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Status and population changes of farmland birds in southern Sweden

JEREMY ROBERTSON & ÅKE BERG

Abstract

Since 1950 there have been considerable changes in the use of Swedish farmland which have led to a more large-scale, homogeneous and intensively managed agricultural landscape. These changes in Swedish farmland have affected the populations of many farmland birds. We give the densities of 29 selected farmland birds and 15 selected species of forest birds at eight large study sites (farmland landscapes of 14.5-21.5 km^2 size; total of 140 km^2) in southern Sweden and review the population changes of 48 species of farmland birds in southern Sweden.

The number of breeding farmland bird species at the different sites was positively correlated with total farmland area, area of scrub and trivial deciduous forest, as well as with the fragmentation of the forest landscape; there were more farmland species in fine-grained than in coarse-grained landscapes. Species found in forest edges and dry pastures were the most widespread ones (found at most sites), and included several species with high densities. Most of these species have not decreased as dramatically as other species. Several species of arable land were also widespread, but most of them have declined in numbers since 1950, possibly as a consequence of changes in farming practices. Meadow is the farmland habitat that has declined most, and this is reflected in the low densities and scattered distribution of many species found on cut or grazed meadows. Several of these species are now largely confined to marginal habitats and areas where farmland still has a traditional structure. However, on abandoned meadows overgrown with bushes and trees a few successful colonists are increasing in numbers.

Of the 48 farmland birds breeding in Sweden the populations of only 10 have remained relatively stable since 1950; seventeen have increased (8 markedly) while 21 have decreased (12 markedly). Of the 21 species that primarily breed on farmland, 9 (43%) have declined markedly compared with only 3 (11 %) of the 27 secondary farmland birds, which have a large proportion of the population in other habitats. Similarly, only 5% of the primary species have increased markedly compared with 26 % of the secondary species. More primary than secondary farmland species are also extinct, or categorized as endangered, vulnerable or requiring consideration on Swedish Red Data lists. Large parts of the Swedish farmland are now being taken out of production, which probably will have negative effects on several farmland bird populations.

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Introduction

There is a lower proportion of farmland in Sweden than in most European countries, and Swedish farmland is usually more diverse, because most farmers own blocks of woodland interspersed with their fields. The traditional agricultural landscape in Sweden is a mosaic of different elements with different management practices, leading to small meadows, pastures and arable fields mixed with patches of woodland and marginal habitats (Larsson 1985, Gerell 1988, Robertson et al. 1990). Unique features of Scandinavian farmland are the patches of surface bedrock or glacial till in the fields forming "habitat islands" (Swedish: "åkerholme") of a variety of sizes that may remain as bare rock but are usually covered with grass, scrub or trees.

Since 1950 there have been considerable changes in the use of Swedish farmland which have led to a more large-scale, homogeneous and intensively managed agricultural landscape (Gerell 1988), which has considerably altered the habitats suitable for breeding populations of farmland birds. The extent of these

changes varies between farms and between different agricultural regions, but modern Swedish farmland is unquestionably more homogeneous than it used to be. Most modernisation has been in the main agricultural regions, whereas there have been comparatively few changes in agriculture in northern Sweden and in the forested region of central Sweden. The changes in Swedish farmland have been too extensive for some species of birds to become adapted, while other species have colonised and consequently there have been some changes in the community of farmland birds (Järvinen & Ulfstrand 1980). Some species like Corncrake *Crex crex* that preferred the traditional habitats, have declined (Risberg 1988b), while other species, particularly steppe species such as the Skylark *Alauda arvensis,* have flourished.

Most studies of the status of farmland birds have been based on territory mapping on small (<100 ha) areas of farmland (e.g. O'Connor & Shrubb 1986). These methods tend to emphasise the commoner species and are less effective for the rarer species that are perhaps at most risk from the changes in agriculture. In this paper we present densities of 29 selected farmland and 15 forest species found at eight large farmland sites (farmland landscapes, including forests) in southern Sweden. We have defined farmland birds in a broad sense and incorporated most species that were found in the traditional farmland. Consequently, we have included species found on meadows and pastures, species found in wetlands but which use farmland when foraging, and several species that are found both in farmland and other habitats. We also review the literature on population changes and discuss the conservation needs of these species.

Methods

Bird census

Eight large study sites (agricultural landscapes including forests) were censused during one of the years 1983-85 in the main agricultural regions of southern Sweden. Two sites, Dörröd (Dör) and Anderslöv (And), are in the main southern agricultural area; three sites, Forshem (Fors), Klockrike (Klock) and Vikbolandet (Vikb) are in the central agricultural region; and three sites, Sjö, Ängsö (Äng) and Västerfärnebo (Väsf) are in the most northerly agricultural area of southern Sweden (Table 1). The sites are large areas (14.5 - 21.5 km^2, total area 140 km^2) with boundaries that could be conveniently recognized in the field (Robertson & Skoglund 1985). All the sites were too large to census using the usual mapping method designed for censusing common birds breeding on small areas (<100 ha, e.g. O'Connor & Shrubb 1986). To overcome this problem we mapped 44 selected species of birds (Tables 3 and 5) at the study sites. These included species that typically nest in fields or at their boundaries, meadow and pasture species and also some forest species that are found in woodland in agricultural areas. Each site was subdivided into sub-areas that could be conveniently mapped by an observer during the four or five hours after daybreak. The sub-areas at each site were thus mapped eight times between 1 April and 30 June. In addition at least two visits were made to each sub-area at night to map nocturnally active species. Full details of the method and the criteria used to determine the number of breeding territories for each species are given in Robertson & Skoglund (1985). The densities of species were calculated by dividing the number of territories by the area of farmland for the farmland species, and by the area of forest for the forest species. Yellowhammers *Emberiza citrinella* were breeding throughout farmland and woodland so their densities were calculated from the total area of the study site. Similarly Marsh Harriers *Circus aeruginosus* utilized both farmland and reed beds in marshes and their densities were calculated from the area of farmland plus marsh.

Any observations of the species that were not mapped were noted and on the basis of the type of observation they were given one of twenty breeding criteria (Svensson 1974). These criteria range from simply observing the species during the breeding season through to finding eggs or nestlings. Our minimum criterion for probable breeding was at least two observations, of which one was breeding behaviour such as singing within a suitable territory during the breeding season. Using all the breeding criteria from the eight visits we could determine the number of breeding birds at each site.

Habitat mapping

The areas of different habitats at the eight study sites were measured from colour infrared aerial photographs (1:30 000). The following habitats were then separated; arable fields, islands of other habitats in arable fields (Swedish: åkerholme), pasture, scrub, meadow, coniferous forest, mixed forest, trivial deciduous forest (mainly aspen *Populus tremula,* alder *Alnus glutinosa* and birch, *Betula pubescens* and *Betula verrucosa*), broad-leaved deciduous forest, clear-cut, wetlands, reeds and urban land.

Results and discussion

Habitat composition

The longitudes and latitudes of the sites, the year they were censused, their areas (excluding lakes) and the percentage of 13 different habitats at the 8 study sites are given in Table 1.

