god tillgång på föda och ostörda rastbetingelser är avgörande för häckningsframgången (t.ex. Gauthier m.fl. 1992, Madsen 1995). Mooij (1993) har dessutom poängterat betydelsen av att nattplatsen är ostörd samt närheten mellan rastplats och goda och födosökslokaler. Studier i övervintringsområden i södra Sverige och i Rhendalen visar att avståndet mellan nattplatsen och huvudsakliga betesfält vanligen understiger 4 km.

I syfte att öka kunskapen om taigasädgåsens krav och behov under den kritiska vårrastningsperioden, kartlades taigasädgässens val av betesfält i Umedeltats slättområde under 2004. Som jämförelse studerades även grågäss *Anser anser*, sångsvan *Cygnus cygnus* och trana *Grus grus*. De fyra arterna räknades systematiskt på samtliga kända födosökslokaler vid fem tillfällen. Dagar däremellan insamlades data från födosökslokaler på ett mer osystematiskt vis; dessutom nyttjades kontrollerade uppgifter rapporterade till Svalan. Dagar utan noterat antal på en specifik lokal angavs ett värde genom linjär intra- eller extrapolering. Samtliga data redovisas i Appendix. Antalet individer multiplicerades med 15 timmar av födosök per dag vilket resulterade i en totalsumma per födosökslokal och art (Tabell 1). Uppträdandet av födosökande gäss, svanar och tranor på de sju identifierade födosökslokalerna inom området analyserades i relation till typ av markanvändning och gröda (Figur 1), avstånd till nattplatsen, markfuktighet samt störningsbild.

Taigasädgåsen visade en hög preferens för tre områden (lokal A, B och C) som alla är lokaliserade inom 2 km från artens enda nattrastplats i området (Västerfjärden). Den bästa födosökslokalen (lokal A – Skäret) stod för 32%, lokal B stod för 21% och lokal C för 18% av den totala födosökstiden i slättområdet (Tabell 1, Figur 2 och Figur 3). Samtliga tre lokaler var fuktiga med inslag av mindre översvämmade områden längs diken och vattendrag. Fälten inom lokal A och B dominerades av stubbåkrar efter korn, medan lokal C bestod i huvudsak av skördad vall samt inslag av oskördad vall med inblandad havre. Utöver dessa tre områden nyttjades de största sammanhängande fälten i Umedeltats slättområde (lokal F), vilka i hög grad täcktes av stubbåkrar efter korn. Även detta område översvämmas regelbundet i början av rastperioden. Områdets öppna karaktär gör dock att marken snabbt torkar ut, vilket gör fälten mindre attraktiva för taigasädgässen. Generellt utnyttjar taigasädgåsen de nordliga betesfälten (G och F) tidigt under rastperioden, medan en allt större koncentration sker till de södra betesfälten efter hand (A, B och C). Detta mönster följer i stort snösmältningens förlopp i området.

Sångsvanen visade ett liknande mönster som taigasädgåsen, men tyngdpunkten till lokalerna A, B och C var ännu mer markant med 75% av den totala födosökstiden (Figur 4). Tranan nyttjade i princip två delområden av slättområdet: lokalerna A+B samt lokal F (Figur 5). Troligen väljer tranan betesfält i hög grad utifrån dess störningskänslig-

het. Fälten inom område A+B är avsides belägna eller avskärmade från vägar och hus, dessutom är fälten ganska stora och faror upptäcks lätt. Lokal F är det största sammanhängande områden med fält, där stora flockar av tranor kan känna sig trygga. Grågåsen uppvisade ett mönster som avvek från de tre andra arternas. Även om grågäss sågs i utkanten av sädgåsflockar här och var, föredrog arten de nordliga betesfälten, och då företrädesvis slagen vall (Figur 6). Denna art är mindre störningskänslig och visar en preferens för vall där gräs är den viktigaste födan.

