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Meadow birds in Sweden – population trends, effects of restoration and management

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Zusammenfassung: Die Fläche des Feuchtgrünlandes in Schweden hat sich im letzten Jahrhundert durch Nutzungsaufgabe und Kultivierung drastisch verringert. Zeitgleich sind auch erhebliche Veränderungen in der Wiesenvogelfauna feststellbar. Die vorliegende Studie beleuchtet die Bestandsentwicklung von 33 in schwedischen Grünlandgebieten auftretenden Brutvogelarten. Von diesen weisen 16 Arten abnehmende Bestände auf. Bei 7 Arten konnte eine Bestandszunahme festgestellt werden. 10 weitere Arten schließlich sind im Bestand stabil. Allerdings ist bei dieser Analyse zu berücksichtigen, dass einige dieser Arten auch in anderen Habitaten vorkommen. Deshalb ist nicht auszuschließen, dass die Populationsveränderungen im Grünland bei einigen Vogelarten möglicherweise weit reichender sind als es die landesweiten Trends vermuten lassen. Allgemein zeigt sich derzeit, dass alle auf eine landwirtschaftliche Bewirtschaftung angewiesene Brutvogelarten (z.B. viele Limikolen) deutliche Populationseinbußen verzeichnen. Singvögel dagegen, die auch eine gewisse Bindung an bestimmte Brachestadien besitzen, sind im Bestand stabil oder nehmen sogar zu.

Seit den 1980er Jahren hat der Schutz von Wiesenvögeln in Schweden Priorität. Dies äußert sich u.a. in einer Zunahme restaurierter Feuchtgrünlandgebiete. Monitoringdaten legen den Schluss nahe, dass bestimmte Arten (hier: Kiebitz, Schafstelze, Großer Brachvogel und Rotschenkel) zumindest in einigen dieser restaurierten Gebiete zugenommen haben. Allerdings erfolgte keine grundsätzliche Zunahme aller Zielarten nach erfolgter Restauration. Wir präsentieren Belege für vier Hypothesen, die diesen Befund zu erklären suchen: (1) Eine Zunahme bei Zielarten ist wahrscheinlicher, wenn diese vor Durchführung der Restaurationsmaßnahmen noch als Brutvögel im Gebiet vertreten sind. (2) Restaurationsmaßnahmen führen bei Zielarten dann nicht zum Erfolg, wenn vorhandene Landschaftsstrukturen den Habitatansprüchen der Zielarten entgegenstehen. (3) Da Beweidung und Mahd, praktiziert in unterschiedlichen Intensitäten, auch zu unterschiedlichen Grünlandtypen in Struktur und Pflanzenartenzusammensetzung führen, kann die vor Ort praktizierte Grünlandnutzung durchaus nicht mit den Habitatansprüchen bestimmter Zielarten im Einklang stehen. (4) Die fehlende Effektivität von Restaurationsmaßnahmen auf bestimmte Brutvogelarten des Feuchtgrünlandes steht möglicherweise in Verbindung mit einer ungenügenden Optimierung des Wasserhaushaltes. Letztere resultiert vielfach aus früheren Eingriffen an schwedischen Flüssen und Seen. Es wird empfohlen, die Auswirkungen von Restaurations- und Managementmaßnahmen im Grünland stärker als bisher wissenschaftlich zu begleiten, da belastbare Daten in diesem Bereich nach wie vor selten sind.

Summary: The area of Swedish wet meadows has decreased drastically during the last century due to cultivation and abandonment. During the same time the meadow bird fauna have changed considerably. Here the population sizes and recent trends for 33 bird species commonly occurring on Swedish wet meadows are reviewed. 16 of the species have declining populations; 7 species have increasing populations, while 10 have more or less stable populations. However, several of the species also occur in other habitats, and population changes in meadow habitats have probably been more extensive than reflected by the overall data. Generally, management dependent species, such as waders, have declined strongly, while passerines connected to unmanaged habitats have had stable or increasing populations.

