The first *Symposium on the Conservation of Meadowbirds in North Germany and the Netherlands* held at Vechta, Germany, on 4 & 5 September 2002

INTRODUCTION

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The rapid decline in biological diversity is surely one of the biggest current problems both locally and globally. It means the loss of genes, the extinction of species and the destruction of ecosystems. It has even been recognised as a challenge at the level of international politics. The passing of the Convention on Biological Diversity at Rio de Janeiro is a good example.

In central Europe, man has contributed greatly to an increase in species diversity in the last five thousand years. Due to the creation of meadows, pastures, arable land and sandy heathland, a multitude of previously non-native animals and birds were able to colonise. Grassland birds also profited, moving from their original habitat of bogs, fens and salt marshes, they gradually settled on the meadows and pastures created by man. This situation has now changed dramatically. Many man-made habitats, such as the heathlands of North Germany and the Netherlands, are now rapidly declining because their original agricultural uses have long since proved uneconomical. Recent changes in agricultural practice have also affected various grassland birds of which almost all are now listed in the Red Data Books of every German state. In many regions, grassland has almost halved in area over the last fifty years. Moreover changes in the agricultural use of meadows and pasture land have had an even more profound effect. In many areas, the survival of grassland birds is now in the balance, as a result of high cattle densities, early mowing dates and intensive land drainage. All this has been know for some decades and in consequence many west European countries have established support programmes and conservation areas.

Unfortunately, though these measures started with much euphoria, their goal of 'the continual and effective protection of grassland birds' has yet to be achieved. Population monitoring shows that, even in conservation areas, bird populations barely maintain themselves and losses are frequently reported. All this points to the vitally important role that scientific research can play. Monitoring populations is sensible, but it is not enough by itself, especially, as in the case of the grassland birds, when populations continue to decline despite every effort to protect the habitat. Research is necessary to establish the causal factors so that effective management prescriptions can be devised to counteract these trends.

Academic ecological knowledge counts for nothing if it is not put to practical use in nature conservation. This means that the results of research must be made public! Conferences and symposia offer an ideal means of doing this. Here we present abstracts of talks given at the first *Symposium on the Conservation of Meadowbirds in North Germany and the Netherlands*.

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On the ecology of grassland birds: No effective protection without knowledge

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The Netherlands is the most important grassland bird country in Europe. It owes this role primarily to its agriculture which not only created much suitable breeding habitat due to land reclamation but which also improved the range of food on offer due to the intensive use of manure. Without question, however, agricultural intensification in the second half of the twentieth century had a negative effect on grassland birds, particularly affecting breeding success and resulting in a sharp decline in many species.

At an early stage, nature conservationists recognised the international importance of the Netherlands for a whole range of grassland birds. In the 1960s, this led to efforts to stop their decline by establishing reserves and through voluntary conservation measures by farmers. Population monitoring in the 1970s and 1980s suggested that both methods of nature conservation were producing good results. Thus, declines in many severely endangered grassland birds, such as Black-tailed Godwit, not only stopped but trends even seemed to be reversed. Today, it has been realised that a new more severe phase of decline in grassland bird populations set in during the 1990s. The causes of this are not yet fully known, but it appears that increasingly intensive and mechanised agricultural practices, such as even earlier mowing, is responsible for low reproduction rates among grassland birds (see Schekkerman's second paper). In an attempt to address this situation, a new programme, Programma Beheer, has been set up that explores new land management procedures.

Programma Beheer includes several ideas for improving grassland bird conservation in the Netherlands but recent

research has raised doubts about the effectiveness of such programmes (see Kleijn and Berendse's paper.) Above all, it shows that we still know too little about a range of fundamental aspects of grassland bird ecology to be able to protect them effectively. In particular we do not really understand what structures and factors lead different species to decide if and where they are going to set up territories including the role that food supply plays. More information is also required about how breeding success varies under different agricultural management regimes. It is also necessary to investigate the relationship between breeding success and breeding site fidelity.

There is an understandable demand that the extensive financial aid granted for the protection of grassland birds should be used effectively. This makes it necessary to expand our mostly qualitative knowledge of these topics to their quantitative details. Quite apart from agricultural practices, current building and infrastructure developments are leading to a reduction in area and fragmentation of grassland bird habitat. The impact of these changes on the spatial dynamics of grassland bird populations must also be taken into account. In the future, it is quite possible that far-reaching decisions will have to be taken as to in where grassland bird conservation is to be carried out and where it will no longer be a priority. In this context, cross-border research and planning will be of increasing importance.

Current trends in the conservation of grassland birds in Lower Saxony: Population trends and the efficiency of protective measures

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Lower Saxony has the highest population of typical species of grassland birds in Germany. Currently, approximately two thirds of the German breeding population of Black-tailed Godwits and approximately half of all the Curlews and Redshanks breed in Lower Saxony. Thus, Lower Saxony has a high level of responsibility towards protecting these characteristic bird communities.

Nationally as well as in Lower Saxony, breeding levels of almost all grassland birds have been in severe decline for years. Within regions of Lower Saxony, losses of grassland bird species has been particularly noticeable in the south and east whereas in the north-west only local loss has been noted along with a regional decrease in densities.

The main cause of this critical situation is that the water balance of the countryside has been completely altered almost everywhere. Further, habitat has been lost as a result of a radical change in the nature of grassland brought about by increasingly intensive agricultural use as well as the development of extensive and intensively-used grazing pasture with high levels of fertiliser input and high cattle densities.

The measures that have been introduced in Lower Saxony in order to preserve the characteristic grassland bird populations include:

- Nature conservation involving farmers on a contractual basis with special regulations for grassland bird conservation in large areas (Proland programmes under Agenda 2000)
- The complete alteration of the water balance in major conservation projects with emphasis on protecting wet grassland areas.
- Expansion of European Bird Conservation Areas with an emphasis on protecting grassland birds.

Population changes of grassland birds in two wet grassland areas in the district of Grafschaft Bentheim in Lower Saxony during the last 15 years

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Since 1986, research has been carried out on changes in the number of breeding bird species in two wet grassland areas that are part of a former fen and heath complex in the Grafschaft Bentheim in the west of Lower Saxony. These are the Hestruper Feld, a 100-ha field complex with patches of grassland, and a 300-ha grassland belt at Syen-Venn, a nature reserve and FFH area. When the survey began, the grassland in both areas was used mainly for intensive agriculture. There were even numerous ploughed fields in the grassland belt of the nature conservation area at Syen-Venn.

The first steps towards less intensive and more extensive management started in 1986 with the setting up of the foundation 'Syen Venn: wet pasture'. Measures were taken to protect wet grassland animals and plants on 37 ha. These included the formation of wetlands, construction of ponds and contracts with farmers for extensive use. At the end of 1995, 254 ha was transferred to the foundation. As a result, the protection of the nests of ground-breeding species in the whole grassland belt area has been guaranteed since 1996. In addition, 32 ha of arable land was transformed into grassland and twelve flat water troughs were constructed.

Altogether, the species-richness of the vegetation in the south of the grassland belt increased enormously (particularly in those areas where management had started in 1987). A wet grassland area was developed with a rich variety of species as a result of the formation of wetland and the extensive use of the land. Plants typical of wet grassland areas started to cover this area such as clusters of *Bromus racemosus*, *Juncus acutiflorus*, *Carex nigra* and *Carex vesicaria*.

All breeding birds of the wet grassland, and waders in particular, were monitored systematically during 1987–2002. This included an effort to find as many wader nests as possible. Breeding success (fledglings per breeding pair) was determined for Redshank, Black-tailed Godwit and Curlew. Finding nests and noting hatching dates made it easier to determine the number of fully-fledged chicks.

