The effects of agricultural intensification upon pastoral birds: lowland wet grasslands (The Netherlands) and transhumance (Spain)

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The last five decades of agricultural intensification have had marked effects on most European farmland habitats. Many bird species depend upon agricultural habitats during some or all stages of their life-cycle and consequently have been affected by these changes. This paper considers an intensive pastoral system (lowland wet grasslands in The Netherlands) and an extensive pastoral system (transhumance in northern Spain). The birds that have adapted to and exploited these systems are described, along with the changes in land use that currently threaten many of them. The agri-environment programme and other measures are examined and assessed for their capacity to promote the conservation of these bird communities.

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INTRODUCTION

One of the most obvious ways in which humans have altered the European landscape is through farming (*e.g.* farmland now occupies over 60% of the land surface of the European Union). Over recent decades, farming methods have become more intensive and farmers in the European Union (EU) have produced ever higher outputs. In many cases this has caused the destruction or severe alteration of landscapes that had been shaped over centuries (*e.g.* increases in field sizes and destruction of hedges, the destruction of traditional agricultural mosaic landscapes, the drainage of wet meadows and other areas, an increase in the use of pesticides and fertilisers, and the improvement of grasslands and increased stocking densities). Such changes have had severe consequences for much of the avifauna and other wildlife that exploit agricultural habitats.

However, overproduction of many commodities has led to recent reforms of the Common Agricultural Policy (CAP) aimed at reducing the output of many agricultural products. These reforms involve changes to the level and type of subsidy for arable production, options for taking arable land out of production (set-aside) and a range of accompanying measures including the agri-environment Regulation (EEC 2078/92). The latter is aimed at promoting/supporting low output farming systems, and included in this Regulation are options for extensification, organic farming and a range of environmentally sensitive practices.

The accompanying measures have some potential to implement farming methods that both reduce or stabilise levels of production and promote wildlife conservation. However, a prerequisite to implementation of such measures is a clear understanding of the requirements of the birds and other wildlife that depend upon farming systems. This paper describes an intensive pastoral system (lowland wet grasslands in the Netherlands), and an extensive system (transhumance in Navarra, northern Spain). The birds that have adapted to and exploited these systems are described, along with the changes in land use that currently threaten many of them. Agri-environment programmes and other instruments are briefly examined and assessed for their capacity to promote the welfare of bird communities.

Note that definitions of intensive or extensive farming systems are never simple - what is considered as extensive in northern Europe may well be considered intensive in southern Europe. However, a few of the criteria that might be used to distinguish between relatively intensive and extensive systems are described in Table 1.

LOWLAND WET GRASSLANDS IN THE NETHERLANDS

Lowland wet grasslands are a major feature of the EU landscape, especially in the Netherlands and Germany. Very little of this habitat is natural, most having been created long ago by human transformation of natural wetlands (*e.g.* salt and freshwater marshes, swamps, peat bogs, riverine forests) into agricultural pastures and meadows. Beintema (1986) has described the process (begun in the Middle Ages) by which reclamation of the wetlands formed the Dutch polders (one of Europe's prime wet grassland habitats and of high importance for 'meadow bird' communities). Thus the orderly landscape we see today is the result of hundreds of years of human interference.

Table 1. Some relative characteristics of intensive and extensive farming systems (from Beaufoy *et al.* 1994).

	Farming system	
	Extensive	**Intensive**
Fodder/grazing	primarily wild plant species/unploughed	cultivated/seeded pasture/ ploughed
Suckling	natural	artificial
Livestock breeds	local, hardy	highly productive/fragile
Inputs of chemical fertiliser and other agrochemicals	low	high
Outputs/stocking density	low	high
Pasture irrigation/drainage	none	may be well developed
Level of mechanisation	low	high

MANAGEMENT SYSTEMS

Since nearly all of Europe's wet grasslands are artificial habitats, their maintenance depends on management (especially of the grass and the water table). These grasslands may be used for grazing (*e.g.* dairy cattle on good-quality grasslands and sheep, beef cattle or horses on poorer pastures) or mowing (for hay or silage) or both. Intensity of use varies greatly, *e.g.* some grasslands are periodically ploughed and re-seeded, others are burned (to keep them open and naturally fertilised), and others receive regular applications of artificial fertilisers or manure.

One major development in the management of these wet grasslands has been the increase in mechanisation (especially the size and working-speeds of farm machinery). In addition, road-building programmes have increased the area of wet grasslands accessible to large machinery, while better drainage has often enabled access earlier in the year.

