Journal for Nature Conservation 15 (2007) 10—25

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Journal for Nature Conservation

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Farmers' perceptions of biodiversity and their willingness to enhance it through agri-environment schemes: A comparative study from Estonia and Finland

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Received 20 December 2005; accepted 8 August 2006

KEYWORDS
Agricultural policy;
Farmers' attitudes;
Farmland birds;
Habitat richness

Summary

This comparative study is based on structured interviews with farmers participating in the agri-environment schemes in Estonia and Finland. It explores farmers' interest in and knowledge of farmland wildlife, their understanding of the concept of biodiversity, and awareness of the potential causes behind declines of farmland birds. It also examines the relationship between farmers' interest and willingness to undertake practices favouring farmland wildlife. Estonian and Finnish farmers showed considerable interest in wildlife on their farms, which was only weakly related to the self-assessed knowledge of wildlife. Many farmers viewed biodiversity from a narrow perspective often excluding species directly related to farming. Finnish farmers expressed more concern about the decline in common farmland species than Estonian ones. In both countries farmers rated intensification of agriculture as the major driving force behind farmland bird declines. The expressed interest in wildlife positively correlated with willingness to undertake wildlife-friendly measures. Only farmers with agri-environment contracts targeted specifically at biodiversity enhancement were more knowledgeable about practical on-farm activities favouring wildlife, and were more willing to employ them than the rest. Estonian farmers expressed a high degree of willingness to enhance wildlife though agri-environment management, which is a good sign for better implementation of the recently established national programme towards conservation.

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doi:10.1016/j.jnc.2006.08.001

Introduction

Farmers struggle constantly between boosting economic returns and using resources in a sustainable way. Current EU agricultural policy sees farmland biodiversity as a resource to sustain, for which farmers are paid under agri-environment support schemes (Council Regulations, 2005). Translating this policy into practice is not straightforward, and many biodiversity support schemes fail to either attract farmers or achieve their objectives (Kleijn & Sutherland, 2003). Farmers' values and attitudes towards the environment have been shown to influence the way they manage their farms and participate in environmental support schemes (Beedell & Rehman, 1999, 2000; Gasson & Potter, 1988; Morris & Potter, 1995; Schmitzberger et al., 2005; Willock et al., 1999; Wilson & Hart, 2000). Farmers' understanding of biodiversity as a target for management is also likely to have an effect. There are few studies of farmers' knowledge of and attitudes towards the biodiversity of their land, specifically related to nature-friendly management (Burgess & Harrison, 2000; Jacobson et al., 2003; Jurt, 2003; Soini & Aakkula, 2006).

Ten countries from Central and Eastern Europe (CEE) entered the EU in 2004, putting over 400 000 km^2 of agricultural land under imminent pressure of modernised production. On entry, the new member states were required to adopt the EU Common Agricultural Policy, which supports intensification of production, but also includes provision for nature-friendly management under agri-environment programmes (Council Regulation, 2005). A wide variety of agronomic, socio-cultural, economic and psychological factors play a role in farmers' response to environmental policies (Knierim et al., 2003). Specifically, there are likely to be major differences in the outlook and attitudes of the CEE farmers towards nature on farmland and its preservation compared to their western European counterparts because (a) typical farmland biota, including birds, are still diverse in the CEE region, (b) farmers' awareness about potential damaging effects of intensive production on farmland wildlife is likely to be limited when intensification is only getting underway, (c) the economic hardships of the region's farmers due to economic transition are greater than those of farmers of western Europe, and (d) their experience of agri-environment schemes is probably minimal because it is a new concept in their countries. As yet, there are no studies on how biodiversity is perceived by farmers in the CEE region, nor any comparative research on the differences between "East" and "West" Europe (Knierim et al., 2003). Such an assessment is important to promote farmers' enrolment into agri-environment schemes targeted at biodiversity enhancement as well as development of conservation-related measures within the schemes.

We explored farmers' interest in and knowledge of major animal groups, plants and nature as a whole, and looked at the relationship between farmers' interest and their willingness to undertake measures favouring farmland biodiversity. We also assessed farmers' awareness of the impact of farming activities on farmland wildlife. Since farmers' willingness to employ wildlife-friendly management has been shown to be influenced by farm size and profitability (Camboni & Napier, 1993; Gasson & Potter, 1988), and, potentially, by plans for the future (Newby, Bell, Saunders, & Rose, 1977), we looked at the effect of both attitudinal and structural factors. Two countries were studied: Estonia, representing a new member of the EU with a recently adopted agri-environment programme, and Finland – a country with a more advanced agri-environment programme developed since its accession to the EU in 1995, with up to 94% participation by Finnish farmers (Kuussaari, 2004). The two neighbouring countries share the same general landscape (farmland occupies 25% of land area in Estonia and 30% in southern Finland) and agricultural sector structure (the average farm size is ca 20 ha in both countries, spring barley being the major crop) (Anonymous, 2002). Despite the difference in the political systems during the Soviet rule in Estonia, the history of traditional land-use is similar (Ikonen, 2004).