Despite improvements in both areas (extensive use, construction of flat water troughs, formation of wetland etc.), Redshanks and Whinchats disappeared by the beginning of the 1990s. Black-tailed Godwits also disappeared after many years of unsuccessful breeding. Even Curlews experienced a dramatic decline. On the other hand, Lapwings and Snipes increased in the grassland belt of Syen-Venn (although their numbers fluctuated widely). Moreover Meadow Pipits and Blue-headed Wagtails also profited from the more extensive use of the land and the formation of wetland. Generally, the

distribution of Snipes, Meadow Pipits and Blue-headed Wagtails coincided with valuable botanical areas and/or extremely wet areas. However, in the Hestruper Feld, which had been drained more intensively, the Lapwing population declined dramatically and breeding Snipe disappeared completely.

It is particularly interesting to compare the results for 1987–2001 with a study done by A. Bröker in 1967. As well as the decline in the wader population, the concentration in a few limited areas is very obvious.

Grassland birds on the coast and inland

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Studies of the distribution and density of Lapwings, Black-tailed Godwits and Redshanks in Schleswig-Holstein have shown that the breeding population has declined significantly inland in recent years, despite tremendous efforts at conservation. However, there is still some population growth in polder areas along the mudflats of the Wadden Sea which are densely populated by grassland birds. The probable reasons for this development are under discussion and are based on biological and breeding studies which are under investigation. The decline in the grazing of cattle in one part of the area due to the BSE crisis is a threat to meadow bird populations.

A four-year study of the breeding success of meadow birds in two areas with different agricultural practice near Osnabrück (Lower Saxony, Germany)

Johannes Melter

The breeding population and the breeding success of Lapwings and Black-tailed Godwits has been studied in two different research areas since 1999. Both are used mainly for conventional farming, but differ in the way the land is utilised. The Schneckenbruch (110 ha) has a high percentage of grassland whereas the Lienen/Glandorf area (330 ha) is predominantly used for growing crops.

The Lapwing population of the Schneckenbruch was 44–53 breeding pairs (BP) and breeding success reached a maximum of 0.84 chicks/BP. Only 11–14 BP were found in the Lienen/Glandorf area and maximum breeding success was 0.4 chicks/BP.

Black-tailed Godwits only bred at the Schneckenbruch. The breeding population of 15–18 BP had an annual breeding success of up to 0.67 chicks/BP.

Predation only played a minor role in clutch loss (12–15% of all marked clutches per year for Lapwings). Most clutches were lost due to the agricultural operations.

The study will continue until at least 2003 and will include the colour ringing of Lapwing and Black-tailed Godwit chicks.

The effect of clutch protection and the safeguarding of young birds on the breeding success rate of curlews (*Numenius arquata*)

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The question must be addressed as to whether, after 40 years of intensive agriculture, the Curlew is capable of achieving sufficient breeding success to sustain its population without human help. In the present study, Curlew clutches were marked by personnel from the Biological Station Steinfurt (Nordrhein-Westfalen) both inside and outside nature conservation areas (NCA) in order to protect them from destruction by machines. In order to avoid clutch loss through cattle trampling, clutches in privately-owned fields with high cattle densities were surround by an electric fence at least 10×10 metres in area. In addition, in a few cases it was also possible to (a) delay putting cattle out to graze in the fields until after the eggs had hatched, (b) change the use of fields to growing hay for a restricted time, and (c) put the cattle elsewhere for grazing. Besides these methods of protecting clutches, other measures were taken to safeguard the chicks. They included mowing fields under supervision and postponing mowing until the young birds were able to fly at approximately 35 days.

The following results relate to two thirds of the Curlew population in the district of Steinfurt in 2001. A total of 230 nests of 163 breeding pairs were found in the 2001 breeding season. 60 pairs had one clutch, two pairs had two clutches and one pair managed three clutches. The number of Curlew clutches inside and outside the NCAs was identical. Of the 230 clutches, 136 were found in grassland areas, 93 in fields and one in a newly-planted wood. Within the NCAs, Curlew clutches were found almost exclusively in grassland, whereas outside NCAs they were mostly confined to fields. Clutches inside NCAs were almost entirely in areas with farming restrictions, mainly relating to mowing dates (not usually before 15 June), which ensured that the clutches could hatch successfully. New contracts, however, allow earlier mowing such as 1 June or even 20 May. In these cases, if clutches and chicks are not found and marked in time (see above), even higher losses can occur due to mowing. Breeding in corn fields rarely results in egg loss as a result of agricultural practice. This is particularly true for the first clutch.

In 2001, almost half the Curlew clutches were lost to predation. There was no difference between NCAs and areas with no protective status. Of the 163 breeding pairs, 101 pairs had chicks. The chicks of 33 pairs had hatched by 11 May. These were able to fly by 15 June (contracted mowing date). As older curlew chicks frequently run away when danger threatens rather than just hiding, it is likely that chicks which hatch prior to 21 May also have a good chance of surviving. In 2001, there was a total of 77 fully-fledged young birds of which 30 grew up inside NCAs and 41 outside. 45 chicks became fully-fledged as a result of measures taken to protect clutches and young birds. The overall breeding success of the 163 pairs was 0.47 young per pair per year, marginally above the 0.41 needed to maintain population levels.

It is impossible to estimate what Curlew breeding success might have been without the protection measures that have been put in place. Without them it might be too low to ensure

a stable population. In summary, establishing nature conservation areas and leasing out areas for agricultural use under contract is rarely successful unless there is intensive supervision.

Analyses of clutch losses in the Curlew in Southwest Germany

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The population and breeding success of the Curlew has been declining for years in the Oberrhein area (Baden-Württemberg). The cause of this trend is not fully known but it has been suggested that various predators might be involved. Therefore I studied the effects of various factors including that of predators on the clutches and the chicks of Curlews in 2001 and 2002. A multi-track approach using various methods was used. The study was carried out in four research areas with varying conditions. These related to the proportion of meadow land, the ground water level or the protective status. The areas chosen were the lowlands of the Elz, the Kammbach, the Rench and the Acher. About 70% of the current population of the Curlew in the Oberrhein area breed in these four study sites with a total of 30 pairs.

Besides recording the incidence of predation via direct observation and continual monitoring of clutches (e.g. using a thermologger) and families, other parameters were recorded so that losses arising for unrelated reasons, such as those connected with reproductive biology, could be taken into account. In particular, I recorded the number of first clutches and replacement clutches and, from 79 clutches in 2001 and 2002, I determined the number of eggs per clutch. Additionally, 47 clutches were monitored using a thermologger.

The results of the present investigations were compared with similar data obtained in the 1980s. At that time, a series of factors were found to influence Curlew breeding success. Of these, one or more limiting factors determined the reproduction success in one particular year or in one particular breeding area.

Preliminary results of the present study show that mammals (primarily foxes) are frequently responsible for clutch loss. However, other agricultural and natural causes also play a role such as dragging off the topsoil in fields in spring or weather factors. Crows could not be proved to be nest predators in any instance in either year.

Results of a long-term study on the Lapwing in the lowland plain of the Eider-Treene-Sorge (Schleswig-Holstein)

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The nature reserve Alte Sorge-Schleife has been known since the 1980s as an important breeding area for grassland birds and since 1991 it has been claimed as being nationally representative. However, the Lapwing population is in sharp decline despite various efforts such as increasing the water level and more extensive agricultural practices. Whereas 107 pairs bred there in 1989, only 10 bred in 2002.

Since 1998, it has been known that there is high clutch-loss due to predation, probably by mammals. Voles are the main prey of such predators and the size of the vole population seems to be a determining factor in the range of prey taken by the predators as well as the areas that the predators search. Various authors (Beintema & Müskens 1987, Marcström *et al.* 1988, Lindström *et al.* 1994) have noted that the predation rate of broods of ground-nesting birds is much lower in years when there is a high density of voles than in years when voles are few. For this reason, we have not only studied the Lapwing population in the nature conservation area and in the surrounding control areas with their conventional management, but also the population of small mammals, particularly voles. Initial results show that here, too, there is a connection between vole density and the predation rate of Lapwing clutches. However, it is striking that the predation rate of clutches in the Alte Sorge-Schleife reserve was much higher than in the surrounding control areas despite the fact that vole density was comparable. In 2002, traces of bites on eggshells indicated that polecats were increasingly responsible for egg loss. Polecats *Mustea putorius* not only prey on voles but also amphibians. In the nature conservation area, the population of the moor frog *Rana arvalis* has experienced exponential growth since the formation of wetlands. Hence, it is possible that it is not only vole numbers that influence the prey-choice and foraging area of mammalian predators but also the spawning time of amphibians, especially in years when vole numbers are low. However, this is only a theory since studies involving such a complex range of interdependent factors have to be undertaken over a long period of time to ensure reliable results.