Table 1. The location of the eight study sites in southern Sweden, the year they were censused, their total area and percentage of different habitats. Crop = arable fields, Isl = islands of other habitats in arable fields, Past=pasture, Mead=meadows, Con=coniferous forests, Mix=mixed coniferous and deciduous forests, Trivdec=trivial deciduous forests, Broaddec= broad-leaved deciduous forests

Geografiskt läge, inventeringsår, total yta och andel (%) av olika biotoper i åtta inventeringsområden i södra Sverige. Crop = åkermark, Isl = åkerholmar, Past = hagmark, Scrub = buskmark, Mead = äng, Con = barrskog, Mix = blandskog, Trivdec = triviallövskog, Broaddec = ädellövskog, Clearcut = hygge, Wetland = våtmark, Reeds = vassområden och Urban = bebyggelse.

Site	And	Dörr	Fors	Klock	Vikb	Väsf	Äng	Sjö
Longitude	13°20'E	13°31'E	13°30'E	15°23'E	16°43'E	16°19'E	16°52'E	17°31'E
Latitude	55°28'N	55°34'N	58°35'N	58°30'N	58°32'N	59°57'N	59°33'N	59°44'N
Year censused	1984	1985	1984	1984	1983	1985	1983	1984
Area (km^2)	17.69	15.26	17.03	18.07	14.54	14.66	21.42	20.90
Crop	83.5	48.6	40.6	61.2	36.5	58.3	39.3	53.5
Isl	0.5	0.4	0.4	0.3	1.2	0.1	0.8	0.8
Past	0.1	3.6	3.3	0.5	8.3	0.0	4.5	0.3
Scrub	0.2	0.5	0.0	0.1	0.4	4.2	0.8	0.8
Mead	3.1	13.5	9.5	10.9	14.2	23.7	9.9	5.4
Con	0.9	5.8	32.0	13.4	22.8	2.9	14.2	20.2
Mix	0.9	1.9	2.9	1.4	5.8	2.9	13.2	4.1
Trivdec	0.8	0.3	1.4	2.6	1.5	5.0	3.4	2.8
Broaddec	6.4	20.6	0.5	0.9	1.1	0.0	6.8	1.9
Clearcut	0.3	0.8	7.2	3.9	3.9	0.3	1.5	3.8
Wetland	0.0	0.4	0.1	0.5	1.6	0.0	0.0	0.0
Reeds	1.0	0.0	0.0	0.0	0.4	0.0	3.1	1.4
Urban	2.3	3.7	1.9	4.3	2.4	2.6	1.7	4.4

Number of breeding species

Table 2 gives the total number of farmland and forest species breeding at each site, the totals being based on the full list of species in Tables 3, 4 and 5. The total number of breeding species varied between 73 and 88 (Table 2). Sjö, Ängsö and Västerfärnebo (i.e. the northernmost sites) had the most breeding species (84 to 88 species) while the other sites had between 73 and 77 species.

The number of farmland species varied between 27 and 37 (Table 2) and was positively correlated with farmland area at the different sites (Spearman rank correlation, $r_s=0.55$, $n=8$, $p<0.05$, one-tailed test). Investigation of relationships between number of species and different farmland habitats showed that the number of farmland species increased with the area of scrub ($r_s=0.80$, $n=8$, $p<0.01$), probably because several passerines prefer scrub areas to more open habitats, and with the area of trivial deciduous forest ($r_s=0.74$, $n=8$, $p<0.05$), probably important for many forest edge species. The area of trivial deciduous forest was, however, correlated with the area of scrub ($r_s=0.64$, $n=8$, $p<0.05$). Surprisingly, there was no relationship between the number of farmland species and the area of habitats such as meadow and habitat islands, although such habitats have been assumed to be important for many species (Gerell 1988, Alexandersson & Eriksson 1988). So, both the total area of farmland and the area of some habitats were associated with the number of farmland species breeding at a site. Another factor that was important for the number of farmland birds was the fragmentation of the forest areas, since the number of farmland species was higher at sites with fragmented forests (Fig. 1), indicating that there are more farmland species in fine-grained than in coarse-grained farmland landscapes.

Table 2. Number of breeding farmland species, forest species and other species at the eight study sites.

Antal häckande jordbruksarter, skogsarter och övriga arter i de åtta inventeringsområdena.

Site	And	Dör	Fors	Klock	Vikb	Väsf	Äng	Sjö
Farmland species *Jordbruksarter*	34	31	27	33	31	37	35	35
Forest species *Skogsarter*	41	45	45	42	45	43	49	50
Others *Övriga*	2	1	1	1	0	4	0	3
Total no. of breeding species *Totalt antal häckande arter*	77	77	73	76	75	84	84	88

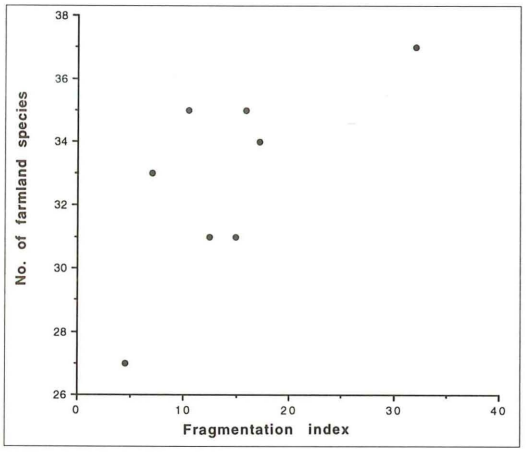

Fig. 1. The number of breeding farmland species at the eight study sites in relation to forest fragmentation (no. of forest patches per km² forest). The number of farmland species was positively correlated with the forest fragmentation index (Spearman rank correlation, n=8, r_s=0.65, p<0.05).

Antal häckande jordbruksarter i åtta inventeringsområden i relation till skogens fragmentering. Antalet jordbruksarter var positivt korrelerat med antalet skogsområden per km² skog (Spearman rank correlation, n=8, r_s=0.65, p<0.05).

The number of breeding forest species (Table 2) was correlated with the total forest area (r_s=0.73, n=8, p<0.05) as well as with certain forest habitats: mixed forest (r_s=0.90, n=8, p<0.001) and coniferous forest (r_s=0.71, n=8, p<0.05), which, however, was correlated with the area of mixed forest (r_s=0.69, n=8, p<0.05). However, the areas of broad-leaved deciduous forest (r_s=0.29, n=8, ns) and trivial deciduous forests (r_s=0.27, n=8, ns) were not correlated with the number of forest species. So, as with the farmland species, the number of breeding forest species was related to total forest area and area of some forest habitats, but not to the fragmentation of the forest landscape (r_s=-0.27, n=8, ns).

The number of forest and farmland species at the different sites was not correlated with each other (r_s=-0.07, n=8, ns), so sites with many farmland species could not be expected to be either good or bad for most forest species.

Densities of farmland birds

The distributions and densities of the 29 farmland species varied considerably between the study sites (Table 3). Some species, such as Corncrake, Rook *Corvus frugilegus* and Kestrel *Falco tinnunculus* were found at only a few sites, while others, such as Skylark and Whinchat *Saxicola rubetra* were widespread and occurred at all sites, although their densities varied considerably between sites. The mean density, standard deviation and coefficient of variation for each species are based on the area of farmland for all the sites and hence are strongly affected by the absence of the localised species from some sites. The occurrences of 19 species of unmapped farmland birds are given in Table 4.