In Estonia, under the pilot Environmentally Friendly Management Scheme operated in three regions in 2001–2003, farmers were required to prepare a whole farm agri-environment plan, implement crop rotation, leave permanent field margins, divide larger fields with permanent vegetation strips, preserve valuable landscape elements and improve the visual appearance of the farm. Supplementary measures were additional to the above and supported organic farming, preservation of endangered animal breeds, mowing of abandoned fields, management and restoration of semi-natural meadows and pastures, establishment and management of hedges and ponds, and restoration of stone walls. The national Environmentally-Friendly Production Scheme in Estonia was introduced in 2002. It is a simplified version of the pilot scheme giving less attention to biodiversity preservation. The pilot scheme was discontinued in 2004 due to lack of funds available to agri-environment support. In Finland the national agri-environment programme comprises a basic level (directed mainly at water protection and management planning) and a set of more advanced-level support schemes. The latter includes such options as establishment of water-protective belts, better storage of cattle manure, improvement in field drainage, creation of small wetlands, preservation of traditional farming biotopes (mainly grazed meadows), and traditional crop varieties and animal breeds, as well as organic production.

In both countries the current agri-environment policies are designed with only marginal provisions for the conservation of biotic resources. In 2000–2003 only about 12% of Finland's agri-environment budget was spent on special measures truly relevant to biodiversity conservation, and farmers' uptake of most of these options was low (Kuussaari, 2004). In Estonia the situation drastically changed in 2004, when support of nearly all supplementary measures within the pilot programme was discontinued, and only about 6% of available funds were spent on biodiversity-related measures thereafter (Anonymous, 2004, 2005).

This paper addresses a number of specific research questions: (a) What are the links between farmers' interest in wildlife, knowledge of it, attitudes towards it, and willingness to act on its behalf? (b) How do these parameters compare between farmers in the neighbouring countries of Estonia and Finland? (c) Does experience of their countries' agri-environment schemes affect farmers' attitudes to wildlife and wildlife-friendly management?

Material and methods

A semi-structured interview was chosen as the research methodology after a pilot questionnaire sent in 2003 to 100 randomly chosen farmers in Estonia. In Estonia the topic, birds versus farming, was novel and not of a routine kind for farmers. Some assistance from an interviewer was deemed necessary. The somewhat provocative theme of "birds suffering because of agriculture" was regarded as unlikely to evoke a willingness to answer from farmers with a different outlook. The possibility to explore the diversity of views of farmers about biodiversity within their fields – a subject not studied in the region previously – was regarded as a useful by-product of an interview-based study. However, employing an entirely qualitative method based on open in-depth interviews simultaneously in two countries by two different people was regarded as prone to potential bias from the interviewer.

The data were collected in Estonia (autumn 2003, 27 interviews) and south-western Finland (spring 2004, 24 interviews) (Fig. 1). In both countries, the farmers were chosen randomly from those taking part in agri-environment schemes or, in Estonia, also applicants to them. In Estonia these included ten farmers from a county where a pilot agri-environment scheme has been running since 2001, and where farmers have received some training. Two other counties were selected because of the high uptake of agri-environment measures under the national programme. In Finland we randomly selected farms from a county in the south–west of the country. Six of the interviewed farmers in Finland were contracted to a more advanced-level support scheme (referred here as "special agri-environment agreements"). All except six of the farmers, all of whom we initially contacted by telephone, agreed to give an interview (lack of time was the reason for denial in both countries). All interviewed farmers owned their farms.

The interviews were conducted in the local native languages by two different interviewers in

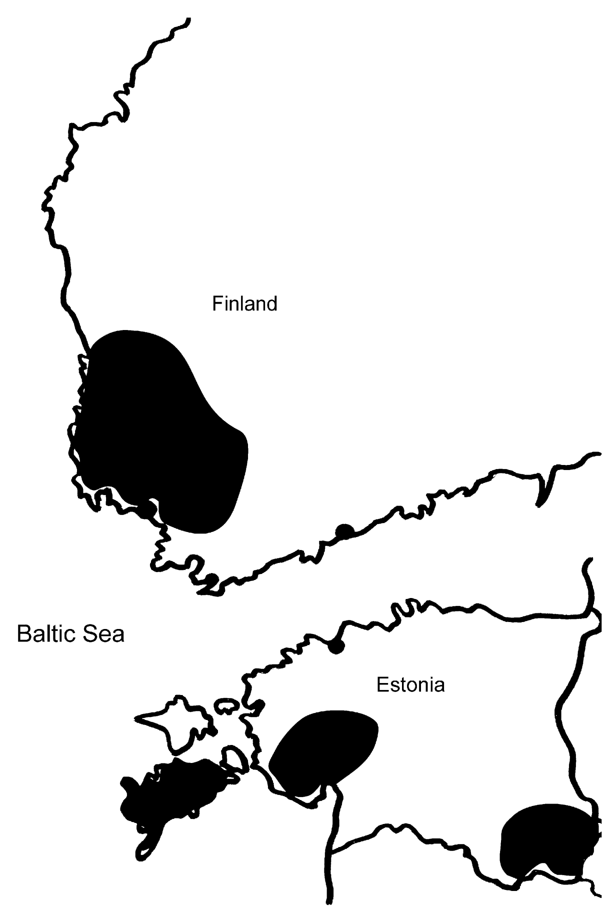

Figure 1. Study areas in Finland (Varsinais Suomi) and Estonia (Saaremaa, Pärnu and Vöru).