Since the 1980s conservation of wet meadow birds have been prioritized in conservation and the area of managed wet meadows have increased. Available data suggests that some species (Lapwing, Yellow Wagtail, Curlew and Redshank) have increased at least in some restored areas. However, no general increase in bird numbers was found for all species after restoration. We present evidence for four not mutually exclusive hypotheses explaining this result: (1) An increase in population size due to restoration measures is more likely if the target species is still present in the area. (2) Restoration measures fail to increase bird numbers if landscape composition and site characteristics do not meet the habitat requirements of the target species. (3) Since there are large differences between mowing and grazing and furthermore grazing intensity on the structure and composition of grasslands, target species might not benefit from restoration measures in the presence of unfavourable grassland management. (4) The lack of effectiveness of restoration measures on target species might be caused by insufficient water levels resulting from former regulations of rivers and lakes. It is recommended that evaluations of effects of restoration measures and different management regimes should be encouraged since high quality data for such evaluations are still scarce.

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1 Introduction

The area of wet meadow habitats in Western Europe has been reduced strongly because of drainage and cultivation (i.e. conversion of meadows to arable fields). Furthermore, habitat quality for breeding birds has declined due to earlier date for hay cutting and higher stocking of cattle (e.g. Beintema & Müskens 1987; Hötker 1991; Glaves 1998; Chamberlain & Fuller 2000; Evans 2004). In farmland plains of southern Sweden the area of wetlands were considerably reduced during the late 19th – early 20th centuries. Because of intense drainage for cultivation 90% of the wetlands disappeared (Bernes 1993). The open wet meadow was reduced further by ceased livestock farming and by the use of arable fields for grazing and fodder production (Emanuelsson & Johansson 1987; SBA 1999). Ceased management of wet meadows has been suggested to be the main cause of declining meadow bird populations in Sweden since World War II (Andersson 1988). Wet meadow management currently depends on grazing animals, whereas mowing is confined to large and regionally scattered sites covering less than 15 % of the total wet meadow area (SBA 2005). However, as the number of livestock farms continues to decrease, mowing (delayed to late in season) may be an important management strategy in the future.

In general, the effects of restoration projects and different management regimes on the occurrence and abundance of breeding wet meadows birds are poorly known (Chamberlain & Fuller 2000; Vickery et al. 2001; Evans 2004; McCracken & Tallowin 2004). This study gives an overview of population changes and effects of restoration projects and different management regimes on meadows birds in Sweden. Habitat requirements, importance of landscape structure and flooding are discussed for selected species.

2 Results and Discussion

The meadow bird fauna in Sweden has changed considerably during the modernisation of farming. According to available national monitoring data 16 of the 33 species commonly occurring on Swedish wet meadows have declined during the last 30 years, seven species have increased, while 10 have more or less stable populations (Appendix 1). However, several of the species also occur in other habitats such as arable fields, wetlands, bogs and mires and in alpine habitats, and population changes in meadow habitats have probably been more extensive than reflected by the overall data. Generally, management-dependent species, such as waders, have declined, while several passerines connected to unmanaged habitats have had stable or increasing populations (Fig. 1 and Fig. 2). For several decreasing species large population changes occurred during the period 1975-1985, while the

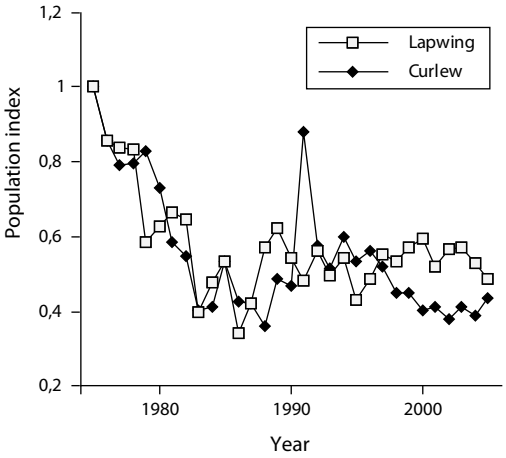

Fig. 1: Population changes for Curlew and Lapwing in Sweden 1975-2005. The population index was set to 1 for 1975. Data from Lindström and Svensson (2006).