Of the mapped birds (Table 3) the dominant species were Skylark and Yellowhammer (25.8 and 14.8 territories/km², respectively). It is probable that Wood Pigeon *Columba palumbus*, which was not mapped but occurred in all areas, is found in nearly the same densities as these dominant species (Ljunggren 1988). A group of common species occurred at densities of 1-5 territories/km². These were, in order of decreasing abundance: Whitethroat *Sylvia communis*, Whinchat, Linnet *Carduelis cannabina*, Meadow Pipit *Anthus pratensis*, Wheatear *Oenanthe oenanthe*, Ortolan Bunting *Emberiza hortulana*, Pheasant *Phasianus colchicus* and Lapwing *Vanellus vanellus* (Table 3). They occurred at all eight sites with the exception of the Ortolan Bunting, which was only found at three sites, but in relatively high densities. This might be explained by its northerly distribution in Sweden (Stolt 1988b). Of the unmapped farmland species it is probable that Jackdaw *Corvus monedula*, Hooded Crow *C. corone cornix*, Starling *Sturnus vulgaris*, Black-headed Gull *Larus ridibundus*, White Wagtail *Motacilla alba*, Fieldfare *Turdus pilaris*, House Sparrow *Passer domesticus*, Tree Sparrow *P. montanus* and Greenfinch *Carduelis chloris*, occur in the same densities as these common species (Erlinge & Svensson 1976).

Some less common species (densities between 0.1 and 1 territory/km²) were found at most sites, in order of decreasing abundance: Stock Dove *Columba oenas*, Red-backed Shrike *Lanius collurio*, Yellow Wagtail *Motacilla flava flava*, Scarlet Rosefinch *Carpodacus erythrinus*, Rook, Marsh Harrier, Grasshopper Warbler *Locustella naevia*, Marsh Warbler *Acrocephalus palustris* and Curlew *Numenius arquata* (Table 3). The densities of these species varied considerably between sites, probably because of a lack of suitable habitats at some sites, and also because of variations in their distribution within Sweden. The Marsh Warbler is more common in southern Sweden, and Scarlet Rosefinch and Grasshopper Warbler are more common in central Sweden. Of the unmapped species, Common Gull *Larus canus* and Magpie *Pica pica*, probably occur at about the same densities as these less common species (Berg & Skoglund 1985).

There was also a group of uncommon species (densities from 0.01–0.1 territories/km²) which were, in order of decreasing abundance: Long-eared Owl

Table 3. Densities (territories/km²) of 29 species of farmland birds at the eight study sites in southern Sweden. The species are subdivided into their main farmland habitats and the primary farmland birds are shown in bold. Population changes since 1950 according to the literature (References) are given under Pop where 0 indicates no change, ? unknown, ++ & + indicate marked and slight increases and -- & - indicate marked and slight decreases. Species marked with 1 are endangered, those with 2 are vulnerable, those with 3 are rare and those with 4 require consideration (Ahlén & Tjernberg 1992). Numbers in parantheses indicate that the species requires consideration in some regions of Sweden.

Tätheten (revir/km²) av 29 jordbruksfåglar i de åtta inventeringsområdena i södra Sverige. Arterna är indelade efter sina huvudbiotoper. De primära jordbruksarterna visas med fet stil och de sekundära med normal stil. Populationsförändringar sedan 1950 enligt litteraturen (References) visas under Pop. 0 indikerar stabil population, ++ & + indikerar stark respektive måttlig ökning, -- & - indikerar stark respektive måttlig minskning och ? okänd trend. Arter markerade med 1 är akut hotade, de med 2 sårbara, de med 3 sällsynta och de med 4 hänsynskrävande. Siffror inom parentes visar att arten är hänsynskrävande i delar av landet.

		Territories/km²				*Revir/km²*								
	Habitat	And	Dör	Fors	Klock	Vikb	Väsf	Äng	Sjö	Mean	S.D.	CV(%)	Pop	References
Perdix perdix [4]	Arable	0.19	0.00	0.00	0.07	0.00	0.08	0.00	0.00	0.04	0.07	163.86	--	Dahlgren 1988, Göransson 1985
Alauda arvensis		50.42	21.37	29.57	32.76	29.13	8.15	7.48	27.47	25.79	13.88	53.83	-	Karlsson & Kjellén 1988, Svensson 1989
Columba oenas		0.52	0.42	0.84	0.07	0.65	0.00	2.98	1.97	0.93	1.03	110.35	--	Roos 1978, 1984
Crex crex [4]	Meadow	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.07	0.19	282.84	0	SOF 1978. Tyrberg 1987
Vanellus vanellus		1.36	1.01	0.32	1.11	0.76	2.31	1.29	1.10	1.16	0.57	49.33	--	Petterson 1981,1988a
Numenius arquata [(4)]		0.00	0.00	0.00	0.28	0.00	0.54	0.16	0.00	0.12	0.20	161.94	--	Petterson 1988b, Stolt 1987
Anthus pratensis		1.10	0.76	0.21	1.66	3.99	4.15	0.08	0.95	1.61	1.60	98.96	--	Österlöf & Stolt 1982, Hjort & Pettersson 1990
Motacilla flava flava [(4)]		0.26	0.00	0.00	0.07	0.00	3.77	0.16	0.66	0.61	1.29	210.48	--	Ekstam 1974
Saxicola rubetra		1.82	0.51	4.01	4.77	5.41	6.99	2.17	1.97	3.18	2.21	69.48	0	Hjort et al. 1981
Locustella naevia		0.00	0.00	0.00	0.35	0.11	3.07	0.32	0.44	0.54	1.04	194.16	++	Källander 1970
Acrocephalus palustris		2.14	0.08	0.00	0.07	0.00	0.00	0.00	0.00	0.29	0.75	261.50	++	Cavallin 1977, Holmbring 1988
Phasianus colchicus	Edge &	2.66	3.04	0.21	0.97	0.97	0.23	0.08	2.05	1.28	1.16	91.15	--	Göransson 1988, Jakt & Vilt 1983
Picus viridis	dry	0.00	0.25	0.63	0.41	1.08	0.23	1.53	1.02	0.65	0.52	80.86	-	Nilsson et al 1992
Luscinia luscinia	pasture	4.74	2.45	–	0.35	1.08	0.23	2.90	1.46	1.89	1.60	85.00	++	Petterson 1986
Carpodacus erythrinus		0.00	0.00	0.00	0.28	0.00	3.61	0.00	0.00	0.49	1.27	260.63	++	Österlöf & Stolt 1982, Hjort & Pettersson 1990
Sylvia communis		4.61	4.22	1.27	1.87	–	4.30	–	4.38	3.44	1.47	42.72	0	Hjort & Lindholm 1978, Hjort & Pettersson 1990
Oenanthe oenanthe		0.32	0.68	0.53	1.11	5.50	0.38	2.49	0.29	1.41	1.80	127.72	-	Carlsson & Moreno 1988
Lanius collurio		0.13	0.42	0.95	0.97	1.51	0.08	1.45	0.95	0.81	0.55	68.08	-	Svensson 1990
Carduelis cannabina		2.47	2.62	1.16	2.28	2.05	0.54	1.69	1.83	1.83	0.70	38.18	--	Risberg 1988a, Svensson 1990
Carduelis carduelis		0.06	0.08	0.00	0.00	0.00	0.00	0.00	0.15	0.04	0.06	151.03	-	Roos 1984, SOF 1990
Emberiza hortulana		0.00	0.00	0.00	0.00	6.90	2.61	0.97	0.00	1.31	2.44	186.25	-	Stolt 1988b, SOF 1990
Emberiza citrinella		4.41	12.25	19.96	16.45	–	8.30	–	27.54	14.82	8.35	56.32	0	Runesson & Jönsson1987, Stolt 1988a
Circus aeruginosus[4]	Wetland	0.19	0.00	0.00	0.00	0.22	0.00	0.24	0.15	0.10	0.11	110.14	+	Nilsson 1981, Roos 1978
Falco tinnunculus [(4)]	General	0.06	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	187.27	--	Nilsson 1981, Pettersson 1986
Buteo buteo		1.52	1.46	0.93	0.83	1.36	1.21	0.60	0.29	1.13	0.35	30.83	--	Roos 1978, Andersson 1988
Accipiter nisus		1.01	0.88	0.13	0.28	0.39	1.21	0.24	0.29	0.59	0.43	72.93	+	SOF 1990
Strix aluco		2.02	0.88	0.53	0.56	0.58	0.61	0.72	0.29	0.84	0.53	63.35	0	Petersson 1977
Asio otus		0.00	0.00	0.00	0.00	0.11	0.23	0.40	0.00	0.09	0.15	162.28	0	Nilsson 1988
Corvus frugilegus		3.24	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.48	1.14	236.98	0	Malmberg 1988, SOF 1990