Estonia and Finland. To ensure consistency, the interviews were based on exactly the same questions, except that in Estonia farmers were additionally asked about willingness to delay mowing (Appendix A). The interviewer in Finland was trained to conduct the interviews in a way as similar as possible to that done earlier in Estonia. Answers were written down verbatim.

A separate part of the interview was devoted to common farmland birds. Birds are conspicious and farmers regularly interact with them (e.g. through traditions of building nest-boxes or casual destruction of ground nests during farming operations), and farmers are more likely to know the names of bird species than of many other, less conspicuous, animals and plants. Finally, most birds are neither serious agricultural pests nor directly beneficial for farming, and many have distinct cultural roles. This part of the interview was constructed in a more open way, so that farmers could express their own views and attitudes. In order to assess the farmers' knowledge of birds associated with farmland we offered them a list of the 23 commonest species and asked them to name species they knew to be living on their farms. They were then encouraged to add to the list. We also assessed how well the farmers knew the basic habitat requirements of the listed species, especially the main habitat within the farmland with which the species associate, and whether they were observant about changes in farmland bird numbers on their land. As an introduction to the request to name wild species whose disappearance from their farm farmers would feel as a "personal loss", we provided farmers with some facts about recent declines of a few common farmland bird species in western Europe.

In addition to presenting data in the form of a frequency distribution, we used some quantitative analysis to detect associations between variables. The effects of such variables as the country, participation in a special support scheme in Finland or a pilot project in Estonia, farm size and farmers' plans for the future, as well as, wherever appropriate, the farmers' age and educational background, were analysed. Because of the use of ordinal scoring and a generally small sampling size, non-parametric tests were used throughout the analysis (Sokal & Rolf, 1995). Unfortunately, this restricted the ability to control for the effects of other possible variables than that of interest, so one needs to be aware of the danger of spurious significant correlations. Principal component analysis (PCA) was used to rank the farmers according to their interest in wildlife, and their expressed willingness to take action favouring wildlife.

As our methodology involved the use of human subjects, we were aware of the ethical issues surrounding our data collection. At the time of the research neither of our respective institutions required formal ethics approval but as far as possible we paid attention to participant rights and ethical conduct of the research.

Results

Farm structure

A total of 51 farmers, one third of which were women, were interviewed (Table 1). In both countries over 30% of the farmers were in the age range 46–55, and over 60% of them had received special agricultural education. The average size of the sample farms in each country was not significantly different from the average farm sizes within the respective region. In both countries farm area was strongly correlated with farm turnover measured in euros (for each country at Pearson $r > 0.7$). In Finland, the area of farms with special agri-environment agreements was smaller than the others, and only in this group were there farmers whose parents themselves were not farmers. In Estonia, farm turnover in the pilot area was smaller and they contained more grassland than the rest. Farmers were also ranked according to their future plans for their farm enterprise, which reflects a readiness to meet change and adapt, and may affect the readiness to invest in nature-friendly management (Gasson & Potter, 1988). The range was from those thinking of decreasing their farming activity or selling it (13% of Finnish and 41% of Estonian farmers), through those thinking of keeping the same level of production (73% and 52%, respectively), to those planning to enlarge it or add new activities (13% and 7%).

The results are presented separately for each country whenever there are significant differences between them; otherwise the data are pooled.

Interest and knowledge

The farmers expressed their interest in a wildlife taxon either directly as being "*interested*" or "*not interested*", or we inferred it from the farmers' willingness to learn more about species harmful or useful to farming, or about all species. Only very few farmers clearly expressed a lack of interest in wildlife (Fig. 2). Even farmers who did not regard themselves as particularly interested in wildlife (that is, they did not choose an option "I am very

Table 1. Main characteristics (Mean and SE) of the studied farms in Estonia and Finland

	Estonia		Finland		Estonia	Finland
	Pilot area ($n = 10$)	The rest ($n = 17$)	With special agreements ($n = 6$)	The rest ($n = 18$)	All ($n = 27$)	All ($n = 24$)
Area (ha)	27.28 ± 5.94	48.24 ± 9.23	15.03 ± 5.07	35.88 ± 5.87*	39.99 ± 6.43	31.64 ± 4.38
Grassland (ha)	10.52 ± 3.08	4.14 ± 2.37**	1.5 ± 1.12	0.53 ± 0.02	6.11 ± 1.88	0.72 ± 0.31***
Agricultural turnover[a], mean class (€)	<1000	2000–6000*	20,000–30,000	30,000+	1000–2000	20,000–30,000***
Parents being farmers (%)	80	77	50	94*	78	83
Farming experience (yr)	19.47 ± 3.69	13.44 ± 2.35	22.33 ± 3.07	27.6 ± 5.11	17.21 ± 2.5(*)	23.48 ± 2.64