The decline of Lapwings in the nature conservation area Alte-Sorge-Schleife has not only been caused by a high predation rate. We have also identified other factors on which we will report elsewhere.

Twenty-five years of monitoring the Lapwing *Vanellus vanellus* – notes on a field-nesting population

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Since 1976, studies on the Lapwing population have been carried out around Osnabrück which is a partly urban, partly agricultural area. Emphasis was placed on amassing data on laying-date, clutch-size, duration of incubation, hatching-success and fledging-success. These data were also compared with spring temperatures.

On average, Lapwing laid their first egg on 24 March during 1976–2000. Half started laying ten days later, measured over nine years. In years with low temperatures in February and March, laying started significantly later than in those years when temperatures were high in those months.

Of 565 complete clutches, average clutch size was 3.85 eggs; the first clutch was of 3.87±0.38 eggs (n=279) and was significantly larger than replacement or subsequent clutches of 3.18±0.50 eggs (n=210). The size of the first clutch was influenced by spring temperature. The largest average clutch-

sizes were found in years when temperatures were high in March and April. Lapwings incubated their eggs for 24–30 days (n = 18). No relationship with temperature could be determined.

Of 628 clutches monitored, 431 hatched successfully (68.6%). Of 342 successful clutches with a total of 1,309 eggs, 1,223 chicks actually hatched. This corresponds to 2.44 chicks per clutch and 3.58 chicks per successful clutch. The hatching rate of successful clutches was 3.43–3.85 chicks per nest per year for first clutches during 1980–1996 and 3.11–3.92 chicks per nest per year for subsequent clutches. The hatching rate of first clutches had a positive but not significant correlation with the temperatures in April. During 1982–2000, 346–377 Lapwing pairs raised between 441 and 467 fully-fledged young per year. Across all study areas, annual breeding success varied during this period between 0.69 and 1.85 young per pair per year (mean: 1.26). There were very large differences in breeding success rate both between the various Lapwing colonies and from year to year.

Research into the occurrence of carnivorous mammals in the Bremer Becken

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A research and development project was started in 2001 in order to study the influence of environmental factors on the breeding success of grassland birds. Aspects such as choice of nest site, food availability, human land use and water management were among the research topics as well as an emphasis on predation.

In 2002, the meadowbird breeding season was documented by various methods including video-recording of nests, monitoring with night vision apparatus, thermologging, and the radio-tagging of young birds. At the same time, the number of mammals and their level of activity was determined. Predators of grassland birds and their eggs or young are the following mammals (* = not found in Bremen until this study), Red Fox *Vulpes vulpes*, Raccoon Dog* *Nyctereutes procyonoides*, Tree Marten *Martes martes*, Beech Marten *Martes foina*, Polecat *Mustela putorius*, Mink* *Mustela vision*, Stoat *Mustela erminea*, White weasel *Mustela nivalis*, Otter *Lutra lutra*, Hedgehog *Erinaceus europaeus*, Brown Rat *Rattus norvegicus*, Mice (Muridae), Shrew (Soricidae), Wild boar* *Sus scrofa*, Domestic dog *Canus lupus f. familiaris* and Domestic cat *Felis silvestris f. catus*.

In order to find out whether certain predators of grassland birds occur in the breeding areas and which structures they use or prefer, various research methods were developed and tried. As most of the mammals can be hunted, it is not possible to catch them to count, mark or radio-tag them without the permission of those people who have hunting rights. Consequently, searches were made for droppings and tracks of the various species in order to determine which occur in the study area. Unfortunately, the tracks of some species such as Polecat and Mink or Beech Marten and Tree Marten are impossible to distinguish one from the other.

As mammal tracks on grassland are barely visible, various track recording stations were constructed. Mud barriers were built at points where animals had to cross over something (such as over ditches) in various different habitats. Print plates made of a mixture of linseed-oil, clay and sand on a PVC base were made so that the tracks of smaller and lighter mammals (such as stoat) could also be included (Schultz 1991). Both methods are currently being validated using night video to monitor mammals at the track recording stations. Finally, stamp tunnels were developed and tried out. This method is less dependent on the weather. The animals tread on a stamp cushion and paper strips when they follow bait along a wire mesh tunnel.

Checks are being carried out at the moment to see whether the database will yield statistically viable results so that the following questions can be answered:

- How high are the activity levels of predators?
- Is there any relation between the presence of predators and the breeding success of grassland birds?
- Does the management of nature conservation areas affect the relation between predators and their prey and thus the breeding success of grassland birds?
- How independent is the presence of predators and the settlement of breeding meadowbirds?

Breeding success of Black-tailed Godwits *Limosa limosa* in agricultural grasslands: sufficient for a stable population?

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Chick survival and breeding success of Black-tailed Godwits was studied between 1997 and 2000 at nine grassland sites, each in a single year apart from one site that was studied for two years, in the central and western parts of The Netherlands. Sites were used for modern dairy farming, but measures aimed at the conservation of meadowbirds (postponed mowing, marking of nests and sparing them during mowing and grazing) were applied, to some extent, in all of them. Nest success was calculated from daily survival rates. Chick survival was determined in 62 broods of which one of the parents was radio-tagged. Both parents stayed with their brood until about a week after fledging, thereafter the female usually left a few days before the male. Based on birds that lost their clutch after being tagged, the renesting rate after clutch-loss was estimated at 100% at one site and 50% at the others. Renesting rate declined during the course of the spring, with no replacement clutches produced after late May. For the ten sites/years, the average proportion of nests in which ≥1 egg hatched was 54%, with a mean of 3.3 chicks hatched per successful nest. On average 26% of these survived to fledging (≥24 days), giving a mean of 0.56 young fledged per breeding pair. In half to two-thirds of all 12 studies in Dutch agricultural grasslands to date, breeding success was lower than the 0.5–0.7 young/pair required for a stable population based on published mortality estimates. This implies insufficient breeding success as a cause of the 33% decline in breeding numbers observed in The Netherlands in the past ten years. Variation between our study sites/years, as well as very limited data from nature reserves, suggest that chick survival and breeding success increase with the propor-

tion of grassland mown late (after 31 May). We conclude that 'agricultural nature management schemes' can only safeguard a self-sustaining Black-tailed Godwit population on farmland when practical measures are applied on a larger scale, or more effectively, than at present (see also *Limosa* 73: 121–134).

Grassland birds in the Netherlands: a current survey of distribution and population trends

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Field data were collected by numerous volunteers for a new atlas of breeding birds in the Netherlands during 1998–2000. On the one hand, this atlas should give an up-to-date survey of distribution and, on the other hand, it should also enable comparisons to be made with the old atlas of breeding birds which was completed at the end of the 1970s.

The interim years were also used to improve the national monitoring of grassland birds. In the past, ornithologists preferred to investigate places with high densities of grassland birds whereas areas of intensive agriculture were less popular. As a result, there was an uneven distribution of study areas, both in different regions and in relation to the various habitats. This uneven distribution resulted in areas of high density being given too much emphasis. Grassland birds are recorded in a systematic way virtually throughout the Netherlands, even in the provinces. SOVON, working together with the provinces, has developed a new national monitoring network for grassland birds which includes approximately 1,000 study areas. These are distributed regularly across the agricultural areas of the Netherlands and were surveyed several times between 1990 and 2000. A statistical procedure was developed with the help of the Dutch Central Bureau of Statistics. This made it possible to analyse population changes across the different agricultural areas. Six more or less geographically discrete areas were identified from landscape maps. It was also possible to distinguish between good, medium and poor areas for grassland birds on the basis of information taken from the atlas of breeding birds. Population changes from 1990 to 2000 at the species level were worked out for every possible combination of 'area' and 'quality of area as a breeding place for grassland birds'. The individual trends were finally put together to achieve a national trend for the whole of the Netherlands whereby the weighting of the individual trends was relative to the population.