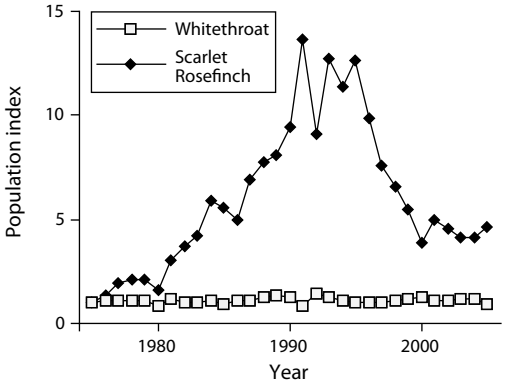

Fig. 2: Population changes for Whitethroat and Scarlet Rosefinch in Sweden 1975-2005. The population index was set to 1 for 1975. Data from Lindström and Svensson (2006).

period 1985-2005 showed more stable populations. Such differences in population trends between time periods with different agricultural policy seem to be a general pattern for farmland birds in Sweden during the last 30 years (Wretenberg et al. 2006).

Since the 1980s conservation of wet meadow birds have been prioritized in conservation and the area of managed wet meadows have increased (Hellström & Berg 2001). Such restoration measures include clearing of shrubs and reintroduction of grazing, and in a few cases reintroduction of mowing. Available data suggests that some species (Lapwing, Yellow Wagtail, Curlew and Redshank) have increased in restored areas. However, a major problem is that population data before and after restoration measures are lacking for most areas, and evaluations of effects of different management regimes are also scarce (but see Gustafson 2006). Thus, it is strongly recommended that standardized census techniques, which require limited resources, are used in future restoration projects and in evaluations of different management regimes (for suggestion see Hellström & Berg 2001).

Available data suggests that all species do not show a general increase in numbers after restorations. There are several potential explanations to this. First, population increases after restoration seem to depend on occurrence of the species in the area before restoration, i.e. even mobile species such as birds do not colonise all restored areas. The Curlew is rare in many farmland landscapes in southern Sweden (de Jong & Berg 2002). It increased markedly after restorations in areas where it was already present in the past (Hellström & Berg 2001), but not in areas where the species was lacking. A probable explanation, for a philopatric species like the Curlew, is that young birds are more likely to settle in or close to the areas that they were born in, and old birds mostly return to the same territories (Berg 1992). Thus, restoration projects have larger possibilities for being successful if they are initiated before "target species" are locally extinct.

A second possible explanation to the lack of population increases after restoration is that landscape composition and site characteristics not are suitable for the target species. Several "open habitat species" (Lapwing, Curlew, Yellow Wagtail, Skylark, Meadow Pipit, Redshank, Common Snipe)

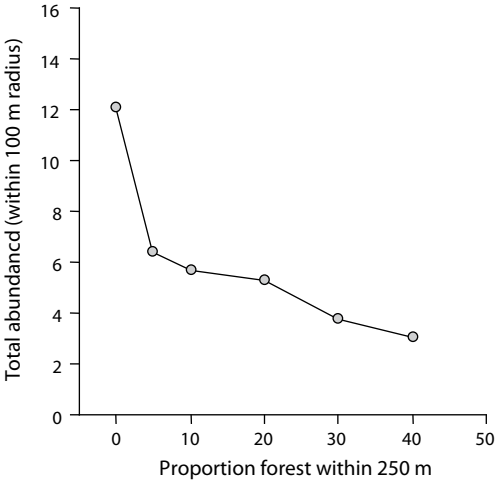

Fig.3: Relationship between total abundance of "open habitat species" (see text above) within 100 m radius in point count censuses (Linear regression, df = 1, F = 49.4, $p < 0.001$, $R^2 = 0.26$) and amount of forest at the 250 m scale. Data (n = 137 sites) from Gustafson (2006).