BIRD COMMUNITIES

Throughout the EU, wet grasslands support an estimated 600,000 pairs of various wader species (*i.e.* more than half the total numbers of waders breeding in the EU: Hötker 1991). Among species breeding almost exclusively on wet grasslands is virtually the entire world population of the nominate race of Black-tailed Godwit *Limosa limosa*.

More grassland waders breed in The Netherlands than in any other European country (Table 2). For example, the Netherlands supports by far the biggest populations of Oystercatchers *Haematopus ostralegus* and Lapwings *Vanellus vanellus* found within the EU, and also holds major populations of Redshank *Tringa totanus* and Curlew *Numenius arquata.* In addition, 85-90% of the European population of the Black-tailed Godwit breeds in The Netherlands, especially in the north-west (Beintema 1986, 1991b; Groot & Jeugd 1994).

Intensive management of these grasslands is almost impossible during the bird breeding without drainage of the fragile soil (especially the water-logged peat). Even on more stable soil types, wet weather has generally restricted access for cattle and machinery during the spring and has thus favoured bird nesting activities. In addition, high water tables retard vegetation growth and therefore also help to delay the onset farming activities in the spring. Finally, the wet soil conditions ensure that the birds have access to soil invertebrates throughout the breeding season. This combination of beneficial factors for breeding waders is almost unique to the Netherlands, occurring only locally elsewhere in Europe (Beintema 1986).

INTENSIFICATION AND INFLUENCE ON BIRDS

Traditionally, lowland wet grasslands were farmed at low-intensity and, as such, were regarded as a semi-natural habitat. However, extensive farming methods have now generally been abandoned in favour of more intensive farming practices. Measures which have increased productivity in agricultural terms but which have had a highly detrimental effects on the suitability of the habitat for breeding waders are summarised in Table 3.

Increasing the intensity of grassland management produces denser and faster growing swards which can hinder foraging by waders and entangle the chicks (see Green 1986 for optimal vegetation height for different species). In addition, better drainage and increased fertiliser application permits earlier growth of the vegetation and also allows livestock and machinery earlier access to the grasslands in the spring. The increased disturbance, earlier mowing dates and greater opportunity for repeat mowings causes increased losses of eggs and chicks. Predation of eggs and chicks may also be higher on drier land, either because predators have easier access or because the adult birds have to forage further afield and therefore leave the nests and chicks unattended for longer (Beintema & Müskens 1987).

Table 2. Population sizes (number of pairs) and trends of selected birds in The Netherlands and Europe. * indicates a population greater than one million pairs.

	Population estimate			
	Netherlands	Europe	SPEC	Trend
Black-tailed Godwit *Limosa limosa*	85,000-100,000	140,000-270,000	2	-
Ruff *Philomachus pugnax*	400-800	*	4	--
Redshank *Tringa totanus*	24,000-36,000	300,000-630,000	2	-
Snipe *Gallinago gallinago*	2,400-3,100	*	2	--
Oystercatcher *Haematopus ostralagus*	80,000-100,000	*	4	++
Curlew *Numenius arquata*	6,500-8,000	120,000	2	+

SPEC indicates the category of Species of European Conservation Concern (Tucker *et al.* 1994).
1: Species of Global Conservation Concern.
2: Concentrated in Europe and with an Unfavourable Conservation Status.
3: not Concentrated in Europe and with an Unfavourable Conservation Status.
4: Concentrated in Europe and with a Favourable Conservation Status.

Trend (over 20 year period). - = decline of 20-50%. -- = decline >50%. + = increase of 20-50%. ++ = increase >50%.

Table 3. Summary of habitat change resulting from intensification of farming methods in lowland wet grassland areas.

Habitat loss
Conversion into arable fields
Habitat modification
Increase in deep drainage (now covering 60-80% of wet grasslands)
Increased use of N fertiliser 50 kg/ha in 1950 to 400 kg/ha in 1980 (Van der Meer 1980)
Increased use of other agrochemicals
Increased grass production
Increased farm size
Habitat disturbance
Increased stocking levels and mechanisation
Earlier and more frequent mowing

Increased application of fertilisers during the initial period of 'improvement' of wet grasslands boosted invertebrate biomass, which in turn enhanced the food supply for waders and produced higher wader densities in certain areas (*e.g.* Black-tailed Godwit numbers increased during the 1940s and 1950s: Beintema 1991a). However, although some species (such as Lapwing, Black-tailed Godwit, Oystercatcher and Curlew) benefit from an increase in intensification, others (such Ruff *Philomachus pugnax*, Snipe *Gallinago gallinago* and Redshank) decrease in numbers. Beintema (1983, 1991a) categorised these two groups 'non-vulnerable' and 'vulnerable' respectively.