The following results were obtained for nine species of grassland birds. Redshank and Tufted Duck are the only species that increased between 1990 and 2000. Lapwings declined slightly. Black-tailed Godwits declined by 25%; Oystercatchers and Skylarks both declined by 40%. Meadow Pipits declined sharply until 1997, but then recovered. However, by 2000 they were still down 20% over the decade. Blue-headed Wagtail numbers changed similarly except that by 2000 the population was back to its 1990 strength. The populations of all species varied greatly between the different areas.

The distribution maps confirm the trend analysis. Many species are now restricted to their core areas whereas others occur frequently over much wider areas. The most severe distribution losses have been suffered by those species that are dependent on very wet grasslands and/or open grasslands. Above all, Garganey, Snipe and Ruff have greatly reduced distributions compared with mapping completed twenty-five years ago. Today, they have very restricted distributions in the Netherlands.

Habitat use and chick mortality of radio-tagged Lapwings *Vanellus vanellus* and Black-tailed Godwits *Limosa limosa* in the Stollhammer Wisch, Lower Saxony

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In recent decades, several authors have reported drastic and widespread declines in the populations of grassland birds in central Europe. Various studies have found that current reproduction rates are insufficient for many species to maintain their populations. Reproductive success depends mainly on three factors: clutch size, hatching rate and chick mortality.

For the past decade, measures to protect grassland birds have been carried out on a voluntary basis at Stollhammer Wisch (Wesermarsch District, Lower Saxony), a 3,000 ha grassland area near the Waddensea coast. Farmers have been able to reduce their production to varying degrees in return for compensation. In addition, the Wesermarsch district operates a programme of clutch protection for conventionally farmed areas.

Research into hatching success and chick mortality in Lapwings and Black-tailed Godwits has been carried out by the University of Vechta for the last two years in different parts of the Stollhammer Wisch which are farmed in various ways. Hatching rates of Lapwings and Black-tailed Godwit clutches varies widely in all areas. Whereas in 2000 high hatching rates (Lapwing *c.*90%; Black-tailed Godwit *c.*75%) were achieved in contract-protected areas and in areas with clutch-protection programmes, they dropped to <20% in 2001. This low hatching rate was caused by a high predation rate, mainly by red foxes. After they had been hunted down, the hatching rate for Lapwings rose to 60% in 2002. In the case of the Black-tailed Godwit, however, only *c.*25% of the clutches actually hatched due to eggs being trodden on by cattle or taken by birds.

In order to determine chick mortality rates and the causes of chick loss, Lapwing and Black-tailed Godwit chicks were radio-tagged in 2001 and 2002. In 2001, only two of 25 radio tagged Lapwing chicks fledged. We found evidence that most were taken by of red foxes. In 2002, 76 Lapwing chicks were radio-tagged of which 14 fledged. As well as loss due to predation (n = 22), other chicks were killed by being trodden on (n = 8), falling into drainage ditches (n = 11) or due to bad weather conditions. In 2002, a small number of Black-tailed Godwit chicks (n = 13) were radio-tagged. Current results suggest that mowing is responsible for most losses as well as predation.

Radio-tagged Lapwing chicks clearly preferred areas where the grass was short. Their preferred areas were often grazed by cattle. In contrast, Black-tailed Godwit chicks tended to stay in fields where the grass was high.

Breeding success and clutch loss of grassland birds in the wet grassland area of the Bremer Becken – initial results of the breeding season 2002*

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* This work was carried out within the framework of an F+E research project on *Environmental factors which influence or reduce the breeding success of grassland birds.*

The Bremer Becken is a grassland-bird breeding area in NW Germany which is of national importance for them and which has been intensively studied. Systematic mapping of breeding birds begun twenty years ago confirms the more of less uniform negative trend for all species particularly waders. Even in conservation areas, it was not possible to prevent the Ruff *Philomachus pugnax* dying out, the collapse of the Black-tailed Godwit *Limosa limosa* population or the current decline in the Lapwing *Vanellus vanellus* population. On the one hand, monitoring of breeding success, which has been going on for 15 years, indicates severe handicaps in areas of intensive agricultural practice; on the other hand, there is increasing clutch-loss due to predation and a high mortality rate among young birds in conservation areas. The latter were the subject of a research project.

Thermo-logging (60 nests), video cameras (30 nests, 400 nesting days respectively), radio-tagging (22 young birds) and night-sight apparatus were some of the techniques used for the analysis of breeding success in the six areas (including four nature conservation areas), an analysis which started in 2002. After hatching, young birds were also ringed, weighed and sometimes colour-marked.

The breeding success of the species varied in the different areas (totals: 71 pairs of Lapwings, 25 of Black-tailed Godwits, 28 of Redshanks). A very wet polder area in Blockland which is in intensive agricultural use out of the breeding season and which has a high density of meadowbirds had relatively good hatching rates and a very high level of success in raising the young successfully. In the early phase, clutch loss was due to mammals which are active at night (e.g. Beech Marten). In the late phase, clutch loss was mainly due to Marsh Harriers. Carrion Crows and Red Foxes probably played only a minor role. Even in June, swampy vegetation (reed sweetgrass, calamus reeds), rich in food and cover, provided excellent conditions for raising the young birds (around 0.8–1.0 fledglings per pair).

Very high hatching rates (> 80%) and a high success rate in raising the young birds was achieved in a very wet and extensive grassland area within the Ochtum lowland plains. It was proven that some young birds were the victims of birds of prey.

In some areas like Hollerland, for example, with a low density of breeding waders, Carrion Crows as predators of clutches are becoming increasingly important. There, breeding success frequently tends towards zero.

In 2002, birds of prey such as Marsh harriers, Buzzards and Peregrine falcons were shown to be the most important predators in terms of the mortality rate of young birds. Also, at least one young bird drowned in a ditch which had steep banks. The weather conditions are also likely to have affected the raising of the young birds. Thus, Lapwing chicks put on weight much more slowly in cold phases when there was a large amount of rain (and there was a high rate of chick-loss) compared to their weight gain in mild weather.

Grassland birds and predation: A growing problem in the Netherlands?

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It is a natural process for a proportion of the clutches and chicks of grassland birds to become the victims of predation. However, at a time when the populations of grassland birds are endangered due to numerous factors such as loss of habitat and intensive agricultural practice, predation can really be seen as a problem, particularly when it is on the increase. Concern about this in the Netherlands has increased in recent years because volunteer helpers throughout the country who are in charge of protecting clutches are being faced more and more with loss due to predation. Meanwhile, not only is the role of predators as a contributory factor to the recent decline of various grassland birds under discussion, but also the eventual need for predation controls and their scope. Unfortunately, there is a tremendous lack of research evidence about the extent, cause (determining the culprits) and the consequences of predation for the populations of grassland birds in the Netherlands. Consequently, the present discussion is based on few real facts.

At the moment, there is a concrete plan to establish a large research project to investigate this problem, finance for which has already, to a certain extent, been organised. The following aspects are to be investigated: the extent of clutch-loss due to predation, the determination of clutch predators, the extent and type of predation of chicks as well as the effects predation has on the dynamics of the population. Also, one important aspect will be determining the relation between predation on grassland birds, on the one hand, and the structure of the countryside on the number of predators and grassland birds, on the other. In this respect, a start was made with an initial study in 2001. 90,000 records of the fate of clutches that had been located by volunteer helpers and farmers in 355 representative areas of the Netherlands were evaluated. On the basis of this dataset, it can be seen that there are definite regional differences in the incidence of clutch predation.