have been shown to avoid forested landscapes and areas close to forest edges (Berg 1991, Berg et al. 1992, Ottwall & Smith 2005, Gustafson 2006). Small areas of forest at the landscape scale (5% within 250 m radius) have been shown to reduce abundance of these species considerably (50% decrease compared to areas without forest, see Fig. 3). Furthermore species such as Curlew (prefers leys) and Lapwing (prefers tillage) frequently use adjacent arable fields for foraging and nesting (Berg 1992a-b, Berg et al. 1992). Thus, land-use in the surrounding landscape might have large effects on meadow bird populations, and for instance, set-asides for conservation purposes is a management option that could have large positive effects on meadow birds.

However, several species associated with unmanaged or less intensively managed wet meadows do not avoid forest edges and forested habitats (Gustafson 2006). For instance, the Corncrake does not show a preference for open landscapes and occurs also close to forest edges on inland wet meadows in central Sweden (Fig. 4).

Similar large effects of woodlands on bird community composition have also been found in arable landscapes (Berg 2002) and in semi-natu-

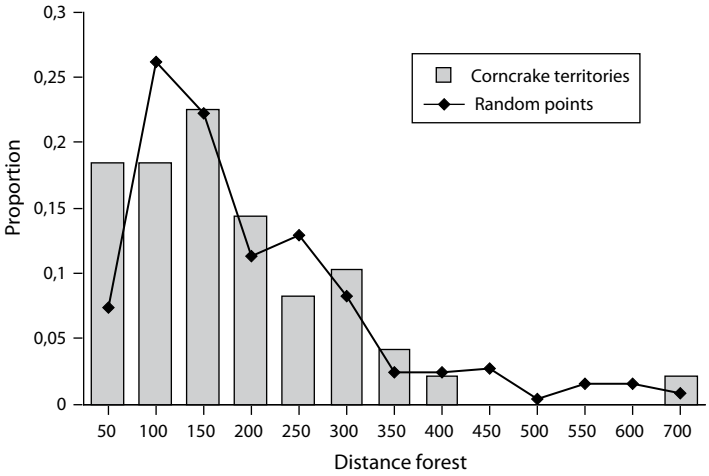

Fig. 4: Proportion of 49 Corncrake territories (bars) and 257 random points (line) at different distances (50 - 700m) from forest edges in 291 km^2 farmland in central Sweden (data from 2006). Distance to forest edge did not differ significantly between territories and random points.

ral dry pastures (Pärt & Söderström 1999) in central Sweden. A probable mechanism for the lower abundance of open habitat species (all ground nesting) is avoidance of edge habitats and mosaic landscape structures due to increased nest predation risk (Møller 1989; Berg et al. 1992; Andrén 1995; Gustafson 2006). Thus, a major management option in many Swedish inland meadow areas (situated in mosaic landscapes with forest) is the clearing of woodlands in order to increase the area of open habitat.

A third explanation to the lack of increasing populations after restorations of wet meadows is grassland management. There are large differences between mowing and grazing, and furthermore different grazing intensity results in vegetation with different height and structure. Mowing results in more uniform swards, and lower plant species richness than low intensity grazing regimes (Bakker 1989; Bakker et al. 1993). Because of homogenous swards, birds that prefer a mosaic of sparse vegetation combined with tussocks (e.g. Lapwing and Redshank, see Milsom et al. 2000) are not likely to benefit from mowing. In line with this, Lapwings did not increase in numbers in a meadow restoration area (largely managed by mowing and grazing of low intensity) in central Sweden during the period 1985 - 1994 (Berg et al. 2002) despite a large increase in the area of managed meadows (from 160 to 530 ha). In contrast, other meadow bird species associated with vegetation of intermediate height (e.g. Meadow Pipit, Yellow Wagtail and Curlew) increased in numbers on and adjacent to the meadows in this area during the same period (Berg & Ström 1998). The number of Lapwings nest-