Intensification has therefore led to the widespread deterioration of lowland wet grassland as a safe and productive habitat for many waders (as well as for other animals and plants). The main effect has been wholesale population declines in the most vulnerable species, *e.g.* Dutch populations of Ruff and Snipe are now extremely small compared to the period prior to the 1970s, and the remaining individuals are virtually confined to breeding on nature reserves (Beintema 1991b).

TRANSHUMANCE IN SPAIN

Transhumance involves the seasonal movement (either local or long-distance) of livestock between grazing areas, and usually involves movement to higher altitudes in the summer and to lower altitudes in the winter. Such movements traditionally take place along established drovers roads called 'cañadas', and transhumance has been practiced in Spain for over eight hundred years (Bignal 1991; Ruiz & Ruiz 1986).

Transhumance involves many ecologically important management techniques (Bignal 1991):

- Seasonal grazing pressure.
- Mixed herds/flocks of livestock.
- The use of traditional breeds of livestock (which better utilise natural pasture).
- Shepherding of livestock (to ensure proper exploitation of pasture).
- Integration of arable and pasture management (especially the use of fallowing and fertilisation from livestock dung).

Transhumance was at its peak in Spain during the eighteenth century, with 3.5 million animals being moved along the cañadas each year, but the practice went into decline during the nineteenth century. By the beginning of the present century only 1.5 million sheep were being moved annually (Klein 1920), and today only half a million sheep are involved each year (Ruiz & Ruiz 1986). Most of the transhumance livestock now travel by train or lorry, but some animals still travel on foot (especially where distances between summer and winter pastures are small). For example, each year 80,000-100,000 sheep move between their wintering pastures in Las Bardenas (an area of steppe in southern Navarra) and their summer pastures in the Salazar and Roncal valleys (in the Pyrenees). The following is concerned largely with transhumance in the Pyrenees and the associated bird communities (see also Pain 1994).

BIRD COMMUNITIES AND POPULATION TRENDS

Over the centuries, a range of bird species have become associated with transhumance and the open landscapes that it maintains. For example, grazed areas provide good hunting grounds for predators such as the Golden Eagle *Aquila chrysaetos*, livestock carcasses provide a readily available food supply for vultures and other scavengers, and grazed areas with an abundance of livestock dung provide good foraging opportunities for invertebrate-feeders like the Chough *Pyrrhocorax pyrrhocorax* and Alpine Chough *Pyrrhocorax graculus*.

Table 4. Population sizes (number of pairs) and trends of selected birds in Spain and Europe.

	Population estimate			
	Spain	Europe	SPEC	Trend
Golden Eagle *Aqila chrysaetos*	1,192-1,265	5,000-7,200	3	-
Griffon Vulture *Gyps fulvus*	8,074	9,300-11,000	3	++
Chough *Pyrrhocorax pyrrhocorax*	7,000-9,800	16,000-70,000	3	-
Lammergeier *Gypaetus barbatus*	42-47	200-640	3	++

SPEC indicates the category of Species of European Conservation Concern (Tucker *et al.* 1994). Codes for SPECS and trends as Table 2.

Griffon Vulture *Gyps fulvus,* Egyptian Vulture *Neophron percnopterus*, Lammergeier *Gypaetus barbatus*, Golden Eagle and Chough are considered to be of high conservation priority as they are threatened throughout all or large parts of their range in Europe and are thus classified as Species of European Conservation Concern (SPECs). Spain contains a large proportion of the European population of these species (Table 4), and within Spain the Pyrenees are extremely important, *e.g.* they support *c.* 15 % of the Spanish population of Golden Eagle, *c.* 18% of Griffon Vultures and all the Lammergeiers. Of these species, the vultures have the most direct association with transhumance. For example, the food of Griffon Vultures in the Pyrenees consists mainly of the soft tissues of medium to large domestic livestock (Fernandez 1975; Kostrzewa, Ferrer-Lerin & Kostrzewa 1986), and Sunyer (1992, 1994) found that more than 80% of food items taken by ten Lammergeier pairs in Spain were of livestock origin.