Table 4. The status of 19 species of farmland birds that were not mapped at the eight study sites in southern Sweden. The primary farmland birds are shown in bold, and • indicates breeding at the site according to the breeding criteria. Population changes since 1950 according to the literature (References) are given under Pop where 0 indicates no change, ? unknown, ++ & + marked and slight increase and -- & - marked and slight decrease. Species marked with 1 are endangered, those with 2 are vulnerable, those with 3 are rare and those with 4 require consideration (Ahlén & Tjernberg 1992), numbers in parentheses indicate that the species requires consideration in some regions of Sweden.

Status för 19 jordbruksfåglar som ej revirkarterades i de åtta inventeringsområdena. Arterna är indelade efter sina huvudbiotoper. De primära jordbruksarterna visas med fet stil och de sekundära med normal stil. • indikerar förekomst i området enligt häckningskriterier. Populationsförändringar sedan 1950 enligt litteraturen (References) visas under Pop. 0 indikerar stabil population, ++ & + indikerar stark respektive måttlig ökning, -- & - indikerar stark respektive måttlig minskning och ? okänd trend. Arter markerade med 1 är akut hotade, de med 2 sårbara, de med 3 sällsynta och de med 4 hänsynskrävande.

	Habitat	And	Dör	Fors	Klock	Vikb	Väsf	Äng	Sjö	Pop	References
Columba palumbus	Arable	•	•	•	•	•	•	•	•	++	Roos 1978, 1984
Miliaria calandra[1]										--	Jönsson 1982
Circus pygargus[2]	Meadow									+	
Upupa epops[3]	Edge and									+	
Motacilla alba	dry pasture	•	•	•	•	•	•	•	•	0	Österlöf & Stolt 1982
Passer domesticus		•	•	•	•	•	•	•	•	-	Tyrberg 1988
Passer montanus		•	•	•	•	•	•	•	•	+	Svensson 1989
Carduelis chloris		•	•	•	•	•	•	•	•	++	Roos 1978, Svensson 1990
Anser anser	Wetland	•			?				•	++	
Branta canadensis					?		•	•	•	++	
Larus ridibundus					?		•		•	+	Fredriksson 1979
Larus canus				?	?		•	•	•	-	
Milvus milvus[3]	Generalists									+	Sylvén 1983
Pica pica		•	•	•	•	•	•	•	•	+	Högstedt 1988a, Svensson 1990
Hirundo rustica		•	•	•	•	•	•	•	•	-	Roos 1978, 1984, Svensson 1990
Corvus monedula		•	•	•	•	•	•	•	•	0	Högstedt 1988b
Corvus corone		•	•	•	•	•	•	•	•	+	Sondell 1971, Loman 1988
Turdus pilaris		•	•	•	•	•	•	•	•	0	Hjort et al 1981
Sturnus vulgaris		•	•	•	•	•	•	•	•	--	Pettersson 1986, Svensson 1990

Asio otus, Corncrake, Grey Partridge *Perdix perdix,* Goldfinch *Carduelis carduelis,* and Kestrel. Some farmland species were not found at the census sites; Montagu's Harrier *Circus pygargus,* Red Kite *Milvus milvus,* Hoopoe *Upupa epops* and Corn Bunting *Miliaria calandra*. These species have relatively small localised populations and a restricted distribution in Sweden and consequently were not found breeding at any of the sites.

The farmland species were divided into different groups according to their main habitats (Tables 3 and 4). The distribution and commonness of these groups of farmland birds are discussed below. There was a correlation between the number of sites where a species was found and the species' mean density for the 29 mapped species of farmland birds (Spearman rank correlation, $n=29$, $r_s=0.81$, $p<0.001$). Thus, the number of sites where the species was found can be used as an estimator of its population density, even if some species, such as raptors, are found at many sites but in relatively low densities. On farmland, the pasture and edge species were the most abundant ones (mean 6.1 ± 3.1 sites). The habitat generalists were also widespread (mean 5.9 ± 3.1 sites). Similarly, the arable species, apart from partridges, were found at most sites (mean 5.2 ± 3.6 sites). Partridges were absent from some sites because their populations have been severely reduced by the effects of pesticides (Potts 1986, Dahlgren 1988). Meadow is the habitat that has declined most with the modernisation of farmland, and this is probably reflected in the variability of distribution and densities of the meadow species (Table 3). Many of these species were rare or absent from the modern sites (mean 4.6 ± 3.0 sites), but more common at traditional sites such as Västerfärnebo, Vikbolandet and Ängsö. All meadow species except the Marsh Warbler (mainly found in southern Sweden) were most abundant at Västerfärnebo, where spring floods of riverside fields prevent early cultivation or modernisation into intensive arable fields, and not surprisingly this was the only site with breeding

Table 5. Densities (territories/km²) of 15 selected species of forest birds at the eight study sites in southern Sweden. Population changes since 1950 according to the literature (References) are given under Pop where 0 indicates no change, ? unknown, ++ & + marked and slight increase and -- & - marked and slight decrease. Species marked with 4 require consideration in Sweden and those marked (4) are locally requiring consideration (Ahlén & Tjernberg 1992).

Tätheten (revir/km²) av 15 utvalda skogsarter i de åtta inventeringsområdena. Populationsförändringar sedan 1950 enligt litteraturen (References) visas under Pop. 0 indikerar stabil population, ++ & + indikerar stark respektive måttlig ökning, -- & - indikerar stark respektive måttlig minskning och ? okänd trend. Arter markerade med 4 är klassificerade som hänsynskrävande och de med (4) är hänsynskrävande i delar av landet.