(*) = $P<0.1$, * = $P<0.05$, *** = $P<0.001$, Mann–Whitney tests for the differences between the countries and groups of farms within each country.
[a]Annual agricultural turnover was registered in classes of below 1000, 1000–2000, 2000–6000, 6000–10,000, 10,000–20,000, 20,000–30,000, and above 30,000 euros.

interested") were still willing to learn more. There was a clear difference in the approach towards birds and mammals compared to that towards insects and plants. Most respondents were willing to learn about all species of birds and mammals or considered they knew enough about them, while concerning insects and plants farmers were mostly willing to learn specifically about species useful or harmful to farming (both differences are significant at $P<0.003$, Fisher exact test). The first PCA axis ranking farmers according to their interest in wildlife captured 73% of the variation, thus grading the farmers from very interested in all or most groups to largely indifferent ones (Table 2). In Finland, farmers having special agri-environment agreements showed a higher level of interest in wildlife than the rest ($U = 25.0$, $Z = -1.957$, $P = 0.028$, one-tailed).

Farmers rated their knowledge of mammals and birds as highest, and of insects as lowest of all the species groups (difference significant by Friedman $\chi^2 = 94,522$, $P<0.0001$) (Fig. 3). Though the self-assessed knowledge of a wildlife group was progressively higher according to the level of interest in the respective group, it correlated significantly only for birds in Finland (Spearman $r = 0.593$, $P = 0.002$). The level of knowledge was independent from having a special agri-environment agreement or being from a pilot area. Neither the level of interest nor knowledge was related to the farmers' background characteristics.

Interest in and attitudes to birds

The lists of bird species compiled by farmers for their farms varied from three to 31 species (mean of 15.47). Twenty three farmers listed fewer than 13 species, and 13 farmers more than 20 species. Finnish farmers named significantly more species on their land than Estonian ones (Wilcoxon rank-sum test $Z = -4.696$, $P<0.0001$). The number of species named was positively related to the farmers' level of interest in birds (Kruskal–Wallis $\chi^2 = 7.3673$, df $= 2$, $P = 0.025$), and farmers who clearly stated their interest in the group could name significantly more species additional to the 23 listed than the rest. However, among farmers willing to learn more about the group, actual knowledge varied from limited to very knowledgeable.

All farmers knew the habitat requirements of at least 10 bird species. Bird species whose habitat requirements were most familiar were magpie *Pica pica* L., starling *Sturnus vulgaris* L., lapwing *Vanellus vanellus* L., rook *Corvus frugilegus* L.,

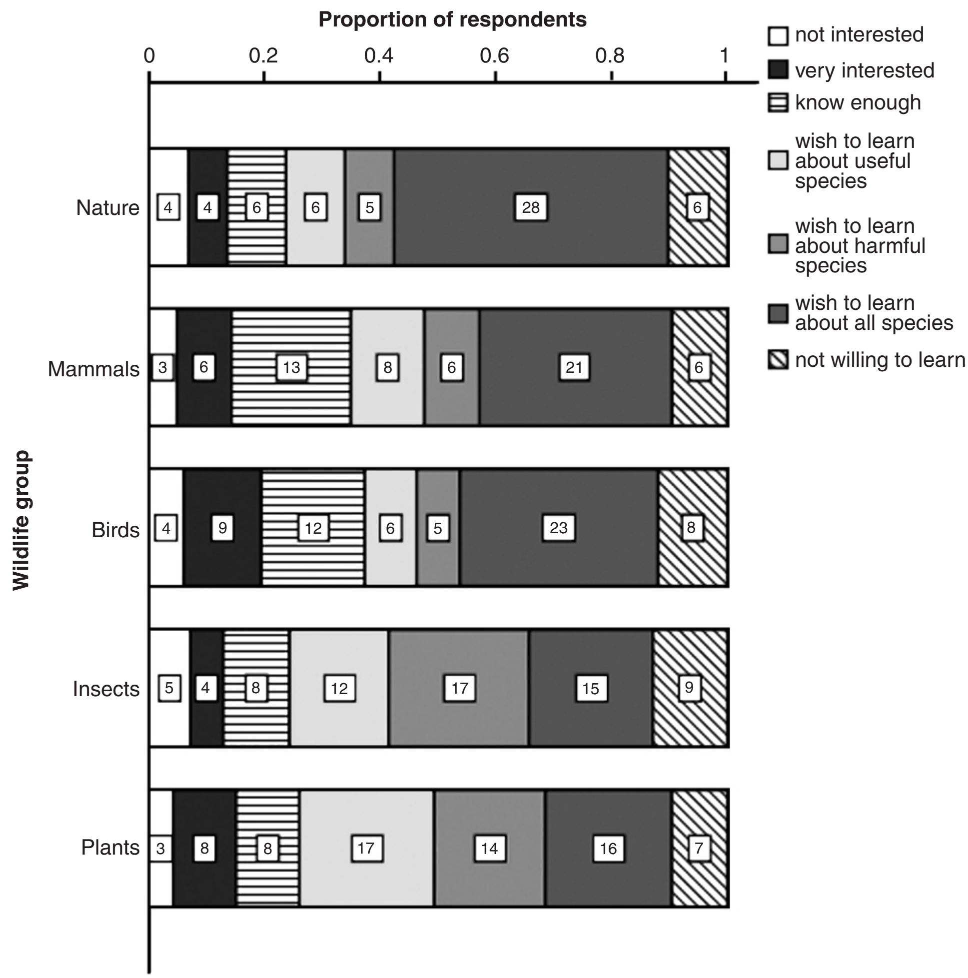

Figure 2. Proportion of farmers in Estonia and Finland who chose suggested answers reflecting their interest in wildlife groups and nature as a whole (figures within the bars represent original numbers, and because of a multiple option answers they do not sum up to the total); $n = 51$.