Spain held large numbers of Griffon Vultures during the eighteenth century, but the reduction in transhumance from the nineteenth century onwards was paralleled by marked decreases in vulture numbers (Cramp & Simmons 1980; Palma & Rufino 1981). Many factors may have influenced this decline (*e.g.* direct persecution, egg collection and disturbance) but food supply is likely to have been important (Cramp & Simmons 1980; Soto 1986). The Griffon Vultures considerable population increase in Spain in recent years (estimated to be 80-90% between 1979 and 1989) probably results from a decrease in persecution and poisoning and an increase in food supply (resulting from the establishment of artificial feeding stations and the illegal disposal of livestock carcasses in open mule tips: Arroyo *et al.* 1990). However, the stricter enforcement of carcass disposal regulations is resulting in a decrease in the number of mule tips (Sunyer 1994), and therefore Griffon Vultures (and other scavenging birds) are likely to become even more dependent on the continuation and maintenance of traditional transhumance in the future.

Golden Eagles may also feed upon dead adults (and also sometimes live young) of grazing animals, and their breeding density has been positively correlated with the availability of sheep and deer carrion in the Scottish highlands in winter (Watson *et al.* 1992). Where transhumance has ceased to be practiced in

Mediterranean subalpine areas, the return of denser forest cover has reduced Golden Eagle hunting grounds and has led to population declines (Palma 1985; Simeon & Cheylan 1985).

The chough is also a typical pastoral bird, preferring open areas of grassland grazed by cattle and/or sheep at low-intensity (Bignal *et al.* 1989). This preference is largely related to the seasonal abundance and availability of invertebrate prey items beneath and on the soil surface and associated with livestock dung (McCracken *et al.* 1992; Rolando & Laiolo in press). Chough populations appear to be stable or increasing in areas where traditional pastoralism or mosaics of extensive farmland are maintained. However, populations have declined and local extinctions have taken place in areas that have undergone agricultural intensification or abandonment (such as Brittany, Northern Ireland, mainland Scotland, England and south-west Portugal: Bignal & Curtis 1989).

THREATS TO THE BIRD COMMUNITIES

The above (and other) species of bird are currently threatened by the loss in both the quantity and quality of extensive farmland habitats. In the Pyrenees, the major threats are from:

- Abandonment of extensive farming systems.
- Increase in intensive livestock production.
- Stricter enforcement of carcass disposal regulations.
- Afforestation.

Until fairly recently, the majority of extensive farming systems in Spain had not been completely displaced by more intensive farming systems because a market remained for products from both types of systems (Baldock & Long 1987; Egdell 1993). However, since the market regulation mechanisms of the CAP first began to operate in Spain in 1986, the freer market has started opening up barriers to importation from other EU countries, and consequently many Spanish farmers are now exposed to fierce competition from elsewhere. Traditional, usually economically 'marginal', livestock farmers are particularly vulnerable to this pressure as they are subject to severe productivity constraints, often have subsistence incomes and are unused to such competition (Egdell 1993). Pressure to compete with other producers combined with recent incentives to reduce production surpluses have resulted in increasing intensification of livestock farming, and the abandonment of areas of extensive farmland (such as mountain pastures). In addition, incentives for afforestation have increased along with efforts to reduce agricultural surpluses, and large-scale afforestation programmes may well be centred around the least productive farming areas (but which are usually also those with the highest nature conservation importance).

MAINTAINING THE CONSERVATION VALUE OF PASTORAL SYSTEMS

Many bird species have become adapted to pastoral habitats and in many cases have come to depend upon them. The above two examples are very different in terms of geography, geology, ecology and intensity of agricultural management. The two systems support very different bird communities, and the most appropriate type and intensity of agricultural management required to support the associated bird communities is very different. However, it is clear that the nature conservation value of both systems is threatened by agricultural intensification beyond a certain point.

We now know enough about the biology and requirements of many bird species to make a reasonable judgement of what aspects of pastoral farming systems need to be maintained (or enhanced) in order to retain their conservation value. However, policy mechanisms must exist to allow this knowledge to be put into practice.

There are often many, sometimes quite complex, reasons behind land-use or land management changes, but social aspirations and economic signals are important factors. Within the European Union, the economic signals are largely dominated by the CAP, and the main objective of the recent CAP reforms has been to find a way of limiting or reducing the production of agricultural commodities (particularly cereals). Amongst the mechanisms that are (or will shortly) become available, are limitations on the subsidies paid to livestock farmers.