In this report, a picture will be presented that outlines the differences between clutch predators. In particular, comparisons between the structure of the landscape and the presence of grassland birds and potential predators will be considered. Regions with a high level of predation (higher than average in the Netherlands) occur in the more elevated regions in the north and east of the Netherlands. The areas, however, that are richest in species and numbers of grassland birds are to be found in the lower lying, open areas of clay and fen peat in north, west and central parts of the Netherlands. There, too, some areas are now known to have a high rate of predation. The phenomenon that has been described requires further monitoring and research.

The influence of foxes on the number of grassland birds in the nature reserve Giethoorn-Wanneperveen

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In the last 10–15 years, red foxes *Vulpes vulpes* have spread from the eastern higher areas of the Netherlands and have even reached the open fen areas. This movement has had various effects.

The grassland bird area of Giethoorn-Wanneperveen

The nature reserve Giethoorn-Wanneperveen, a former fen, is a wet grassland area to the east of Giethorn, some of which is part of the nature conservation area de Wieden. It mainly consists of wet grassland which is further subdivided by reed banks, marshy woodland and many narrow ditches. The nature reserve is one of the few grassland bird areas in the Netherlands where most types of grassland birds are still to be found. The area is important for endangered species of grassland birds such as Redshank *Tringa totanus*, Black-tailed Godwit *Limosa limosa*, Curlew *Numenius arquata*, Meadow Pipit *Anthus pratensis*, Snipe *Gallinago gallinago*, Garganey *Anas querquedula* and Shoveler *Anas clypeata*. There were contract mowing and grazing dates on about half the area from 1987 to 1992, and since 1993, these arrangements have applied to 80–90% of the area. Various mowing and grazing dates between 1 June and 1 July were agreed. The development of the grassland bird population in the sub-areas of de Bramen and de Stouwe were studied between 1987 and 2001. From 1988 onwards, hatching rate was also recorded. During 1989–1991, the number of Black-tailed Godwit pairs with fully-fledged chicks was also monitored in some sub-areas. This procedure was also applied to the whole area between 1997 and 2001.

The development of the grassland bird population

All species maintained their population levels or even increased between 1987 and 1994. This was to be expected because the conditions for grassland birds had been almost perfectly organized (high water level, late mowing and grazing dates, sufficient manure) and additional arrangements had been agreed with farmers so that the highest possible number of grassland birds could be achieved (including the removal of copses). From about 1990 onwards, the breeding population withdrew from the edges of the grassland bird area to its central core. Despite the best possible management in the de Bramen area, there was a severe decline in the population of grassland birds from 1995 onwards. In the de Stouwe area, however, a decline was not recorded until 2000. This area is surrounded by wide ditches and is relatively isolated.

Breeding success

Hatching rate of Black-tailed Godwits was very low during 1988–1996 and the most important cause of clutch-loss was predation. From 1987 to 1992, loss due to grazing and working the land also played an important role in addition to predation. From 1993 to 2001, there were agreed mowing and grazing dates for almost all areas (see above) so that clutch losses due to agricultural factors were negligible. In 1989, 1995, 1996, 2000 and 2001, there were, however, extremely high predation rates (75%, 82%, 70%, 65% and 75%). Whereas prior to 1992, grazing and the use of agricultural machines as well as predation were the main negative influences on hatching rate, a noticeable increase in predation, mainly by foxes, was noted from 1992 onwards. Until about the end of April, predation is limited locally to clutch and chick loss and to attacks on adult breeding birds (dead birds with their heads bitten off in or near the nest). From mid-May, all the chicks and nests disappear within a few days (possibly even during one single night) over a very wide area. This explains why broods of Black-tailed Godwits, which breed later than Lapwings, are more affected than Lapwing broods. It is doubtful, however, whether Lapwing breeding success is really higher as a result because usually all the chicks disappear at the same time in areas where there is also high clutch loss due to predation.

Reproductive success

The number of Black-tailed Godwit pairs with fully-fledged chicks was recorded in the de Bramen area during 1989–1991 and 1998–2001. The number of breeding pairs dropped from 70 to 10 over ten years. Hatching success dropped from 30–50% to virtually nil within the same period. Eighteen, 26 and 35 Black-tailed Godwit pairs successfully raised one or more chicks in 1989, 1990 and 1991 respectively. It is significant that at least one or more chicks of every brood that hatched became fully-fledged even though more than half of each clutch was lost due to predation or grazing in these years. During 1998–2001, not one single fully fledged Black-tailed Godwit chick was found in the de Bramen area!

A total of 30, 21, 36 and 33 Black-tailed Godwit territories were mapped in the de Stouwe area in 1998, 1999, 2000 and 2001 respectively. In these years, the number of chicks that fledged as a proportion of those that hatched declined: 11/11 in 1998, 10/14 in 1999, 4/9 in 2000 and 2/7 in 2001. In the light of these figures, it would seem to be only a question of time before the number of breeding Black-tailed Godwits as well as those of most other grassland birds starts to decline.

Is there a future for grassland birds?

The developments in the nature reserve Giethoorn-Wanneperveen are not unusual. Such trends are also becoming typical of other areas of the province of Overijssel and in the Netherlands as a whole. Foxes are increasing throughout the country. If we want to keep grassland birds in the Netherlands, we need to greatly reduce the number of foxes, regulate farm management and put other measures into effect, such as clutch protection. Clutch and chick loss due to predators other than foxes tends to be negligible in grassland bird areas affording optimal habitat. Protecting foxes and grassland birds in one and the same area simply does not work. If the number of foxes is not brought under control, nearly all species of grassland birds will decline dramatically and disappear in many areas. A species like the Black-tailed Godwit will then be as rare in 5–10 years' time as the Ruff is today.

Survival rate and habitat use of Lapwing families *Vanellus vanellus* on the west coast of Schleswig-Holstein

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Time/space budgets of Lapwing families were studied in two nature conservation polders (Beltringharder Koog and Hauke-Haien-Koog) on the west coast of Schleswig-Holstein during 1999–2001. In sub-areas, nests were marked and hatching success determined. After hatching, the chicks were individually ringed with colour rings and/or radio-tagged. Time/space use by each marked chick was then continually monitored. As well as noting each chick's location, the behaviour of the birds was recorded in blocks of 15 minutes. The following behaviours were differentiated: searching for food, comfort behaviour, brooding and other types of behaviour (e.g. locomotion). The areas used by the Lapwing families were characterized in terms of their agricultural use, vegetation height and the wetness of the ground. The food supply was sampled using pitfall traps. The aim of the study was to determine the optimal breeding and feeding habitat for Lapwings by comparing all the data obtained.

During 1999–2001, 60–70% of all clutches hatched. After hatching, the families set up feeding territories nearby. Analysis of the food supply showed that there was high availability of tipula larvae, but earthworms were not found in every soil sample. Feeding territories appeared to be similar to the surrounding areas in terms of vegetation and structure. However, the use of individual habitat elements by the birds did not correspond to what was on offer. Survival of the chicks was 40–50% which was significantly higher than the levels found in other breeding areas. Therefore, it is concluded that the Lapwing population in the nature conservation polders in Schleswig-Holstein achieves reproduction levels which will ensure a stable population.

The influence of fertilisation and winter flooding on soil-macroinvertebrates in the grassland areas of the Dümmer, Lower Saxony

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Soil-macroinvertebrates, like earthworms and crane fly larvae, are amongst the most important components of the diet of adult waders in the grassland areas of central Europe. The availability of earthworms and crane fly larvae to waders depends crucially on how easily they can penetrate the soil. Therefore, measures have been initiated in many grassland bird areas to create wetlands through flooding in winter and early spring. Parallel to this, fertilising such areas is either restricted or has been stopped in order to create a habitat that has low soil penetrability and which is rich in flowers and insects. Taking the lowland plains of the Dümmer as an example, the effects of both measures – of winter flooding and of ceasing fertilisation – on the soil-macroinvertebrates was studied.