En jämförelse med vårarna 2001–2003, då organiserade räkningar gjordes i Västerbottens ornitologiska förenings regi vid några tillfällen bekräftar taigasädgåsens preferens för betesfält inom område A och B. Faktum är att vid de räkningar som utfördes under kulminationen av vårrastningen 2001, 2002 och 2003 uppehöll sig 47%, 100% respektive 98% av taigasädgässen inom område A, B och på rastplatsen i Västerfjärden (Tabell 2). En skillnad mot våren 2004 var att rastplatsen i Västerfjärden utnyttjades mer dagtid under vårarna 2001–2003, troligen beroende på att isen spruckit upp i fler vakar dessa år då gässen rastade lite senare i april.

Taigasädgåsens totala födosökstid per födosökslokal visar en signifikant ($p<0.05$), negativ korrelation med avståndet till nattplatsen i Västerfjärden (Figur 7). Eftersom det fanns gott om stubbfält med varierande fuktighet i hela slättområdet indikerar sambandet att andra omständigheter än födovalet var avgörande för val av betesfält. Analys av de faktorer som överensstämmer eller skiljer sig mellan lokaler som nyttjas och inte nyttjas utmynnar i hypotesen att taigasädgåsen: (1) minimerar avståndet till nattplatsen, (2) kräver viss grad av fuktighet på betesfälten, samt (3) väljer fält med minimal störning.

Vi rekommenderar att skötseln av Natura 2000-området inriktas mot att bibehålla en tillräcklig andel stubbåkrar (d.v.s. undvika höstplöjning), speciellt för de födosökslokaler som ligger närmast nattplatsen, samt att ytterligare dränering av området förhindras. Tvärtom borde åtgärder som begränsar avrinningen under vårrastningsperioden ekonomiskt stimuleras. Det redan idag begränsade antalet betesfält som är ostörda från vägar och hus måste bibehållas och vår bedömning är att nya störningskällor inte kan accepteras i Natura 2000-området om taigasädgåsen skall kunna vidmakthålla sin status i området

Appendix

Table A. Counts and intra-/extrapolations of Taiga Bean Goose *Anser f. fabalis* roosting and foraging in the Ume River Delta Plains in April 2004.
*Räkningar och intra-/extrapoleringar av övernattande och födosökande taigasädgås* Anser f. fabalis *i Umeälvens delta och slätter under april 2004.*

| April | 6-8 | 9-10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 1.5 | Sum | Hours | % hours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0 | 77 | 139 | 175 | 200 | 250 | 300 | 390 | 300 | 290 | 450 | 300 | 257 | 250 | 310 | 307 | 450 | 400 | 400 | 476 | 250 | 123 | 15 | 6109 | 91635 | 32,54 |
| B | 0 | 0 | 0 | 0 | 40 | 80 | 115 | 140 | 260 | 720 | 400 | 311 | 440 | 400 | 320 | 285 | 200 | 120 | 70 | 0 | 0 | 0 | 0 | 3901 | 58515 | 20,78 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 60 | 100 | 200 | 400 | 405 | 450 | 500 | 574 | 340 | 179 | 150 | 23 | 5 | 3 | 0 | 3419 | 51285 | 18,21 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 40 | 40 | 100 | 50 | 47 | 150 | 120 | 100 | 94 | 50 | 2 | 0 | 0 | 0 | 0 | 0 | 813 | 12195 | 4,33 |
| E | 0 | 0 | 0 | 0 | 0 | 20 | 40 | 75 | 160 | 85 | 50 | 24 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 494 | 7410 | 2,63 |
| F | 0 | 30 | 30 | 30 | 30 | 30 | 100 | 200 | 520 | 425 | 420 | 420 | 420 | 300 | 100 | 47 | 35 | 26 | 15 | 0 | 0 | 0 | 0 | 3178 | 47670 | 16,93 |
| G | 15 | 50 | 65 | 115 | 108 | 100 | 75 | 60 | 45 | 26 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 671 | 10065 | 3,57 |
| Sum | 45 | 314 | 234 | 320 | 378 | 480 | 650 | 935 | 1385 | 1746 | 1582 | 1502 | 1712 | 1520 | 1330 | 1307 | 1075 | 727 | 635 | 499 | 255 | 126 | 15 | 18772 | 281580 | 100,00 |
| Total counts | | | | 290 | | | | | 1340 | 1646 | | | 1712 | | ***1293*** | 1307 | ***917*** | ***797*** | ***730*** | ***566*** | ***249*** | 126 | 15 | | | |

