Breeding birds on organic and conventional arable farms

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Chapter 8

Conclusions and discussion

The main objective of this study was to compare organic and conventional arable farms as breeding habitat for farmland birds. Therefore, a series of studies was carried out in a uniform, highly productive arable landscape in the Netherlands with the following objectives: (1) assessing and explaining differences in breeding bird densities between organic and conventional arable farms, (2) assessing and explaining differences in breeding success of birds between organic and conventional farms, (3) assessing the effectiveness of volunteer nest protection on reproductive success on both farm types, and (4) assessing chick food availability on organic and conventional arable farms. Differences in breeding bird densities were explained by looking at three different factors: (1) abundance of non-cropped habitats, (2) crop partition, and (3) within-crop factors. The latter includes sward structure and food abundance. Concerning reproductive success, direct effects of farm management on nest survival were investigated. Additionally, the possibility of indirect effects of differences in food resources on breeding success was assessed as well.

In this chapter first the overall conclusions related to breeding bird densities, breeding success and food abundance will be summarized briefly. Following, the implications for management will be discussed:

1) Can organic farming enhance farmland bird populations?
2) Are there other options to counteract the decrease of arable birds?
3) How should arable bird conservation be facilitated?

Conclusions

Differences in breeding bird densities

Total territory density of field-breeding species did not differ between organic and conventional arable farms. However, the species composition was different.

At the species level, skylark and lapwing were significant more abundant on organic farms. Skylark reached 3-4 times higher densities and lapwing densities were about twice as high on these farms. For both species differences in cropping pattern were the most explaining factor for the higher densities. Organic farms had a more diverse cropping pattern. Besides this, organic farms grow relatively large areas of spring cereals. Conventional farms grow relatively large areas of winter cereals, sugar beet and potatoes. Larger areas of spring cereals on organic farms contributed to higher densities of breeding skylarks. It was shown that on conventional farms suitable breeding habitat for skylarks is limited during the peak of the breeding season: at this time winter cereals are too dense and too high and no alternative habitat is available. On organic farms however, suitable breeding habitat was available during the entire breeding season. The larger areas of winter cereals on conventional farms limited lapwing densities these farms. Non-crop habitats did not result in differences in breeding bird densities between organic and conventional arable farms. Both organic and conventional farms had similar amounts of non-crop habitats (field margins, ditch banks, reed beds). Woody landscape elements, like solitary trees and hedgerows were only present around organic fields, but acreages were very small. Finally, indications were found that higher food abundance on organic farms contributed to higher lapwing densities.

Comparing the breeding densities of the farmyard bird species barn swallow no difference was found between the organic and conventional farms. Farmers' attitude towards these birds did not differ either; both were very positive.

Differences in breeding success

Breeding success was studied for two field-breeding species: lapwing and skylark. Indications were found that on organic farms nest success of lapwings is lower compared to conventional farms. This was caused by higher nest failure rates due to agricultural operations, especially mechanical weeding. Nest predation rates did not differ between the two farm types. Nest protection significantly reduces nest loss due to agricultural operations, but indications were found that nest protection might lead to higher nest predation and desertion rates. Overall the effectiveness of nest protection on total nest success was limited. For skylarks a comparison of breeding success of could not be made between the two farm types, however, indications were found that agricultural operations were te most common cause of nest failure.

Differences in food abundance

Food abundance was compared between organic and convention al arable farms for three groups of birds: (1) soil invertebrate (earthworm) feeders, (2) ground-dwelling invertebrate feeders and (3) aerial invertebrate feeders. Earthworms and aerial invertebrates were generally more abundant on organic farms. Total ground-dwelling invertebrate abundance did not differ between the two farming types, but some groups (e.g. carabid beetles and spiders) were more abundant on organic farms. Earthworm abundance did not differ between crop types, but ground-dwelling and aerial invertebrates did. Ground-dwelling invertebrates were most abundant in onions, carrots and cereals on organic farms and in onions on conventional farms. Aerial invertebrates were more abundant above cereal fields on both farm types.