The southern lowland plains of the Dümmer are one of the most important breeding areas for grassland birds in Lower Saxony. As a result of a national nature conservation project, over 1,000 ha of grassland was bought and then used for the formation of wetlands. This was achieved by flooding the ground for varying lengths of time in winter and spring. Land leased to farmers frequently includes a clause in the contract forbidding the use of fertilisers.

To evaluate lack of fertilisation on earthworms and soil-living insect larvae, three grassland areas that do not become waterlogged were studied closely. Half of each area was fertilised with stable manure; the other half was left unfertilised. By taking numerous soil samples in April, July and September, it was established that the fertilised areas had a significantly higher biomass of earthworms than the unfertilised areas. However, the same could not be shown for crane fly larvae. There were no differences in the densities of earthworms between fertilised areas and unfertilised areas so the increased biomass associated with fertilisers was because the earthworms were larger. The biomass of earthworms varied over the year with the lowest levels found in summer.

Unfertilised grassland that was waterlogged in spring had significantly lower levels of earthworm biomass. In contrast, high densities of earthworms with high biomass were found in areas that were elevated and had remained free from flooding. Earthworm biomass on non-flooded 'islands' was inversely proportional to the size of the area that had remained free from flooding. As the level of the water sank in areas that had been flooded, the density and biomass of earthworms increased. Simultaneously, there was a decrease in the density and biomass of earthworms in more elevated land. However, it was only in autumn that density and biomass of earthworms became the same in both higher and lower lying areas.

Differences have been discovered between the earthworm communities of dry and newly-flooded grasslands. In those areas that have been formed into new wetlands, *Octolasion tyrtaeum* is already dominant. This is a species typical of traditionally flooded areas. In contrast, the non-flooded grasslands are dominated by *Lumbricus rubellus* and *Aporrectodea caliginosa*.

The importance of fertilisation for the food supply of grassland birds

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Populations of grassland birds are declining in many conservation areas despite specially-adapted land management. A severe decline in the number of Black-tailed Godwits *Limosa limosa* was observed in one part of the nature conservation area Giethoorn-Wanneperveen. Was the cause for this decline a poor food supply? In order to evaluate this, two aspects were studied: (a) the influence of fertilisation on the soil megafauna (earthworms, tipula larvae) and (b) the importance of the food supply in territory-choice by adult Black-tailed Godwits when they set up territories in spring.

The nature reserve Giethoorn-Wanneperveen

The nature reserve Giethoorn-Wanneperveen is a wet grassland area some of which is part of the nature conservation area De Wierden (Province Overijssel). It consists mainly of wet grassland that is subdivided by reed banks, marshy

woodland and many narrow ditches. Over the years, the area was extended by buying new areas (by Vereniging Natuurmonumenten, for example) and was farmed under restricted conditions. In most areas these include agreed mowing and grazing dates. The nature reserve Giethoorn-Wanneperveen is an important habitat for typical grassland birds, most of which still occur including endangered species like Black-tailed Godwit, Redshrank *Tringa totanus*, Curlew *Numenius arquata*, Meadow Pipit *Anthus pratensis*, Snipe *Gallinago gallinago*, Garganey *Anas querquedula* and Shoveler *Anas clypeata*. Some of these species even occur in high numbers.

Research methods

A research project on the effects of land management, particularly farming, on the population of grassland birds in the reserve was commissioned in 1987. Results showed that the decline in Black-tailed Godwits might be due insufficient food availability. This problem was looked into more closely during 1992–1996 when special emphasis was laid on the local distribution of grassland birds (Black-tailed Godwits and Lapwings) in relationship to that of the soil megafauna. The density of breeding birds was estimated with the help of a standardised mapping process. Soil samples were 30 × 30 cm in area to a depth of 10 cm and analysed manually for earthworms and tipula larvae which were counted and weighed (fresh weight). From 1991 to 1996, soil samples were taken three times each year, at the beginning of April, mid-June, and at the end of September.

Soil megafauna

The soil samples contained mainly earthworms and only small numbers of tipula larvae. Earthworms are the most important source of food for adult Black-tailed Godwits in the breeding season. Almost all the earthworms were found in the top 5 cm of the soil samples (the root zone). This was true of both plots that had drained very well and also areas that were still wet even after long periods of dry weather. Earthworms had not moved to deeper soil layers in dry periods as is frequently mentioned in the literature.

The highest numbers of earthworms were found in plots with a high water level that were regularly fertilised with stable or liquid manure. Fertilising the soil with lime in grassland areas on acid soil also resulted in a sharp increase in the number of earthworms. The biomass of tipula larvae was markedly lower than that of earthworms (15–25 g/m^{-2} vs. 70–120 g/m^2). This relationship only changed where there were plague-like numbers of tipula larvae. However, the biomass of tipula larvae and earthworms was more equal in areas that had not been fertilised. Tipula larvae seem to be of less importance as food for Black-tailed Godwits than earthworms.

Grassland birds and soil megafauna

The decline in the number of Black-tailed Godwits in one part of the nature reserve Giethoorn-Wanneperveen can be traced to a severe decline in food availability (earthworms). The biomass of earthworms increased due to the use of lime as fertiliser and, at the same time, an increase in the number of Black-tailed Godwits and Lapwings was observed. Comparison of the biomass of earthworms in different areas suggests that a decline in the number of Black-tailed Godwits occurs if biomass drops below about 10 g/m^2 (fresh weight). Conversely, there is no improvement unless biomass is at least 25–30 g/m^2. Further studies on this topic are needed. Moreover the whole question of whether food supply and Black-tailed Godwit populations correlate positively requires more research. In order to conserve grassland birds in fen areas, low to medium levels of organic fertilisation, using stable or liquid manure from cattle, is recommended. This is virtually the same as the level of fertilisation practised in the area 30–40 years ago. A strip of land about 3 m wide should be left unfertilised to aid ditch and bank vegetation. The use of lime depends on soil pH and should only be used in areas with a pH of less than 4.5.

Disturbance of breeding grassland birds by railway traffic

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We investigated the amount of disturbance caused by railway traffic to breeding grassland birds. For this purpose, we determined the relationship between the level of noise produced by passing trains and densities of breeding birds, using complementary log–log modelling. The noise of trains had a significantly negative effect on all grassland birds combined, on waders combined, and at the species level on Black-tailed Godwits, Skylarks and Garganeys. No significant effect was observed for Shovelers, Lapwings, Oystercatchers, Redshanks, Curlews, Common Snipes, Meadow Pipits or Yellow Wagtails. On average, disturbance occurred only above a threshold level of noise of 45 dB(A); this being very similar for all species involved. The range of disturbed area varied from 1,500 to 200 m from the railway track, depending on the frequency the track was used. We estimated that densities of breeding birds decreased by 19–26% along a frequently used track, and by 13–17% along a less frequently used track.

The project was financed by NS Railinfrabeheer, Utrecht, The Netherlands.

Effects of road construction and traffic on grassland birds and compensation – initial results of an on-going research project

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The effects of road construction and traffic on different species and communities are various and differ from one area to another. Studies so far have shown that a close proximity to roads with a high traffic density frequently restricts habitat quality. This manifests itself not only in a lower level of biological diversity but also in a lower density of many species. The latter seems to be true of grassland birds as is substantiated by research undertaken in the Netherlands. That

research looked at roads with different levels of traffic density and compared density in areas near the roads with that of densities further away. A different approach has been chosen for this current study. The building of two new roads near the coast in Lower Saxony (A 31, B 212n) that will have a high traffic density when completed made it possible to compare the situation on a 'before and after' basis. In addition, control areas were studied so that population changes that did not have their cause in the road construction project could be filtered out. The research project will also evaluate the compensatory and alternative measures as a further step. The following information relates exclusively to the road construction project B 212n across the Weser.