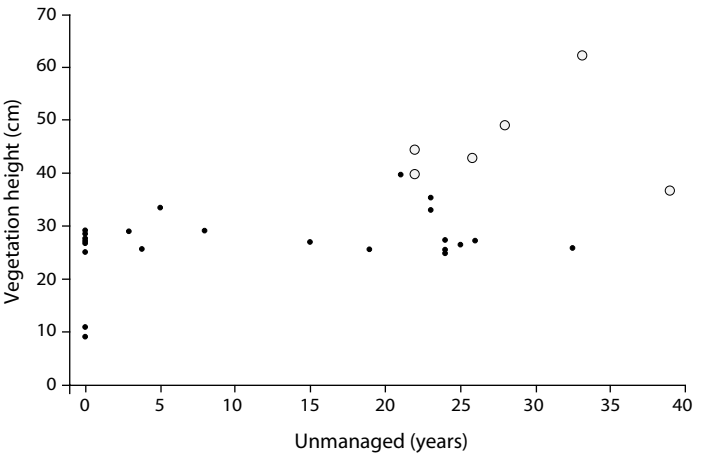

Fig. 5: Relationship between vegetation height (mean from 21 plots in each census point) and years without management, during the last 40 years, (Linear regression, df = 1, F = 12.9, p < 0.001) in a meadow area managed by mowing in central Sweden (from Berg & Gustafson, in press). Small filled dots represent meadow parcels without corncrake observations and large unfilled dots (n = 6) represent meadow parcels with observations of calling corncrakes during 1999 - 2002.

ing on meadows was very small (< 1 %) throughout the period and population change of Lapwings was not associated with area of managed meadow. The relatively high relaying frequency (mean = 49.6 %) improved hatching success, but still, hatching success was lowest in the most preferred habitat (adjacent spring sown crops, total hatching success ca. 30 %). The few Lapwings breeding in the least preferred habitats (meadows and adjacent cultivated grassland) had a better hatching success (> 70 % total hatching success) suggesting that habitat selection was not determined by hatching success (Berg et al. 2002).

In contrast to the Lapwing the Corncrake prefers areas with tall vegetation (Berg & Gustafson 2007). In the mentioned study Corncrakes preferred unmanaged meadows and avoided grazed meadows. The preference for mowed meadows seemed to depend on management continuity, since meadows with long management continuity had low vegetation and were not utilized by Corncrakes, while meadows with less continuity in management seemed to be suitable for Corncrakes (Fig. 5).

The Lapwing and the Corncrake are two species with "extreme" preferences regarding management and vegetation structure. However, there is a general "conservation conflict" between species preferring tall vegetation and meadow bird species associated with shorter vegetation and more intensively managed meadows. Today, meadow management focuses on restoring areas and reintroducing management regimes that are beneficial for the management-dependent species preferring short vegetation, since such meadows have declined drastically. However, in the future, there might be a shortage of suitable habitats for Corncrakes since abandoned areas become swamp forests. Furthermore, less intensive management (intermediate vegetation heights 5 - 30 cm) have been suggested to be preferred also by many management-depending species (Gustafson 2006). Present management aims and recommendations might result in polarized landscapes with intensively managed meadows and totally overgrown meadows in succession to forest. Less intensive management and alternative management regimes (e.g. mowing every second year or every few years) should be considered and further evaluated in some areas.

Another major factor that affects bird community composition strongly is wetness, with a gradient from dry to flooded meadows often adjacent to wetlands (Gustafson 2006). The effect of flooding is also evident among ducks and some wader species when comparing wet and dry years. Many species are more abundant in wet years (Gustafson 2006) and the abundance of Lapwings in different years has been shown to be correlated with spring flooding levels (Berg et al. 2002). Natural water fluctuations or wetness has generally been shown to be important for abundance of meadow birds (Milsom et al. 2000; Hart et al. 2002; Kleijn & Zuijlen 2004; Smart et al. 2006). Wet areas provide habitats for many of these species with occurrence of aquatic prey, more accessible soil prey and more accessible surface prey due to reduced vegetation growth (Ausden et al. 2001). Therefore wetness or amount of flooding might be a fourth explanation to lack of effects of meadow restoration projects, since many wet meadow areas have lower water level variations today than they had before water level regulations of many rivers and lakes in Sweden (Bernes 1993). Larger efforts should be put into creating spatial and temporal variation in humidity of meadow sites, as a means to achieve enough heterogeneity in sward structure preferred by several species of conservation concern. Wet meadows are often intersected or bordered by ditches, and effects of manipulations of existing draining systems to allow for periodic water flow, in particular to slow down the drying up after spring time flooding, should be evaluated.