	Territories/km²					*Revir/km²*							
	And	Dör	Fors	Klock	Vikb	Väsf	Äng	Sjö	Mean	S.D.	CV(%)	Pop	References
Accipiter gentilis [4]	0.00	0.00	0.00	0.28	0.00	0.61	0.12	0.15	0.14	0.23	159.72	-	SOF 1990
Falco subbuteo	0.00	0.29	0.00	0.00	0.19	0.00	0.00	0.00	0.07	0.12	175.54	0	
Pandion haliaetus	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.15	0.03	0.09	264.58	0	SOF 1990
Cuculus canorus	11.62	7.31	0.40	1.11	2.14	1.21	2.04	0.15	3.69	4.18	113.20	-	SOF 1990
Dryocopus martius [4]	1.01	1.17	0.40	0.83	0.39	0.00	0.36	0.44	0.59	0.42	70.40	0	
Dendrocopus minor[4]	1.01	0.58	0.40	0.00	0.00	1.21	0.60	0.58	0.54	0.46	85.04	--	SOF 1990
Jynx torquilla	0.00	0.29	0.40	0.83	1.75	0.00	2.28	1.16	0.79	0.90	112.74	-	Svensson 1989, SOF 1990
Lullula arborea	0.00	0.29	0.00	0.00	0.19	0.00	0.00	0.00	0.07	0.12	175.54	--	Roos 1978
Nucifraga caryocatactes[4]	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.29	0.02	0.05	264.58	?	
Troglodytes troglodytes	11.62	4.97	0.53	0.28	0.00	0.00	0.12	0.73	2.50	4.40	175.89	+	Hjort & Lindholm 1978
Hippolais icterina	11.11	5.26	0.00	0.83	0.00	9.09	0.84	0.00	3.88	4.65	120.05	++	Svensson et al. 1986
Phylloscopus sibilatrix	2.02	7.60	0.26	7.22	0.19	9.09	4.45	1.16	4.41	3.67	83.23	0	Svensson 1985
Ficedula parva[4]	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.19	264.58	?	
Aegithalos caudatus	1.01	2.05	0.13	0.00	0.39	1.21	2.16	0.15	0.99	0.88	88.34	?	
C. coccothraustes[4]	2.02	6.14	0.00	0.28	0.00	0.00	2.16	0.15	1.51	2.25	148.83	+	SOF 1978

Corncrakes. The least common species were the wetland species (mean 2.8 ± 0.8 sites).

Blocks of woodland on farmland can be important for forest birds. Table 5 gives the densities of 15 species of selected forest species that were mapped at the eight study sites, together with their status according to the published information. Some of these species, such as Cuckoo *Cuculus canorus*, Wryneck *Jynx torquilla*, and Lesser-spotted Woodpecker *Dendrocopos minor*, are found in forest habitats and forest edges. Other species, such as Black Woodpecker *Dryocopus martius* and Nutcracker *Nucifraga caryocatactes*, are strictly forest species that require different proportions of coniferous and deciduous trees. Despite these differences in habitat requirements, the forest species are found in at least some of the sites, which gives some indication of how varied the landscape is even in the main agricultural regions of southern Sweden.

Population changes

We have reviewed the literature on population changes of farmland birds since 1950 and give their status in Tables 3 and 4. However, the quality of these data is variable. The status of raptors, doves and some passerines has been based on migration counts (Roos 1978, 1984b and 1985), while the status of several other passerines has been based on ringing data (Österlöf & Stolt 1982, Stolt 1987, and Hjort et al. 1981). Other estimates are based on censuses or surveys (e.g. Fredriksson 1979, Källander 1970). It must be stressed that most population changes are more complex than continuous increases or decreases since 1950. Yellowhammer, Ortolan Bunting, Hooded Crow, Rook, Kestrel and some other raptors declined in the early 1960s. After the prohibition of mercury-based seed dressings most of these species recovered to their earlier population levels (Otterlind & Lennerstedt 1964, Runesson & Jönsson 1987, Loman 1988, Malmberg 1988). Several passerines fluctuate in numbers because of differences in reproductive success and winter survival (Hjort & Lindholm 1978). Despite these deficiencies we think that the estimates of status (Tables 3 and 4) show the main population changes of Swedish farmland birds since 1950.

Of the 48 species classified as farmland birds (Tables 3 and 4), the populations of only 10 have remained relatively stable since 1950. Seventeen species have increased, eight of them markedly, while 21 species have decreased, 12 of them markedly (Tables 3 and 4). The population of the Corncrake, although requiring consideration, is shown as stable because the main decline was due to changes in farming practice before

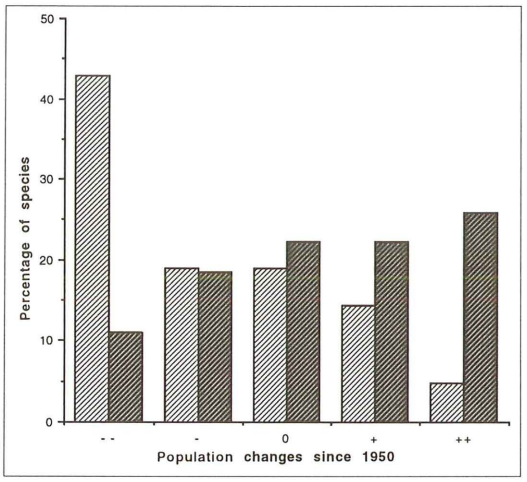

Fig. 2. Population changes of farmland bird populations since 1950. 0 indicates no change, ++ & + indicate marked and slight increases, and -- & - indicate marked and slight decreases. Primary farmland birds (light bars) are those with the bulk of their population depending on farmland, while secondary farmland birds (dark bars) have the bulk of their population in other habitats (mountains, bogs, marshes and villages) or simultaneously use farmland and these other habitats during the breeding season.

Förändringar av jordbruksfåglarnas populationer sedan 1950. 0 indikerar stabil population, ++ & + indikerar stark respektive måttlig ökning, -- & - indikerar stark respektive måttlig minskning. Primära jordbruksarter (ljusa staplar) är de med största delen av populationen på jordbruksmark, medan sekundära jordbruksarter (mörka staplar) har den största delen av populationen i andra biotoper (t. ex. fjäll, myrar, våtmarker och bebyggelse) eller nyttjar både jordbruksmark och dessa biotoper under häckningssäsongen.

1950. Thus, more species seem to have decreased (21) than increased (17). We have split the farmland birds into two groups: primary farmland birds (shown in bold in Tables 3 and 4) are those with the bulk of their population (more than half of the Swedish population) depending on farmland. Secondary farmland birds have the bulk of their population in other habitats (mountains, bogs, marshes and villages) or use both farmland and other habitats during the breeding season. There are marked differences in the population trends of primary and secondary farmland species (Fig. 2): nine (43 %) of the 21 primary species have declined markedly (indicated by -- in Tables 3 and 4) compared with only 3 (11%) of the 27 secondary farmland species. Similarly, only 1 (5 %) of the primary farmland species have increased markedly (++ in Tables 3 and 4) compared with 7 (26 %) of the secondary farmland species. These differences in marked population changes (++ and --) between primary and secondary farmland species were significant (χ^2=7.5, df=1, p<0.01). Thus, the populations of primary farmland birds have declined more than the populations of secondary farmland birds, particularly as the secondary species also thrive in other habitats.