An area of about 550 ha in the districts of Wesermarsh and Cuxhaven was bought by the authorities as a compensation measure for the new road B 212n. The compensation area covered six sites. All were leased back to local farmers. The six compensation areas are subject to regular water maintenance, particularly from January to May, as well as various farming restrictions such as varied land use, a restriction on the number of cattle allowed to graze, agreed mowing dates and fertilisation regulations. Both the measures for water maintenance and the farming of the areas are organized in the best possible way from year to year in collaboration with the farmers.

Taking all the compensation areas together, the results of the management measures to date show a significant increase in the diversity of ducks and waders. The number of breeding pairs of various duck and wader species increased significantly as did their breeding densities. However, no similar increase was found for songbirds like Skylarks and Meadow Pipits, though Blue-headed Wagtails increased in many areas.

Although all six areas were managed in much the same way, there were some different responses. Thus, whereas numbers of breeding waders increased greatly in some areas, they remained more or less constant in others or showed only a slight positive trend.

The construction and use of the B 212n resulted in a major decline of waders in areas near the road. However, populations did not change or even increased slightly in areas further away. Therefore, the results obtained so far correspond to those of the studies carried out in the Netherlands (see above). The construction of an experimental noise barrier near the road showed a positive effect on breeding birds and this may prove to be an important solution to the problem of road disturbance.

The wet grassland programme in Lower Saxony

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Lower Saxony has integrated its essential focal points for nature conservation programmes in the so-called co-operation programmes (KOOP), including the KOOP wet grasslands programme, within the universal programme Proland. The KOOP are financed by the EU (to the tune of 50% from the European Adjustment and Security Fund for Agriculture) and therefore there are guidelines which are agreed with the EU Commission (or which are notified from there).

The KOOP wet grassland programme is applied in project areas which are focal areas within one of the designated areas according to the area backgrounds nationally determined by the NLÖ. The preservation of grassland birds is the central factor. Contractual agreements are made with farmers. The guidelines prescribe a long catalogue of different conditions for this. A remuneration of €125–480 per hectare per year is paid, depending on the difficulty of the conditions imposed. Contracts run for five years.

There are eight project areas with *c.*13,000 ha in the Weser-Ems district and about 3,200 ha are under contract at present. At first, there were a great many problems with the degree of acceptance of the project but the contract areas have been steadily on the increase since the programme began in 1995. Whereas only a part of the money available was applied for at the beginning, it is now completely utilised. Nevertheless, only a relatively small part of the project area is under contract (district Weser-Ems; Lower Saxony: 22%, Nds.: 13%). The efficiency of the project is somewhat restricted due to the low area under contract and the five-year time limits although there is the possibility of an extension if the programme continues.

Putting the programme into effect requires considerable work, particularly due to the very extensive formal requirements laid down by the EU. In addition, there is considerable financial expense in relation to the total budget for nature conservation. In Weser-Ems alone, the measures cost more than €700,000 in 2002.

Due to the complexity of the factors responsible for the decline in the number of grassland birds, it has not been possible as yet to achieve a change in direction which is both convincing and measurable.

The programme has, however, had one important effect resulting from the dialogue that has arisen between nature conservation and agriculture. Working groups have been established in every project area, and representatives of farmers, official departments as well as agricultural and nature conservation groups meet together regularly. As a result, the protection of grassland birds now has a much broader basis.

Continually, efforts are being made to improve the programme. People are also trying to establish positive perspectives for the preservation of grassland birds via supporting measures and these are being applied in grassland nature conservation areas as well.

The wet grassland programme of the 'Grafschaft Bentheim' district

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The wet grassland programme of the Grafschaft Bentheim district was passed in 1989 with the aim of preserving, long-term, the current population of grassland birds via habitat preservation and adapted farming methods. Farmers who join the programme agree to certain land use restrictions for which they receive financial compensation. Originally funds of €102,258 per year were available for the programme. The money is used in 26 chosen areas, some of which still have large populations of grassland birds. At the moment, 58 farmers with a total of 250 ha of grassland area participate in the project. As the money available was not all used, the level of money available has been reduced in the meantime to €66,467 per year.

The effectiveness of the wet grassland programme is checked by continual monitoring. Two biologists have been working on 850 ha of grassland, including those under nature conservation contracts. The Feuchtgebiet Syen-Veen Foundation and the parish of Wietmarschen have provided money for monitoring particular areas. Population densities of grassland birds outside the 850 ha are surveyed by volunteer ornithologists.

Six wader species are currently breeding on grassland areas in the district. The numbers of the various species have varied differently since the programme began. Black-tailed Godwits and Curlews have declined while Lapwings and Oystercatchers have increased. Population changes in the other areas also varied. Overall, however, the numbers of six wader species have remained fairly constant, and this is judged to be a success. Moreover the voluntary participation and the clear guarantee of compensation have led to a great level of acceptance among farmers. For this reason, the programme has twice been extended for a further five years although it was originally limited to five years only.

As a supportive measure for the programme, the district authorities have begun to buy land in the most important grassland bird areas and to turn them into nature protection areas for grassland birds.

The effectiveness of agri-environment schemes in Dutch agricultural landscapes

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Throughout the European Union, farmers are being subsidised to manage their farms in ways that promote biodiversity and protect the environment. Although in some countries these so-called agri-environment schemes have been implemented for well over a decade, few detailed studies exist that examine their ecological effects.

Here we present the results of an extensive study that evaluated the effectiveness of agri-environment schemes in The Netherlands. The conservation measures were designed to enhance the abundance of meadow birds or the species richness of the vegetation. We made a pair-wise comparison between grassland fields that were managed to promote biodiversity and nearby conventionally managed fields (39 pairs throughout the Netherlands). On each field, vegetation and breeding birds as well as bees and hover flies were surveyed.

We found no significant effect of conservation management on the species richness of either vegetation or birds, the two target groups. In contrast, the species richness of both bees and hover flies was significantly higher on fields with adapted management, probably as a consequence of delayed mowing which resulted in a more abundant supply of pollen and nectar, the main food source of these groups (Kleijn *et al.* 2001, *Nature* 413, 723–725). Furthermore, we found a strong positive relation between the species richness of the vegetation and the species richness of both insect groups.

We hypothesise that adverse environmental conditions in the Dutch agricultural landscape have effects that neutralise any positive effects of agri-environmental measures on birds and vegetation. The main factors are considered to be soil-type, ground water level (for both birds and vegetation), diaspore availability, water seepage (vegetation) and food supply (birds).

Wet grassland management and the protection of grassland birds at the Dümmer, Lower Saxony

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The grasslands of the lowland plain area around Lake Dümmer (50 km^2) is an important area for grassland birds in NW Germany. The annual flooding was stopped in 1953 when the Dümmer was dyked. Since the 1960s, there has been a continual decline in the number of grassland birds due to (a) drainage as a result of dyking, (b) soil improvement and (c) the transformation of grassland into arable land. Intensive efforts designed to both protect the wet grasslands and to help them regenerate have been made since 1987. They are paid for by Lower Saxony and the Diepholz and Vechta districts together with support from large projects financed nationally and by the EU. About 4,000 ha are to be protected as permanent grasslands by being declared nature conservation areas. Around 2,500 ha are to be formed into wetlands as well as being used for extensive farming by 2006. Up to now, about 2,000 ha have been bought by the public authorities and are now in extensive use. The total cost of these measures has amounted to over sixty million German marks. Some areas have now been consolidated so that arrangements to form wetlands have already been initiated. Protective measures in the NSG Ochsenmoor are particularly well-advanced since widespread forming of wetlands has been taking place since 1992. The nature conservation station 'Dümmer' of Lower Saxony is on hand to provide expert advice, care and attention to the lowland plain area.