Table 2. Factor loadings on the principal component axis describing farmers' interest in wildlife taxa and the whole nature

	Axis 1
Interest in plants	0.909
Interest in insects	0.816
Interest in birds	0.905
Interest in mammals	0.874
Interest in nature	0.754

skylark *Alauda arvensis* L., swallow *Hirundo rustica* L., and nightingale *Luscinia luscinia* L. in Estonia, and *H. rustica*, *S. vulgaris*, hooded crow *Corvus corone cornix* L., and *P. pica* in Finland. Least known were: collared dove *Streptopelia decaocto* Friv., linnet *Carduelis cannabina* L., whinchat *Saxicola rubetra* L., partridge *Perdix perdix* L., roller *Coracias garrulous* L., curlew *Numenius arquata* L., and kestrel *Falco tinnunculus* L. in Estonia; and *C. cannabina*, corncrake *Crex crex* L., *F. tinnunculus*, and tree sparrow *Passer montanus* L. in Finland. Among the least known species most are either uncommon or have been declining in recent decades. The number of species for which habitat requirements were known was positively related to the self-assessed knowledge (Kruskal–Wallis $\chi^2 = 6.4239$, df $= 2$, $P = 0.04$). Knowledge of farmland birds correlated well with how observant farmers were about the bird population changes in the recent decades (correlation between bird species known to farmers and the named number of declining or increasing species was significant at $P = 0.004$, Pearson $r = 0.398$).

Farmers were asked how they felt about birds living on farmland. In over half of the cases the response was clearly positive including such answers as "*I enjoy bird songs in spring*", "*they evoke joy and curiosity*", or "*bring me pleasure*". Only four respondents were predominantly negative in their response ("*birds bring too much*