There are differences in population changes between habitats. Strictly arable species seem to have declined in numbers, while species foraging in arable habitats but breeding in other habitats seem to have done better. There have been large changes in the bird fauna on meadows; species favoured by grazed or cut meadows have declined in numbers, while those preferring abandoned grassland have increased. Edge and pasture species seem to be the group that has declined least.

Ahlén & Tjernberg (1992) have classified all threatened and rare vertebrates in Sweden into different categories depending on their vulnerability and need for conservation measures (see Tables 3, 4 and 5). More primary than secondary farmland species have gone extinct, or are categorized as endangered, vulnerable or requiring consideration (Fig. 3, χ^2=13.7, df=1, p<0.001). The White Stork *Ciconia ciconia* and the Barn Owl *Tyto alba* have vanished from Sweden since 1950. Of the primary farmland species the Corn Bunting is classified as endangered, Montagu's Harrier as vulnerable, Hoopoe as rare and four species (Partridge, Corncrake, Yellow Wagtail and Curlew) are classified as requiring consideration in at least some parts of the country. No secondary farmland species have vanished since 1950, none is classified as endangered or vulnerable, although three species (Red Kite, Marsh Harrier and Kestrel) are classified as requiring consideration. Thus the secondary species are considerably less at risk than the primary farmland species, presumably because they are able to survive in a variety of habitats including farmland.

Farmland as breeding habitat

The changes in Swedish farmland are still continuing and most farmland birds are less common on modernised than on traditional farmland (Robertson et al. 1990). Some species can perhaps adapt to modern farmland, for example the Whitethroat has to some degree adjusted its choice of habitat and now breeds in oil-plant fields (Cavallin 1988). On the other hand, some farmland species that appear to be adapted to modern farmland may only be surviving on farmland because of immigration from source areas in other habitats that compensates for the lower breeding success on farmland. Pulliam (1988) argued that an equilibrium with both source and sink habitats can be both ecologically and evolutionarily stable. Only a small fraction of the

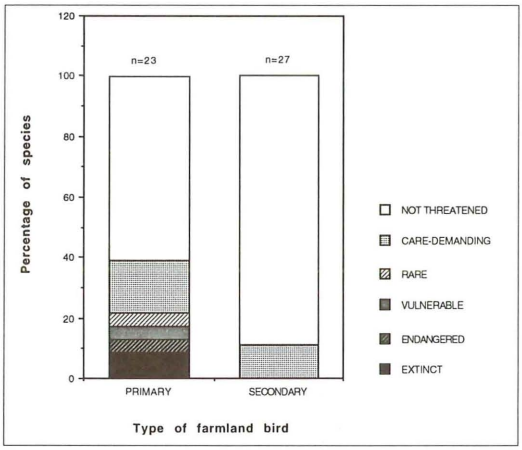

Fig. 3. Percentage of primary and secondary farmland birds that are classified as extinct, endangered, vulnerable, rare or in need of conservation measures. Primary farmland birds are those with the bulk of their population depending on farmland, while secondary farmland birds have the bulk of their population in other habitats (mountains, bogs, marshes and villages) or simultaneously use farmland and these other habitats during the breeding season.

Proportionen av primära och sekundära jordbruksarter som klassificeras som försvunna, akut hotade, sårbara, sällsynta och hänsynskrävande. Primära jordbruksarter (till vänster) är de med största delen av populationen på jordbruksmark, medan sekundära jordbruksarter (till höger) har den största delen av populationen i andra biotoper (t. ex. fjäll, myrar, våtmarker och bebyggelse) eller nyttjar både jordbruksmark och dessa biotoper under häckningssäsongen.

population will occur in the source habitat if the surplus population of the source is large and the deficit per capita in the sink is small. For example, Lapwings and Curlews have been shown to produce too few fledglings to maintain their farmland populations in areas dominated by cereal crops (Galbraith 1988, Berg 1992).

In the next few years there will be major changes to Swedish farmland, resulting from large areas being taken out of production. This will imply a threat to several farmland birds, especially since marginal farmland habitats such as meadows, where several uncommon species are found, can be expected to be withdrawn from production. It is therefore of vital importance that conservation needs are taken into account when land use in farmland changes and that the effect of these changes are studied.

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References

Ahlén, I. & Tjernberg, M. 1992. *Artfakta. Hotade och sällsynta vertebrater i Sverige 1992*. The Swedish University of Agricultural Sciences, Uppsala.

Alexandersson, H. & Eriksson, M. O. G. 1988. Hävdade fuktängar och mader som fågelmiljö. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:21-34.

Andersson, S. 1988. Ormvråk *Buteo buteo* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:147-154.

Berg, Å. 1992. Factors affecting reproductive success of curlews *Numenius arquata* on farmland. *Ibis* 133:44-51.

Berg, Å. & Skoglund, T. 1985. Faunan i Ängsöarkipelagen. *Länsstyrelsen i Västmanlands Län informerar*, nr 9, 1985.

Carlsson, A. & Moreno, J. 1988. Stenskvätta *Oenanthe oenanthe* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:293-298.

Cavallin, B. 1977. Kärrsångarens förekomst i Skåne 1977. *Anser* 18:243-252.

Cavallin, B. 1988. Törnsångare *Sylvia communis* Latham. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:307-314.

Dahlgren, J. 1988. Rapphöna *Perdix perdix* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:159-166.

Ekstam, U. 1974. Förändringar av fågelfauna och miljö vid Tåkern 1850-1974. *Vår Fågelvärld* 34:268-282.

Erlinge, S. & Svensson, S. 1976. Fågelsamhällen i jordbrukslandskap med olika markanvändning. *Anser* 15:201-210.

Fredriksson, S. 1979. Skrattmåsen *(Larus ridibundus)* i Sverige. *Vår Fågelvärld* 38: 173-200.

Galbraith, H. 1988. Effects of agriculture on breeding ecology of lapwings *(Vanellus vanellus)*. *Journal of Applied Ecology* 25: 487-503.

Gerrell, R. 1988. Jordbrukslandskapets fågelfauna i historisk perspektiv. In: Andersson, S. (Ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12: 1-20.

Göransson, G. 1985. Fältviltet under 30 år – en enkätundersökning. *Viltnytt* 21:7-9.

Göransson, G. 1988. Fasan *Phasianus colchicus* L. In: Andersson, S. (Ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:173-182.

Hjort, C. & Lindholm, C.-G. 1978. Annual bird ringing totals and population fluctuations. *Oikos* 30:387-392.

Hjort, C. , Lindholm, C-G. & Pettersson, J. 1981. Ringmärkningssiffror vid Ottenby fågelstation 1946-1980. *Rapport från Ottenby fågelstation, nr 2*. Degerhamn.

Hjort, C. & Pettersson, J. 1990. Flyttfåglarnas antal och den föränderliga miljön. *Calidris* 19: 13-23.

Holmbring, J. -Å. 1988. Kärrsångare *Acrocephalus palustris* (Bechst). In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:299-306.

Högstedt, G. 1988a. Skata *Pica pica* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12: 321-326.

Högstedt, G. 1988b. Kaja *Corvus monedula* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:327-330.