Table B. Counts and intra-/extrapolations of Wooper Swan *Cygnus cygnus* roosting and foraging in the Ume River Delta Plains in April 2004.
*Räkningar och intra-/extrapoleringar av övernattande och födosökande sångsvan* Cygnus cygnus *i Umeälvens delta och slätter under april 2004.*

| April | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | Sum | Hours | % hours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 51 | 60 | 86 | 145 | 161 | 258 | 395 | 300 | 300 | 300 | 270 | 270 | 190 | 130 | 70 | 39 | 35 | 30 | 30 | 15 | 10 | 5 | 2 | 3152 | 47280 | 33,0 |
| B | 0 | 30 | 60 | 50 | 50 | 50 | 50 | 160 | 273 | 270 | 270 | 270 | 241 | 175 | 160 | 140 | 100 | 66 | 38 | 20 | 0 | 0 | 0 | 2473 | 37095 | 25,9 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 60 | 90 | 120 | 150 | 187 | 190 | 210 | 220 | 150 | 96 | 50 | 16 | 1569 | 23535 | 16,4 |
| D | 0 | 0 | 0 | 0 | 0 | 10 | 26 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 690 | 0,5 |
| E | 0 | 0 | 0 | 7 | 10 | 10 | 10 | 20 | 50 | 70 | 90 | 21 | 87 | 70 | 60 | 55 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 590 | 8850 | 6,2 |
| F | 0 | 0 | 3 | 20 | 40 | 30 | 40 | 50 | 60 | 70 | 80 | 80 | 46 | 57 | 80 | 111 | 50 | 20 | 2 | 0 | 0 | 0 | 0 | 839 | 12585 | 8,8 |
| G | 0 | 0 | 10 | 18 | 25 | 32 | 30 | 60 | 100 | 116 | 115 | 110 | 109 | 110 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 890 | 13350 | 9,3 |
| Sum | 51 | 90 | 159 | 240 | 286 | 390 | 551 | 600 | 783 | 826 | 855 | 811 | 763 | 662 | 575 | 532 | 405 | 326 | 290 | 185 | 106 | 55 | 18 | 9559 | 143385 | 100,0 |
| Total counts | | | | | | | 465 | | | | | 701 | | | | 532 | | | 290 | | | | 18 | | | |

Table C. Counts and intra-/extrapolations of Greylag Goose *Anser anser* roosting and foraging in the Ume River Delta Plains in April 2004.
*Räkningar och intra-/extrapoleringar av övernattande och födosökande grågås* Anser anser *i Umeälvens delta och slätter under april 2004.*

| Locality | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | Sum | Hours | % hours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0 | 0 | 0 | 3 | 3 | 3 | 30 | 40 | 40 | 50 | 55 | 30 | 80 | 50 | 30 | 12 | 15 | 20 | 17 | 31 | 13 | 12 | 12 | 546 | 8190 | 11,7 |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 10 | 10 | 10 | 0 | 65 | 60 | 40 | 30 | 20 | 10 | 6 | 0 | 0 | 0 | 0 | 271 | 4065 | 5,8 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 30 | 40 | 40 | 40 | 40 | 40 | 40 | 44 | 20 | 5 | 8 | 8 | 370 | 5550 | 7,9 |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 10 | 10 | 10 | 10 | 0 | 35 | 71 | 50 | 30 | 30 | 31 | 40 | 20 | 0 | 0 | 0 | 367 | 5505 | 7,9 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 20 | 40 | 60 | 120 | 60 | 14 | 10 | 10 | 5 | 5 | 0 | 5 | 7 | 5 | 0 | 371 | 5565 | 8,0 |
| F | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 45 | 80 | 120 | 160 | 170 | 180 | 190 | 192 | 150 | 95 | 48 | 20 | 0 | 0 | 0 | 1470 | 22050 | 31,6 |
| G | 14 | 14 | 14 | 60 | 60 | 60 | 100 | 100 | 93 | 100 | 120 | 150 | 150 | 150 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1260 | 18900 | 27,1 |
| Sum | 14 | 14 | 14 | 63 | 63 | 63 | 150 | 190 | 218 | 290 | 390 | 490 | 600 | 565 | 435 | 314 | 260 | 201 | 155 | 96 | 25 | 25 | 20 | 4655 | 69825 | 100,0 |
| Total counts | | | | | | | 150 | | | | | 340 | | | | 314 | | | 155 | | | | 20 | | | |