General discussion

Can organic farming enhance farmland bird populations?

Organic farms are often mentioned to provide better habitat for birds as a result of a more diverse cropping pattern, higher food availability, and better quality of non-crop habitats (Christensen *et al.*, 1996; Wilson *et al.*, 1997; Chamberlain *et al.*, 1999). However, based on the results of this study it is doubtful whether organic farming is able to enhance farmland bird populations. In this study only skylark and lapwing were found to breed in higher densities on organic farms. Other studies however generally found positive effects on more species (e.g. Christensen *et al.*, 1996; Beecher *et al.*, 2002). However, studies comparing bird numbers between organic and conventional farms have so far been always a comparison at a given moment. In order to conclude whether organic farming can enhance farmland bird populations, future studies should focus on the difference in population trends between organic and conventional farms. Besides that some of these studies had some methodological differences, they also focussed on more than only field-breeding species. These other species might benefit from differences in non-crop habitats between both farm types (Chamberlain *et al.*, 1999), although most studies did not analyse this possibility. As mentioned earlier, quantitative differences in non-crop habitats between both farm types were very limited in this study. This was caused by the fact that the study area of this study was very homogenous in terms of presence of non-crop habitats, also including land not owned by farmers. Therefore, it is unlikely that birds dependent on these habitats will differ in abundance on the studied farms. The fact that the number of breeding barn swallows did not differ between organic and conventional farms indicates that the quality of farmyards of both farm types is more or less equal.

Certain factors should get more attention before a final conclusion can be drawn. These factors include: (1) ecological quality of non-crop habitats, (2) landscape composition (3) non-use of pesticides and mechanical weeding, (4) improving nest protection schemes and (5) winter situation. Additionally, population dynamic models should be designed for a more complete assessment of the effects of organic farming on farmland birds.

In this study no difference in the amount of non-crop habitats was found, but the quality of these habitats was only partly studied by focussing on invertebrate abundance. Suitability of a certain habitat is also determined by vegetation structure and composition and by management (e.g. Devereux *et al*, 2004). Vegetation density determines whether the habitat is suitable for nesting or foraging. These qualitative factors should be better investigated in future studies.

Landscape composition of an area might be of influence on the difference in bird densities between organic and conventional farms. Christensen *et al.* (1996) conducted their study in a more mixed agricultural landscape and found most species in higher numbers on organic farms. In many agricultural areas organic farms are characterised as mixed farms. However, the organic farms in this study were in most cases specialised arable farms. Although some farmers had livestock, their pastures were often outside the study area. This might have resulted in the somewhat limited effects of organic farming on breeding birds compared to other studies. Besides this, the heterogeneity of the landscape can have an effect as well. This study was carried out in a homogenous open area. In a landscape with small scale agriculture and more non-crop habitats, different bird species will occur and possibly different effects of organic farming might be found. So, further studies should be conducted in mixed areas and in areas with small scale agriculture.

The non-use of pesticides on organic farms is often mentioned to have positive effects invertebrates and consequently breeding numbers and breeding success of farmland birds (Smeding and de Snoo, 2003; Boatman *et al.*, 2004;

Hart *et al.*, 2006). In this study some indications were found that higher food abundance on organic farms might lead to higher lapwing densities. However, intensive and frequently carried out agricultural operations (e.g. mechanical weeding) are an important cause nest failure for field-breeding birds on organic farms. This was shown for lapwing and skylark, both the species which were more abundant on organic farms. Therefore, a detailed study should be carried out it focussing on this dilemma. Population dynamic models should be developed to analyse whether the reproductive success on organic farms is sufficient to enhance farmland bird populations.