Jakt och viltvårdsberedningen 1983. Vilt och jakt. *Statens Offentliga Utredningar* 1983:21. Stockholm.

Järvinen, O. & Ulfstrand, S. 1980. Species turnover of a continental bird fauna: northern Europe, 1850-1970. *Oecologia* (Berl.) 46: 186-195.

Jönsson, P. E. 1982. Skånska fåglar: kornsparven. *Anser* 21: 213-222.

Karlsson, J. & Kjellén, N. 1988. Sånglärka *Alauda arvensis* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12: 245-254.

Källander, H. 1970. Förekomst av gräshoppsångare *(Locustella naevia)* i Sverige 1968. *Vår Fågelvärld* 29:6-10.

Larsson, B. M. P. 1985. Jordbrukslandskapets vilda växtvärld - en hotad naturresurs. *Skaraborgsnatur* 22:24-37.

Ljunggren, L. 1988. Ringduva *Columba palumbus,* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:201-208.

Loman, J. 1988. Kråka *Corvus corone cornix* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:337-344.

Malmberg, T. 1988. Råka *Corvus frugilegus* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:331-336.

Nilsson, S. G. 1981. De svenska rovfågelbeståndens storlek. *Vår Fågelvärld* 40:249-262.

Nilsson, I. 1988. Hornuggla *Asio otus* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:231-240.

Nilsson, S. G., Olson, O., Svensson, S. & Wiktander, U. 1992. Population trends and fluctuations in Swedish woodpeckers. *Ornis Svecica* 2:13-21.

O'Connor, J. & Shrubb, M. 1986. *Farming and birds.* Cambridge Univ. Press, Cambridge.

Otterlind, G. & Lennerstedt, I. 1964. Den svenska fågelfaunan och biocidskadorna. *Vår Fågelvärld* 24:335-400.

Pettersson, J. 1977. Förekomsten av ugglor och rovfåglar i Kvismareområdet 1957-1976. *Vår Fågelvärld* 36:129-133.

Pettersson, J. 1986. Ottenby Fågelstation 1985. *Calidris* 15:7-24.

Pettersson, Å. 1981. Kvismaren. Vegetation och fågelliv. *Länsstyrelsen i Örebro län.* Publikation 1981:20.

Pettersson, Å. 1988a. Tofsvipa *Vanellus vanellus* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:189-194.

Pettersson, Å. 1988b. Storspov *Numenius arquata* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:195-200.

Potts, G. R. 1986. The Partridge. Collins, London.

Pulliam, H. R. 1988. Sources, sinks and population regulation. *American Naturalist* 132 : 652-661.

Risberg, L. 1988a. Vart tog hämplingen vägen? *Fåglar i X-län* 19:29-34.

Risberg, L. 1988b. Kornknarr *Crex crex* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:183-188.

Robertson, J. G. M. & Skoglund, T. 1985. A method for mapping birds of conservation interest over large areas. In: *Bird census and atlas work.* Taylor, K., Fuller, R. J. & Lack, P. C. (eds.) . British Trust for Ornithology, Tring.

Robertson, J. G. M., Eknert, B. & Ihse, M. 1990. Habitat analysis from infra-red aerial photographs and the conservation of birds in Swedish agricultural landscapes. *Ambio* 19:195-203.

Roos, G. 1978. Sträckräkning och miljöövervakning: långsiktiga förändringar i höststräckets numerär vid Falsterbo. *Anser* 17:133-138.

Roos, G. 1984. Sträckräkningar vid Falsterbo hösten 1983. *Anser* 23:1-26.

Roos, G. 1985. Sträckräkningar vid Falsterbo hösten 1984. *Anser* 24:1-28.

Runesson, B. & Jönsson, K. 1987. Inventering av ortolan- och gulsparv vid Kvismaren 1965-86. *Fåglar i Kvismaren* 2:2-12.

Sondell, J. 1976. Populationsutvecklingen hos kråka *(Corvus corone cornix)* i Kvismaren, Närke 1964-73. *Vår Fågelvärld* 35: 113-121.

Stolt, B.-O. 1987. Ringmärkning och populationsförändringar hos fåglar. Proceedings of the fifth Nordic Ornithological Congress 1985. *Acta Reg. Soc. Litt. Gothoburgensis, Zoologica* 14:202-212.

Stolt, B.-O. 1988a. Gulsparv *Emberiza citrinella* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:363-368.

Stolt, B-O. 1988b. Ortolansparv *Emberiza hortulana* L. In: Andersson, S. (ed.) Fåglar i jordbrukslandskapet, *Vår Fågelvärld, Suppl.* 12:369-374.

Svensson, S. 1974. Mer om svensk fågelatlas. *Vår Fågelvärld* 33: 99-104.

Svensson, S. 1985. Effects of changes in tropical environments on the North European avifauna. *Ornis Fennica* 62:56-63.

Svensson, S. 1989. *Övervakning av fåglars populationsutveckling och reproduktion hos stare. Årsrapport 1988.* Ekologiska institutionen. Lunds Universitet.

Svensson, S. 1990. *Övervakning av fåglars populationsutveckling och reproduktion hos stare. Årsrapport 1989.* Ekologiska institutionen. Lunds Universitet.

Svensson, S. , Hjort, C., Pettersson, J. & Roos, G. 1986. Bird population monitoring: a comparison between annual breeding and migration counts in Sweden. *Vår Fågelvärld Suppl.* 11:215-224.

Sveriges Ornitologiska Förening. 1978. *Sveriges Fåglar.* 1 uppl. Stockholm.

Sveriges Ornitologiska Förening. 1990. *Sveriges Fåglar.* 2 uppl. Stockholm.

Sylvén, M. 1983. Projekt glada – verksamhetsrapport för perioden 1981-82. *Vår Fågelvärld* 42:106-114.

Tyrberg, T. 1987. Fågelrapport för 1987. *Vår Fågelvärld* 46:375-417.

Tyrberg, T. 1988. Gråsparv *Passer domesticus* L. In: Andersson, S. (Ed). Fåglar i jordbruklslandskapet. *Vår Fågelvärld, Suppl.* 12: 355- 360.

Österlöf, S. & Stolt, B.-O. 1982. Population trends indicated by birds ringed in Sweden. *Ornis Scandinavica* 13:135-140.

Sammanfattning

Status och populationsförändringar hos jordbruksfåglar i södra Sverige

Sedan 1950 har det skett omfattande förändringar av det svenska jordbrukslandskapet (Gerell 1988). Detta har lett till ett storskaligt, homogent och intensivt brukat jordbrukslandskap i stora delar av landet, speciellt i slättbygdsområdena i södra Sverige. Moderniseringen av jordbruket har påverkat många jordbruksfåglar, några arter har försvunnit som häckfåglar och andra har tillkommit under denna period (Järvinen & Ulfstrand 1980, Ahlén & Tjernberg 1992). Många arter har också minskat eller ökat kraftigt i antal under denna period och jordbrukslandskapet torde vara en av de miljöer där det skett störst förändringar.