Farmers who reduce production (or maintain low outputs) can do so in many ways, not all of which are environmentally beneficial. It is therefore essential to incorporate not just the amount produced, but the way in which it is produced, into agricultural policy and funding mechanisms. One way in which this can be done is through the introduction of environmentally sensitive management agreements (*e.g.* under the new agri-environment Regulation), which would allow Member States to support farming systems in areas where populations of threatened species are dependent on the maintenance of those systems.

Lowland wet grasslands in the Netherlands

Environmentally sensitive farming practices and extensification are already implemented under the Dutch Management Agreement Scheme. Under this agreement, 200,000 ha of farmland (*i.e.* one third of the total area of farmland regarded as valuable for wildlife) must be designated, with 50% being entered into a reserve-areas scheme (where the land is purchased by the government and nature reserves created) and 50% being entered into a management-areas scheme where land is managed in an environmentally sensitive way through voluntary agreements with farmers). The 200,000 ha includes 50,000 ha of lowland wet grassland (*i.e.* 10% of the total area of lowland wet grassland in The Netherlands).

The total area covered by the management-areas scheme (MAS) is relatively small (typically less than 10% of the farmland utilised by breeding waders) in many areas, but does rise to as much as 50% in the north (where the highest densities of waders occur). However, there is no guarantee that MASs will accommodate a high proportion of an area's breeding birds. For example, half the Dutch breeding population of Black-tailed Godwits is found in the Friesland but only a small proportion of these birds occur within the 22,000 ha Friesland MAS. In addition, management agreements can be 'passive', 'light' or 'heavy', according to the stringency of management prescriptions and targets, and only the 'heavy' management prescriptions appear to benefit breeding waders (see Dunn 1994).

In areas where management agreements have been established for at least five years, these have apparently contributed to halting declines in Lapwing, Black-tailed Godwit and Redshank. Black-tailed Godwit and Redshank have also stopped declining in reserves, as apparently have Snipe (which continue to decline sharply outside reserves). However, the results hold out little hope for conserving Ruff - highest densities of Ruff are found on reserves, but even here the decline which started in the mid-1970s shows no sign of slowing down.

Considering all wader species, it is therefore very doubtful whether present population levels can be maintained, especially given that MASs and reserves cover such as small proportion of the land area and that most programmes are not stringent enough to even maintain the *status quo.* There is thus a definite need in The Netherlands for alternative, more effective instruments for conserving birds of lowland wet grassland. However, until such alternatives are put in place, farmers should be given the incentives necessary to make the current 'heavy' management prescriptions an attractive option.

One mechanism for improving overall management of lowland wet grasslands is through cross compliance (see Taylor & Dixon 1990). However, The Netherlands' uniquely high water table and drainage problems may require stronger instruments in concert with cross compliance. Thus, even with cross compliance, it is possible that MASs will always be an essential component of the overall strategy for ensuring extensive farming methods in Dutch lowland wet grasslands.

Transhumance in Spain

In a small country like the Netherlands, it is conceivable that a high proportion of the conservation value of pastureland could be maintained through a comprehensive network of reserves and MASs. However, this is patently not the case for extensive pastoralism, which covers vast areas of the countryside in Spain (Beaufoy, Baldock & Clark 1994). Indeed, transhumance provides a good example of how individual site protection measures and management agreements would not necessarily always be enough to ensure the traditional management and maintenance of the ecological value of an area.

Transhumance depends upon the seasonal exploitation of often distant pastures, and therefore a zone encompassing a network of sensitively managed summer and winter pastures would be required to maintain this system. Such a zone would include very different habitat types (which would require different management prescriptions) and other mechanisms (such as special dispensations to exempt farmers from carcass disposal regulations) would also have to be implemented within the zone. The scheme would therefore be very complex to establish and manage correctly.

Until such complex wider countryside schemes can be established effectively, it will be essential that other Spanish and EU financed schemes (*e.g.* for afforestation and rural development) in ecologically important areas are closely monitored to ensure that they do not conflict with nature conservation objectives. Much more integration of environmental policy with agricultural and forestry policy is therefore required (both within Spain and throughout the EU).

Currently in Europe, more bird SPECs depend upon farmland than on any other habitat. Established methods (*e.g.* site protection) have, and always will, play an important part in the conservation of birds and other species. However, such methods cannot stand alone. What is required is a new philosophy towards the environment. The whole of our landscape must be managed in an appropriate and a sustainable way in order to secure a future for not just birds but for all species. However, the mechanisms to enable this to happen must be developed and implemented now.

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