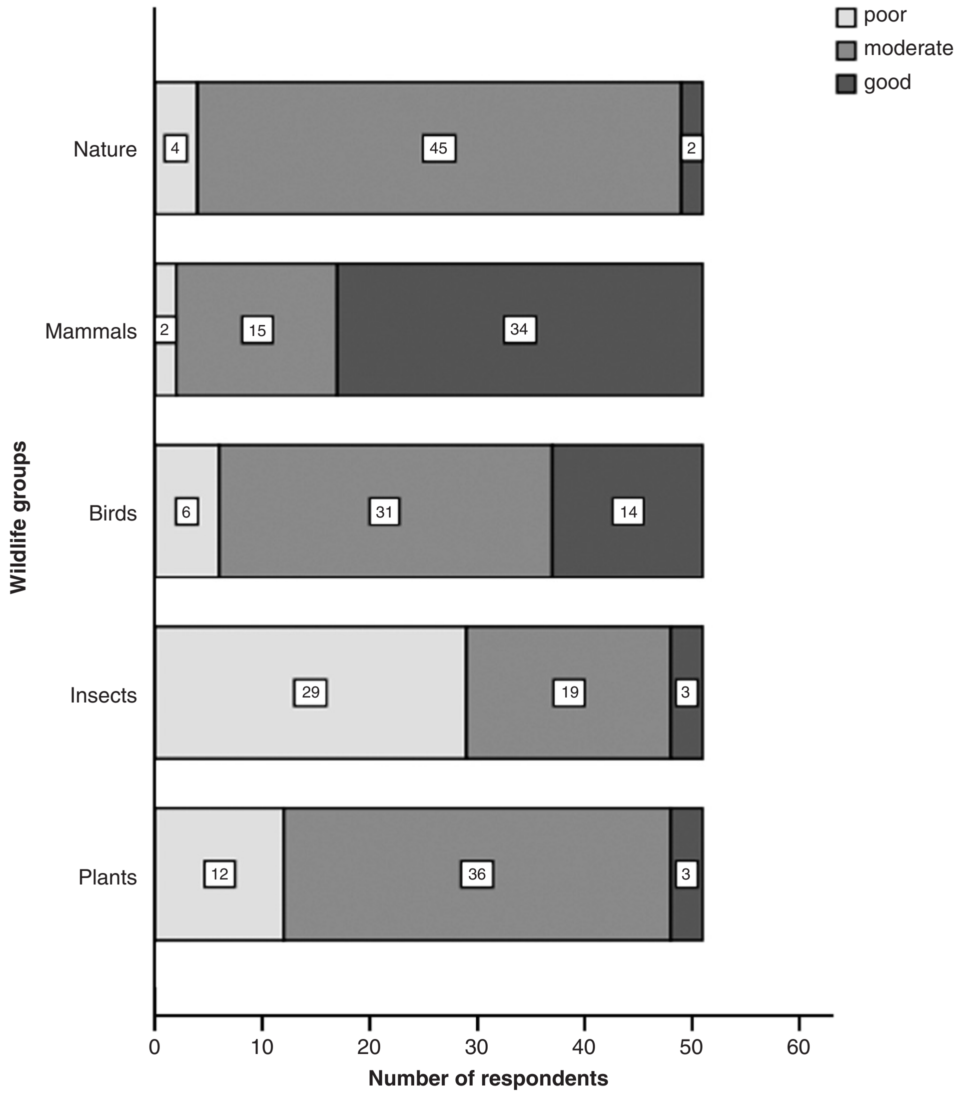

Figure 3. Level of knowledge of wildlife groups and nature as a whole as self-assessed by farmers in Estonia and Finland; $n = 51$.

harm''). However, some farmers, though generally positive, were also angry at some species they regarded as harmful either to farming (thrushes *Turdidae*, flocks of cranes *Grus grus* L. and geese *Anseridae*) or other birds (*P. pica*, *C. corone cornix*). There was no difference between the countries, though in Estonia more negative responses came from the pilot area, which is an island where migrating geese and cranes are common. Farmers most knowledgeable about birds were also more positive about them than the rest (Kruskal–Wallis $\chi^2 = 3.935$, df $= 2$, $P = 0.047$).

Farmers were encouraged to name wild species whose disappearance from their farm they would feel as a ''personal loss''. For Estonian farmers the question appeared difficult to answer and about 40% did not answer it at all. A further 20% of Estonians said no species would be for them a personal loss, and only 40% disliked wildlife species disappearing in general and would miss some (examples named were: hare (*Lepus europeus* L.), moose (*Alces alces* L.), *H. rustica*, *A. arvensis*, *S. vulgaris*, and black grouse *Tetrao tetrix* L.). Contrasting with this, as many as 74% of the Finnish farmers felt strongly about the potential disappearance of wildlife species on their farms, while the rest could not answer the question (the difference between the countries is significant at $P = 0.014$, $U = 207$, 5, $Z = -2464$). Only one Finnish farmer answered that ''*the world is changing all the time, and why should I worry*''. Most Finnish farmers could also provide examples of species particularly close to them; 64% of these were birds, 16% plants, 16% mammals, and 7% invertebrates. *S. vulgaris, H. rustica*, *Delichon urbica* L., *V. vanellus*, *Numenius arquata* L., and

P. perdix dominated the answers, that is, all common farmland birds, which have been strongly declining or already disappeared from some of the Finnish countryside (BirdLife International, 2004).

The biodiversity concept

We asked farmers to include into the biodiversity concept various aspects they regarded as relevant. Two farmers included only crop variety, four farmers included only wild species outside the fields, and one farmer could not answer the question. Most of the interviewed farmers included several aspects of biotic variety (Table 3). We gave each farmer a score according to how inclusive was his/her outlook on biodiversity (Fig. 4). Over 20% of the interviewed farmers, especially in Estonia, viewed biodiversity in a narrow way, limiting it to only the variety of crops and wild species outside the crops. The perception of wild species diversity was most relevant to the farmers, while diversity of ecosystems and genes was less so. Perceptions of species diversity were not uniform; e.g., farmers' treatment of wild species in and outside the field, and pests and weeds and other species, was different. Most farmers avoided explicit inclusion of pests and weeds into the "biodiversity" concept. The differences between the countries were not significant (Table 3). The score was not related to the experience with agri-environment schemes or to the expressed interest in wildlife. During the interviews it became obvious that farmers in both countries preferred the term "*natural diversity*" in their native languages to the scientific term of "*biodiversity*".

Farmers' understanding of the impact of their enterprise on farmland birds

When asked to rank a list of possible factors behind the declines of farmland birds, all the factors pertaining to farming were rated much higher than the others (Table 4). They were also rated in a similar way, that is, farmers who considered intensification as an important factor tended to consider the rest of the farming-related factors to be also important. Four farmers in Estonia considered land abandonment as having a positive effect on farmland bird life.

Farmers in Finland rated afforestation, an increase of predators, land abandonment, agricultural intensification, and loss of crop diversity as having a significantly stronger effect than farmers in Estonia (Table 4). Only the impact of pesticides was rated significantly higher by Finnish farmers with special agri-environment agreements (Mann–Whitney tests, all $P<0.044$), among whom were