Målsättningen med denna undersökning var att genom inventeringar fastställa olika jordbruksfåglars status samt att med hjälp av tillgängliga litteraturdata bedöma vilka populationsförändringar som skett hos dessa arter. Vi presenterar tätheter för 29 utvalda jordbruksfåglar och 15 skogsfåglar (som förekommer på skogsmark i jordbruksområden) i åtta stora jordbruksområden (14.5-21.5 km^2, totalt 140 km^2) i södra Sverige, vilka revirkarterades under åren 1983-85. För ytterligare 19 jordbruksfåglar, som ej inventerats kvantitativt, redovisas kvalitativa data (förekomst eller ej förekomst i områdena) och för samtliga 48 arter redovisas populationsförändringarna sedan 1950.

Undersökningsområden och metoder

Två undersökningsområden, Dörröd (Dör) och Anderslöv (And) ligger i Götalands södra slättbygder, tre områden, Forshem (Fors), Klockrike (Klock) och Vikbolandet (Vikb) ligger i Götalands norra slättbygder och tre områden, Ängsö (Äng) och Sjö och Västerfärnebo (Väsf) ligger i Svealands slättbygder. Områdenas geografiska läge, storlek och biotopsammansättning presenteras i Tabell 1.

Fyrtiofyra arter (29 jordbruksfåglar och 15 skogsarter) inventerades enligt en modifierad form av revirkarteringsmetoden (se Robertson & Skoglund 1985). Varje område delades in i lämpligt antal delområden som kunde inventeras under ett morgonpass. Varje delområde besöktes under 8 morgnar och två nätter och alla observationer av de 44 utvalda arterna noterades på kartor. Kriterier för fastställande av antalet revir för de olika arterna vid utvärderingen av materialet framgår av Robertson & Skoglund (1985). Tätheten av jordbruksarter beräknades genom att antalet revir dividerades med arealen jordbruksmark för jordbruksarterna, och för skogsarterna dividerades antalet revir med arealen skogsmark. Dessutom noterades observationer av övriga arter enligt de kriterier för häckning som redovisats av Svensson (1974), vilket möjliggjorde fastställandet av antalet häckande arter i de olika områdena.

Arealen av olika biotoper mättes på infraröda flygfoton (skala 1:30 000) med hjälp av ett digitaliseringsbord. Följande 11 biotoper särskildes då: åker, åkerholmar, hagmark, buskmark, ängsmark, barrskog, blandskog, triviallövskog, ädellövskog, kalhygge, våtmark, vass och bebyggelse.

Resultat och diskussion

Antalet häckande arter i de olika områdena varierade mellan 73 och 88, med det högsta antalet i de tre nordligaste områdena (Sjö, Ängsö och Västerfärnebo). Antalet häckande jordbruksarter i de olika områdena (Tabell 2) påverkades av flera faktorer. Antalet jordbruksarter var positivt korrelerat med arealen jordbruksmark, men också med arealen av biotoperna buskmark och triviallövskog. Antalet jordbruksarter var också positivt korrelerat med skogens fragmentering, d.v.s. det fanns fler arter i landskap med flera små skogsområden än i de landskap där ett fåtal stora skogsområden fanns (Fig. 1). Antalet häckande jordbruksarter var alltså beroende av areal, förekomst av vissa biotoper samt landskapets mosaikstruktur.

Antalet områden en art fanns i var korrelerat med artens täthet (Spearman rank korrelation, $n=29$, $r_s=0.81$, $p<0.001$), vilket visar att detta kan vara ett godtagbart mått på hur spridd en art är för de arter som ej inventerades kvantitativt. Kant och hagmarksarterna fanns i flest områden (Tabell 3 och 4) och inkluderade arter med höga tätheter såsom gulsparv samt flera arter med relativt höga tätheter t. ex. ortolansparv, stenskvätta, näktergal och törnsångare (Tabell 3). De flesta arterna i denna biotop har inte minskat så dramatiskt i antal som andra artgrupper (Tabell 3 och 4). Biotopsgeneralisterna var (förutom rovfåglarna) som väntat vanliga i inventeringsområdena (Tabell 3 och 4). Några arter som är beroende av åkermark fanns också i de flesta områdena (Tabell 3 och 4). Sånglärkan förekom med högst tätheter av alla arter (Tabell 3), och ringduvan fanns i samtliga områden och förekommer normalt i höga tätheter i jordbrukslandskapet (Ljunggren 1988). De flesta av åkermarksarterna har emellertid minskat i antal sedan 1950 (Tabell 3 och 4), troligen en effekt av jordbrukets modernisering som medfört åkrar utan så kallade "odlingshinder" och av en omfattande användning av besprutningsmedel. Ängsmark är den biotop som minskat mest i areal och de flesta ängsmarksarterna fanns bara i vissa områden (Tabell 3 och 4) och för det mesta i låga tätheter (Tabell 3). Ängsmarksarter som

trivs på igenvuxna ängar, t. ex. gräshoppsångaren, har emellertid ökat i antal (Tabell 3). De som trivs på hävdade ängar har minskat i antal och arter som storspov, tofsvipa, kornknarr och gulärla förekom i låga tätheter i de flesta områden (Tabell 3).

Med hjälp av data från flyttfågelräkningar, ringmärkning och olika inventeringar har vi gjort ett försök att uppskatta vilka populationsförändringar som skett hos de studerade arterna. Kvalitén på dessa data är dock varierande och populationsförändringarna är oftast mer komplexa än fortlöpande ökningar eller minskningar under denna period (se t. ex. Otterlind & Lennerstedt 1964, Hjort & Lindholm 1978). Vi tror dock att de redovisade populationsförändringarna visar de huvudsakliga förändringar som skett sedan 1950. Av de 48 jordbruksarter som häckar i Sverige har 10 haft relativt stabila populationer sedan 1950, 17 har ökat i antal (8 markant), medan 21 har minskat i antal (12 markant) (Fig. 2), vilket tyder på att ungefär lika många arter minskat som ökat i antal. Det var emellertid skillnader mellan olika typer av jordbruksfåglar. Av de 21 arter som primärt häckar på jordbruksmark har 9 (43 %) minskat markant jämfört med bara 3 (11 %) av de sekundära jordbruksarterna, som har en stor andel av populationen i andra biotoper, t. ex. i bebyggelse, på fjäll eller myrar (Fig. 2). Likaledes har bara 5 % av de primära jordbruksarterna ökat markant, jämfört med 26 % av de sekundära jordbruksarterna (Fig. 2).

En större andel av de primära jordbruksarterna är också enligt Ahlén & Tjernberg (1992) försvunna eller klassificerade som akut hotade, sårbara, sällsynta eller hänsynskrävande på de svenska hotlistorna (Fig. 3). Fågelarter beroende av jordbrukslandskapet är alltså utsatta för större hot än de arter som också förekommer i andra biotoper.

Hotet mot jordbruksfåglarna ökar nu ytterligare när stora delar av jordbrukslandskapet överförs till alternativ produktion p.g.a. överproduktion av stråsäd. Det råder dock fortfarande stor osäkerhet om vad som skall ske med stora arealer omställningsmark. Plantering av skog (som ansetts vara ett rimligt alternativ) får negativa effekter för de flesta jordbruksarter, medan t. ex. anläggning av våtmarker och extensiva betesmarker har övervägande positiva effekter. Det är därför av största vikt att effekterna av dessa omfattande förändringar av jordbrukslandskapet följs upp och att naturdvårdshänsyn tas vid överföringen av jordbruksmark till alternativ produktion.