In conclusion, decreasing populations of management dependent meadow bird species in Sweden suggests that restoration of further meadow areas should be given priority. Areas abandoned for relatively short time should be targeted, since they are likely to harbour at least remnant populations of meadow birds, and have a potential for population growth of management dependent meadow bird species. The avoidance of forested areas by several management dependent species, and increased predation rates close to edges, suggest that the most intensive management regimes (grazing and mowing combined with grazing) should preferably be targeted to landscapes with high qualities, i.e. concentrated to large open meadow areas without woodland. In contrast, less intensively managed areas could be situated in

partly forested areas since meadow birds associated with unmanaged or tall sward not seem to avoid areas adjacent to forests. Use of different management regimes (also less intensive management such as mowing every second year), planning at a landscape level (e.g. establishment of set-asides adjacent to meadows, clearing of targeted woodlands) and conservation-oriented regulations of the spring flooding levels are key factors for meadow bird populations in farmland landscapes. Furthermore, evaluations of effects of restoration measures and different management regimes (use of standardized census techniques) should be encouraged since high quality data for such evaluations are scarce.

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Appendix 1. Population estimates (number of breeding pairs) and population trends 1975-2005 (data from Lindström & Svensson 2006 and the Swedish Species Information Centre) of 34 meadow birds* in Sweden.

Latin name	English name	Population	Trend
Anser anser	Greylag goose	32.000	+
Anas penelope	Wigeon	45.000	0
Anas strepera	Gadwall	1.200	+
Anas crecca	Teal	70.000	0
Anas platyrhynchos	Mallard	135.000	+
Anas acuta	Pintail	950	-
Anas querquedula	Garganey	600	-
Anas clypeata	Shoveler	2.300	-
Porzana porzana	Spottted crake	230	0
Crex crex	Corncrake	250	+
Haematopus ostralegus	Oystercatcher	15.000	0
Recurvirostra avosetta	Pied Avocet	1.100	0
Charadrius hiaticula	Ringed Plover	17.000	0
Vanellus vanellus	Lapwing	55.000	-
*Calidris alpina***	Dunlin	150	-
*Philomachus pugnax***	Ruff	200	-

Latin name	English name	Population	Trend
Gallinago gallinago	Snipe	13.000	-
Limosa limosa	Black-tailed Godwit	150	-
Numenius arquata	Curlew	13.000	-
Tringa totanus	Redshank	16.000	-
Larus minutus	Little Gull	1.200	+
Larus ridibundus	Black-Headed Gull	125.000	0
Chlidonias niger	Black Tern	225	0
Alauda arvensis	Skylark	825.000	-
Anthus pratensis	Meadow Pipit	830 000	0
*Motacilla flava***	Yellow Wagtail	10 000	-
Saxicola rubetra	Whinchat	250 000	-
Locustella naevia	Grashopper warbler	4 500	+
Acrocephalus palustris	Marsh Warbler	20 000	+
Acr. schoenobaenus	Sedge Warbler	50 000	-
Sylvia communis	Whitethroat	750 000	0
Carpodacus erythrinus	Scarlet Rosefinch	10 000	+
Emberiza schoeniclus	Reed Bunting	460 000	-

* Broad spectrum of species occurring on wet meadows (managed and abandoned). Many species are also breeding in other habitat, such as arable fields, forest clear cuts, bogs and mires, wetlands and alpine areas.

** In southern Sweden (mainly on meadows), excluding northern Sweden (alpine areas and bogs) with larger populations.