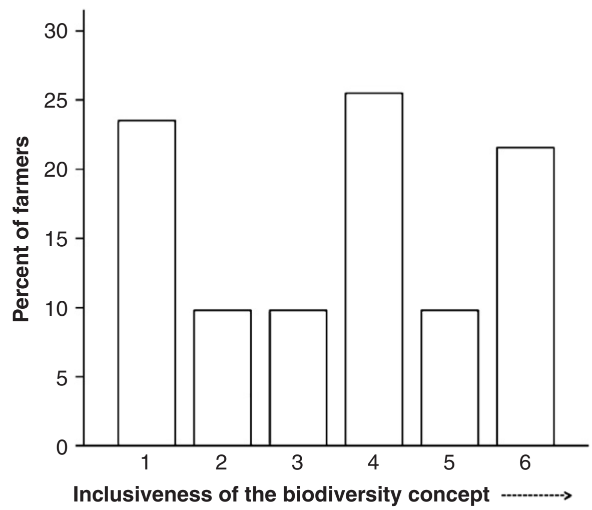

Figure 4. Percent of farmers whose perception of biodiversity concept includes several aspects of biotic diversity, grouped as: 1 – only those farmers who included crop varieties or wild species outside fields, or only habitat variety, 2 – crops or habitat and also wild species outside fields, 3 – wild species of all farm, 4 – crops or habitat and also all wild species of the farm, 5 – crops and habitats, and all wild species of the farm, and 6 – same as above but includes also pests and weeds; $n=51$.

Table 3. Number of respondents and, in brackets, percent from the total for the respective country who included a particular aspect of biotic variety into a concept of "biodiversity"

	Estonia	Finland	Total
Variety of crops and domestic animals on the farm	11 (41)	14 (58)	25 (44)
Wild species (plants, insects, birds) on the whole farm	14 (52)	16 (67)	30 (53)
Wild species only outside the fields, not within the crop	5 (19)	2 (8)	7 (12)
All species of the farm, including weeds and pests (*)	7 (26)	12 (50)	19 (33)
Variety of all farmed and non-farmed patches on the farm	14 (52)	10 (42)	24 (47)
Combined score, mean and SE (*)	3.04 ± 0.39	4.04 ± 0.33	3.51 ± 0.26

The combined score reflects how inclusively the concept is perceived.
(*) $=P<0.1$, Mann–Whitney test for the difference between the countries.

Table 4. Percent of farmers who regarded the suggested factors as having moderate or strong negative effect on the populations of farmland birds

	All ($n = 51$)	Estonia ($n = 27$)	Finland ($n = 24$)
Wide use of pesticides (%)	65	67	63
Farming intensification and specialisation (%)*	63	52	75
Loss of crop diversity (%)**	59	41	80
Increase of predators (%)**	53	37	71
Land abandonment (%)*	43	33	54
Climate change (%)	39	44	33
Afforestation (%)*	26	19	34
Hunting (%)	24	19	29

*$P<0.05$, **$P<0.01$, Mann–Whitney test for the difference between the countries.

three organic farmers with a highly critical view on the use of pesticides.

Willingness to take action

When provided with a hypothetical choice of measures to support farmland birdlife, all farmers expressed interest in adopting at least one (Fig. 5). Most farmers were willing to continue without monetary compensation with such low-cost and, above all, traditional measures of supporting birdlife as winter feeding and putting up nestboxes. Avoiding the destruction of ground nests was also not regarded as needing additional payments and indeed is practiced by many, especially small-scale farmers, who comprise the majority in both countries. However, farmers mostly required reimbursement for changes in the farm-area structure such as planting of hedges as well as modifications in customary farming practices such as reducing chemical applications. These measures also gained least interest in uptake.

Estonian farmers were highly positive about delaying mowing on both semi-natural and sown grasslands. On the semi-natural grasslands all farmers would agree to delay mowing until after the 1st of July, half of them even without compensation, and 90% until after the 15th of July, mostly with costs reimbursed at least partly. On sown grasslands 94% of the farmers would agree to mow after the 1st of July, nearly half of them agreeing to do so without cost reimbursement, and 90% after the 15th of July, but nearly all with costs reimbursed at least partly.

We graded the farmers according to their willingness to take up the suggested measures from full reimbursement of expenses to none. When we conducted PCA with all variables except country-specific mowing, the two first PCA axes explained 58.5% of the variation (Table 5). The larger scoring a farmer gets along a PCA factor, the more willing and generous he/she is towards most of the measures. The first axis, and so willingness to adopt most of the measures even without full reimbursement of the costs, positively correlated with farmers' interest in wildlife, as summarised by the first axis of interest in wildlife groups (Table 3) ($r_s = 0.439$, $P = 0.001$). The second axis had no strong associations with variables of interest. Estonian farmers were ranked significantly higher on the 1st axis than their Finnish counterparts ($U = 178.5$, $Z = -2.746$, $P = 0.006$), and so were more willing to adopt the suggested measures (Fig. 6). Finnish farmers with special agri-environment agreements scored significantly higher on the 1st axis than the rest ($U = 14.0$, $Z = -2.667$, $P = 0.008$). We could not find any relation between interest in adopting wildlife-friendly management and knowledge of it or any background variables. Only positive attitude towards birds was related to the willingness to employ some wildlife-friendly management (to supply nest boxes, reduce chemical applications, and leave unsprayed crop margins, respective statistics: $r_s = 0.406$, $P = 0.003$; $r_s = 0.322$, $P = 0.021$; and $r_s = 0.319$, $P = 0.023$).