Especially on organic arable farms nest protection programmes might be an effective conservation measure. However, these programmes can be better designed. Currently nests are often protected by volunteers by marking them with poles. However, this often happens during periods where no agricultural activities take place. Marking nests might attract predators or result in nest desertion. By marking the nests only shortly before agricultural operations will take place, chance of predation will be limited and effectiveness of nest protection might be further improved (Berg *et al.*, 1994). For small passerine birds (e.g. skylark, yellow wagtail) nest protection will be practically impossible, as nests of these species are well hidden en thus difficult to find. For these species nest protection is not an option and solutions should be found in field-scale management. These could include postponed cutting and weeding dates for certain crops.

This study focussed completely on the breeding season situation. Several previous studies indicated that the winter situation is an important explaining factor for declining farmland bird populations as well (Peach *et al.*, 1999; Siriwardena *et al.* 2008). Low food availability is often mentioned to be the most important factor. So far, no studies have compared food availability between organic and conventional arable farms during winter. During winter, most species feed on plant material such as cereal grains and seeds. Stubble fields and unharvested seed-bearing crops are important foraging habitats during winter (e.g. Henderson *et al.,* 2004; Bradbury *et al.,* 2008). Because of agronomic reasons it is not likely that the availability of these habitats differs between both farming types. However, the lack of herbicide use on organic farms might lead to higher seed availability on organic fields (Bradbury *et al.*, 2008). This might be a cause for higher numbers of wintering birds on organically managed farms (Chamberlain *et al.*, 1999, 2009; Fuller *et al.*, 2005). The winter situation on organic and conventional arable farms for farmland birds is still unclear in the Netherlands and should therefore be investigated in the future.

Are there other options to counteract the decrease of arable birds?

Besides organic farming, other ways for farmland bird conservation should be explored. One of the most widespread alternatives are agri-environment schemes, which have been implemented in many European countries (Kleijn and Sutherland, 2003). Although there has been a serious discussion about the effectiveness of agri-environment schemes (e.g. Kleijn *et al.*, 2001; Kleijn and Sutherland, 2003; Kleijn and van Zuijlen, 2004) there are several examples of effective agri-environment schemes for birds of arable farmland. Thus, establishments of field margins and cereal stubble fields have had positive effects on cirl bunting *Emberiza cirlus* numbers (Peach *et al.*, 2001; Bradbury *et al.*, 2008). Wintering granivorous passerines and skylarks benefit from stubble fields and wild bird cover crops (Bradbury *et al.*, 2003). Also positive effects of agri-environment schemes on breeding lapwings and populations of grey partridges were found (Bradbury and Allen, 2003; Bradbury *et al.*, 2003). The discussion about effectiveness of agri-environment schemes was mainly based on disappointing results of such schemes in grassland areas. Meadow birds (e.g. black-tailed godwit *Limosa limosa*, common redshank *Tringa totanus*) use meadows for all stages during the breeding period: nesting, feeding and chick rearing. In common agricultural practice all fields are cut during the breeding season, making these fields unsuitable for nesting and chick rearing (Kruk, 1994). So, there is a large conflict between common agricultural practice in grasslands and arable birds. However, for birds breeding on conventionally managed arable land the conflict is likely to be smaller, as not many nest threatening farming operations are carried out. Agri-environment schemes for arable birds can focus on three different factors: (1) providing breeding habitat (2) providing foraging habitat during the breeding season and (3) providing foraging habitat during winter.

In the UK, so-called 'Skylark-plots' have been introduced as a measure to increase breeding habitat for especially skylarks (Morris *et al.*, 2004). However, these plots seem to be not effective in the Netherlands (Willems *et al.*, 2008). Another option to increase availability of breeding habitat for ground breeding birds is the reintroduction of set-aside. Set-aside was originally introduced to counteract the overproduction of cereals in the EU. Farmers were obliged to leave a certain area of their land out of production. These areas proved to attract high numbers of breeding and wintering birds (e.g. Buckingham *et al.*, 1999; Henderson *et al.*, 2000). Furthermore, a species like skylark produced more chicks on set-aside fields compared to conventional arable crops (Poulsen *et al.*, 1998). However, cereal stocks have diminished and worldwide cereal demands are increasing. Because of this, the EU has abolished the set-aside regulation and because of increasing cereal prices it is unlikely that farmers will maintain set-aside. As a consequence, it is likely that farmland bird populations will become more under pressure (Kragten, 2008). Therefore, set-aside could be adopted as an agri-environment scheme.