Appendix continued

Table D. Counts and intra-/extrapolations of Eurasian Crane *Grus grus* roosting and foraging in the Ume River Delta Plains in April 2004.
*Räkningar och intra-/extrapoleringar av övernattande och födosökande trana* Grus grus *i Umeälvens delta och slätter under april 2004.*

| Locality | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | Sum | Hours | % hours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 6 | 15 | 24 | 55 | 40 | 133 | 180 | 280 | 250 | 250 | 250 | 220 | 177 | 150 | 80 | 60 | 50 | 100 | 0 | 10 | 5 | 5 | 4 | 2344 | 35160 | 30,59 |
| B | 0 | 0 | 10 | 10 | 70 | 131 | 120 | 50 | 300 | 150 | 120 | 91 | 54 | 50 | 75 | 87 | 150 | 150 | 78 | 50 | 0 | 0 | 0 | 1746 | 26190 | 22,79 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0,00 |
| D | 0 | 0 | 0 | 0 | 0 | 50 | 100 | 80 | 80 | 80 | 80 | 62 | 180 | 140 | 80 | 0 | 100 | 50 | 10 | 0 | 0 | 0 | 0 | 1092 | 16380 | 14,25 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 90 | 0,08 |
| F | 0 | 0 | 30 | 75 | 70 | 200 | 150 | 150 | 120 | 200 | 300 | 345 | 200 | 130 | 150 | 142 | 100 | 50 | 0 | 0 | 0 | 0 | 0 | 2412 | 36180 | 31,48 |
| G | 0 | 0 | 8 | 10 | 10 | 10 | 14 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 | 930 | 0,81 |
| Sum | 6 | 15 | 72 | 150 | 190 | 524 | 564 | 570 | 750 | 680 | 750 | 724 | 611 | 470 | 385 | 289 | 400 | 350 | 88 | 60 | 5 | 5 | 4 | 7662 | 114930 | 100,00 |
| Total counts | | | | | | | 259 | | | | | 724 | | | | 239 | | | 88 | | | | 4 | | | |

Feeding sites: A - Skäret, B - Degernäs SE, C - Stöcke, D - Degernäs N, E - Degernäs W, F - Obsladan+T-vägen, G - Röbäcksdalen
Underlined numbers = actual counts. Other numbers represent intra- and extrapolations.
Total counts are summations of systematic counts at feeding sites and for Taiga Bean Goose counts made in the evening at the night-roost at Västerfjärden (italics).
Differences between Sum and Total counts are due to corrections based on counts ouside the time for systematic counts
Hours are total numbers of birds multiplied by 15 hours of feeding per day

*Födosöksplatser: A - Skäret, B - Degernäs SE, C - Stöcke, D - Degernäs N, E - Degernäs W, F - Obsladan+T-vägen, G - Röbäcksdalen*
*Understrukna värden = fältobservationer. Övriga värden representar intra- and extrapoleringar.*
*"Total counts" är summan av systematiska observationer på födosöksplatser och för Taigasädgås räkningar vid kvällsinfloget till nattplatsen i Västerfjärden (kursivt).*
*Skillnader mellan "Sum" och "Total counts" hänförs till korrigeringar av antal baserat på räkningar utförda före eller efter den systematiska räkningen*
*"Hours" anger totalt antal fåglar multiplicerat med 15 timmars födosök per dygn*