Extensive use of the grassland has not or has only partially led to the developments hoped for. A lasting improvement can only take place after carefully controlled formation of wetlands. The main aims of the nature conservation measures are the development of the vegetation and of 'habitat structures suitable for grassland birds'. Species of grassland birds like White Storks, Garganeys, Shovelers, Spotted Crakes, Quails and Corncrakes which had previously vanished from the area of Ochsenmoor have now returned to breed. Overall, the breeding densities of grassland birds in the whole area are much higher than at the beginning of the 1990s. Many species are showing a remarkable increase in numbers. Thus, the number of breeding Snipes has more than quadrupled to 45 pairs. Meadow Pipits have increased six-fold and now numbers 140 pairs. There are 180 pairs of Blue-headed Wagtails, a more than tenfold increase. However, Lapwings and Black-tailed Godwits have not increased.

Hatching rates for Snipes in the years following the formation of wetlands were 70–98%, and breeding success 57–76%. However, Black-tailed Godwits and Lapwings have only achieved a breeding success rate of >0.5 fledglings per pair in certain years and in certain areas. Despite hatching rates that are usually above 50%, the breeding success of Black-tailed Godwits at Ochsenmoor remains very low at

0.0–0.7. The annual average is 0.2 fledglings per pair. In contrast, higher levels are achieved in most years on the intensively used grassland of Osterfeiner Moor.

The density of predators has fallen in areas that have been formed into wetlands. The whole population of smaller rodents, e.g. voles, in Ochsenmoor virtually disappears after the widespread winter flooding. Generally the re-settlement of prey as well as of predators takes place only slowly and usually after the breeding season of the grassland birds.

Current ecological studies show that food supply can be a limiting factor for the settlement and breeding success of Lapwings and Black-tailed Godwits after the formation of wetlands and a lengthy period of time without fertilisation. As well as a decline in earthworms, the main source of food for adults, there might also be insufficient food for the chicks. The biomass of insects, the main food source for Black-tailed Godwit chicks, is higher in newly formed wetlands as well as in fertilised areas during the time when the chicks grow up. However, every year the number of insects (especially Nematocera) rapidly declines in May by up to 95% so that the food supply is no longer sufficient in many areas. Every year, chick loss coincides with the collapse in the population of diptera. The effect of the collapse of the Nematocera population is less severe in fertilised areas which have not been formed into wetlands as the loss is compensated by higher numbers of Brachycera (real flies).

Nature conservation measures and their effects on the population of breeding birds in the Fehntjer Tief lowland plain

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The Fehntjer Tief lowland plain lies in East Frisia (Lower Saxony, Germany) and is approximately 3,400 ha. It is characterized by wet meadowland areas and is of great importance for grassland birds and for different plant communities. These are protected as, for example, nature conservation areas or as NATURA 2000 areas. Furthermore, voluntary nature conservation on a contract basis and adapted management measures should also ensure protection.

Extensive farming in the nature conservation areas (1,352 ha) is achieved first and foremost by buying land which is then leased free of cost but with severe usage restrictions. Privately-owned land inside and outside the nature conservation areas may be subject to production restrictions on a voluntary basis in return for financial compensation dispensed by a co-operation programme. Unfortunately, farmers are increasingly losing interest in grassland areas owned by the state which have been formed into wetlands and which are subject to severe restrictions of usage. The reasons for this are the current economic conditions and the particular difficulties associated with farming such areas. This development endangers the aims of nature conservation because the fields are temporarily left fallow and the lack of attention results in long grass, a matting of the turf and the dominance of *Juncus effusus* and *Deschampsia caespitosa*.

The monitoring of breeding birds which is carried out each year shows that the measures taken to date have had predominantly positive effects on most species of grassland birds. The populations of Black-tailed Godwits, Curlews, Snipes and various other species in the Red Data Book of Lower Saxony are stable or even increasing in the nature conservation areas. In contrast, Lapwings declining though breeding densities vary enormously from year to year. The cause of this is the lack of attention paid to re-established wetland areas as mentioned above. The effect of this is that, in some years, Lapwings have to move to intensively used grassland and fields outside the nature conservation areas because they need areas of short vegetation. Other bird species actually prefer the long grass and fallow areas that occur when there is a lack of use and care. In some places, an increase in such habitat, in lakeside areas for example, has resulted in larger numbers of Sedge Warblers, Whinchats, Quails, Shovelers, Teals and Garganeys. Birds which have recently bred for the first time or which have returned to breed after absence include Corncrakes, Spotted Crakes, Bluethroats, and Stonechats.

Development and breeding biology of a population of Lapwings *Vanellus vanellus* during the agricultural extensification of their breeding site

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This breeding ecology of the Lapwing *Vanellus vanellus* population in the former sewage farms of Münster (Westphalia) was studied during the agricultural extensification of their 150 ha breeding site. Population changes and hatching- and fledging success were monitored during this time in order to assess the significance of extensification for the declining Lapwing population. Reasons for population changes, varying breeding success and an unbalanced sex-ratio during the breeding season were investigated. Breeding biology data were collected in 1995 (before extensification) and 1998–2000 (during and after extensification). Resighting data on colour-marked Lapwings were collected during 1995–2000.

The median sex-ratio of Lapwings during the breeding season was about 5 males to 3 females every year. Overall, 21 of 41 colour-marked fledglings were seen again in or near the study area in at least one of the first two years of their lives. Ten of them bred at least once in the study area (hatching site fidelity). In 37 of 53 cases, colour-marked breeding adults were seen again in or near the study area one year after breeding, while 24 cases involved re-breeding in the study area (breeding site fidelity). Fewer females than males were seen again in the study area or nearby in the post-breeding year. Of the returning Lapwings, fewer females than males bred again in the study area.

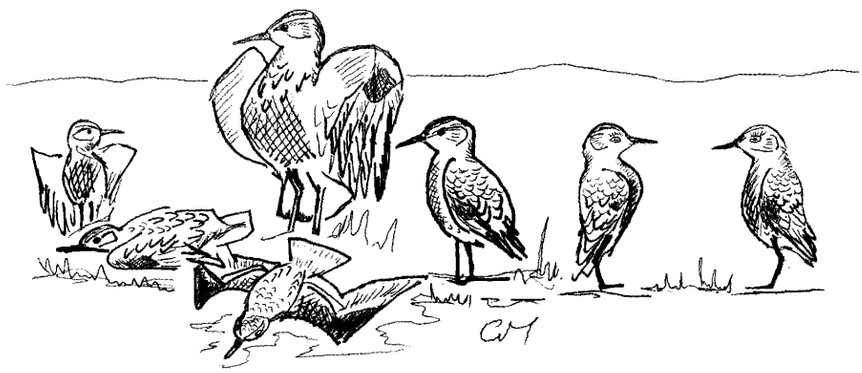
In 1995, there were 67 females breeding in the study area and from 1998 to 2000 the number decreased from 59 to 31. Each female produced 1.6–2.7 clutches per year (2.7 clutches in 2000). Between 0.5 and 0.9 clutches hatched per breeding female and year (0.5 clutches in 2000). Before the extensification of land-use started, the main reasons for clutch-loss were destruction by agricultural work and predation. Since 1998, predation has become the main reason for clutch-loss. Overall, the time when brooding stopped was

established in respect of 54 lost clutches. In 51 of these, brooding stopped between sunset and sunrise. Furthermore, ten video-monitored nests were robbed during darkness, in one case by a polecat *Mustela putorius* and in nine cases by a red fox *Vulpes vulpes*.

Breeding success was 0.23–0.45 fledged chicks per breeding female and year (0.23 fledged chicks in 2000). By radio-tagging 27 chicks, it was shown that many chick losses were due to predation. The sex-ratio of the chicks did not deviate from 1:1.

The decreasing number of breeding Lapwings is explained by low hatching- and breeding site fidelity, low breeding success and presumably too little recruitment from other breeding populations. The unbalanced sex-ratio during the breeding season may be caused by lower site fidelity and greater mortality of females compared with males. Possibly, the changes in habitat have led to the decrease in the breeding population and many losses of clutches and chicks. It is uncertain whether it will be possible to arrest the decline in the Lapwing breeding population in the study area.

"It's my new boyfriend from Siberia . . ."



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