This study found lower invertebrate abundance in field margins compared to crops. However, this could be a bias effect of the sampling protocol. In contrast with these results, several other studies showed that foraging habitat can be offered by grassy field margins or by cereal margins (e.g. Vickery *et al.*, 2002). Also unsprayed field margins might be useful as foraging habitats for species like yellow wagtail (de Snoo, 1999). In order to be effective though, field margins should have certain robustness (e.g. Koks *et al.*, 2007). Currently new agri-environment schemes are being discussed in the Netherlands, for example a minimum width of 9 meters for field margins, but this might be a result of biased sampling.

In winter, food availability can be improved by leaving seed bearing crops (e.g. cereals, quinoa, linseed, kale) unharvested or by leaving (cereal) stubble fields (e.g. Henderson *et al.*, 2004; Bradbury *et al.*, 2008). From 2010, only two agri-environment schemes aiming at arable farmland birds will be available in the Netherlands. One of these schemes mainly aims at providing foraging habitat during the breeding season, the other one at providing foraging habitat during winter. So, there will be no schemes available aiming at providing more breeding habitat. As this thesis shows that skylark populations probably suffer from limited availability of breeding habitat on conventional arable farms, development of such schemes should have priority.

How should arable bird conservation be facilitated?

Farmland bird conservation can only be achieved when at least some of the agricultural land will be managed less intensively and in a lot of cases will not be primarily used for food production. This means that farmers are likely to lose income when they apply conservation measures for farmland birds. Therefore, farmers need be financially compensated in order to carry out conservation measures, which are often organised under agri-environment schemes.

Budgets available for agri-environment schemes are mainly determined by the European Common Agriculture Policy (CAP), although member states have some flexibility. The CAP was originally installed to safeguard food production and farmers income. The CAP consists of two financial pillars. Pillar I is the traditional market- and price policy, mainly aimed at protecting farmers against fluctuations in the world market. Pillar II is aimed at sustainable rural development. One of the goals of this pillar is improving the quality of the environment, nature and landscape in rural areas. Agri-environment schemes are financed through this pillar. Currently, the budget available for Pillar I is approximately 5-10 times higher than the available budget for Pillar II in most European countries (Farmer *et al.*, 2008). For the period 2007-2013, the Netherlands had a total CAP budget of € 6.4 billion, of which 5.9 billion was labelled to Pillar I and the remaining 0.5 to Pillar II.

From 2013 a new CAP will be introduced and there is a strong call to focus the future CAP more on social values, such as biodiversity and environmental quality (e.g. SER, 2008). In other words, future agriculture should contribute to social welfare: production of sufficient food and delivering green services. One way to do this could be by only providing farmers income support when they deliver green services, such as field margins or winter food measures. Switzerland is already working with a system like this.

The coming decades, conservation of farmland biodiversity will be the biggest challenge for conservationists and policy makers. The skylark was once one of the most common bird species in the Netherlands. The severe decline of this species indicates a dramatic downfall of ecosystem health in agricultural areas. Typical farmland birds like corn bunting and ortolan bunting are already extinct from the Netherlands and at the current rate of population declines black-tailed godwits, skylarks and grey partridges will soon follow. Arable farmland birds are slowly getting more and more attention in the Netherlands. Although the Netherlands have no international responsibility for the conservation of these species, they contribute to the quality of life in a large part of the Dutch agricultural landscape. It is therefore important to protect these species and take immediate action.

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