All but three farmers expressed interest in preserving and enhancing habitat variety for wildlife on their farms. They were particularly willing to preserve and maintain wide margins, tree groups, old trees, areas of shrubs, and semi-natural grasslands. The last-named enjoyed an especially high level of interest with the farmers from the pilot area in Estonia, where this habitat is relatively abundant and valued by rural people (Kaur, Palang, & Sooväli, 2004). The majority regarded groups of trees and semi-natural grasslands as being especially valuable for wildlife (69% of farmers chose either or both), which generally reflects a good understanding of the habitat needs of many of the region's farmland species. Farmers who regarded these habitats as valuable for wildlife were also

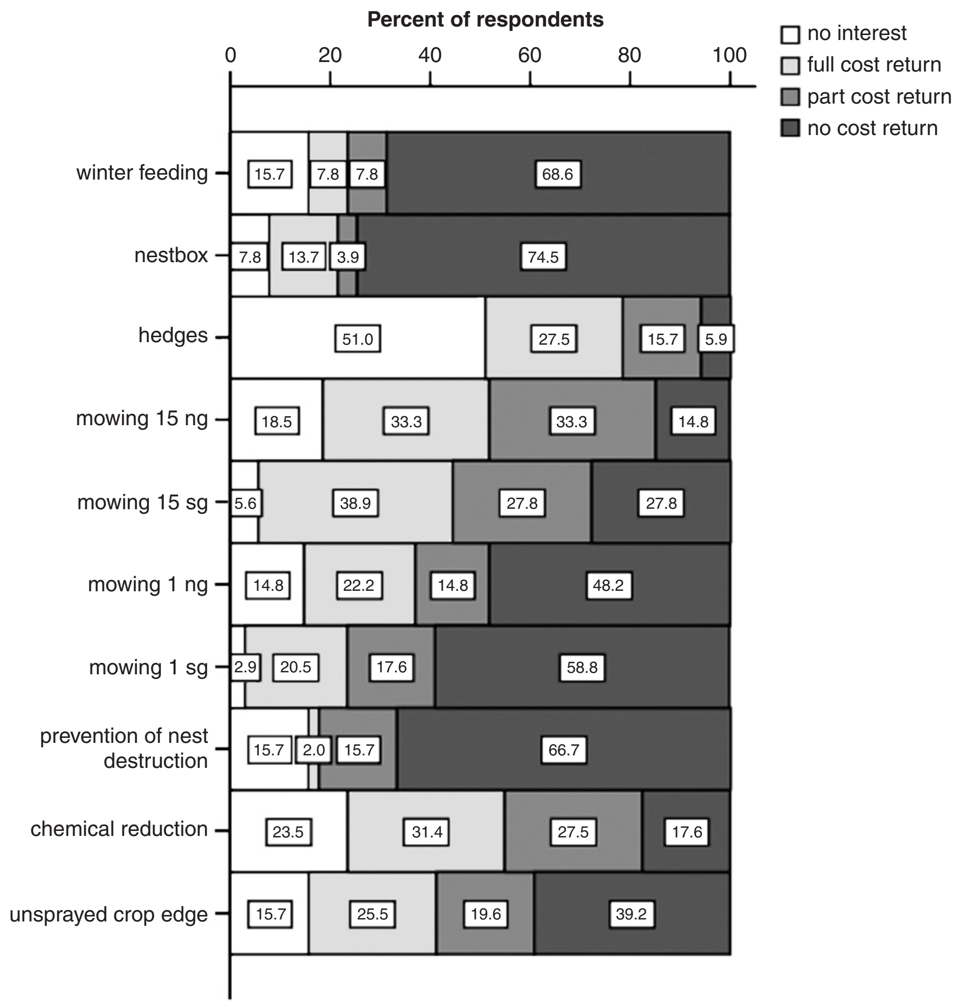

Figure 5. Willingness of farmers in Estonia and Finland to employ wildlife-friendly measures with full coverage of costs of both expenses and time, with partly paid costs of only real expenses such as petrol, without any costs returned, as well as no interest in employing them. "Mowing 15 ng" refers to delay of mowing until after the 15th of July on semi-natural grassland; "mowing 15 sg" – same on sown grassland; "mowing 1 ng" – until after the 1st of July on semi-natural grassland; and "mowing 1 sg" – on sown grassland. $n = 51$.

Table 5. Factor loadings on the principal component axis describing farmers' willingness to adopt measures supporting farmland wildlife

	Axis 1	Axis 2
Leaving unsprayed crop edges	0.765	−0.122
Limiting applications of fertilisers and pesticides	0.816	−0.066
Planting hedges or tree groups	0.372	−0.551
Putting up nest boxes	0.712	0.060
Providing feed to birds and mammals in winter	0.663	0.334
Avoiding mechanical destruction of the nests in crops	0.104	0.850

willing to preserve or restore them on their farms more often than the other farmers ($r_s = 0.386$, $P = 0.05$ and $r_s = 0.491$, $P = 0.0001$).

The more interest a farmer expressed in wildlife, the more habitat types he was willing to preserve or establish (respective $r_s = 0.447$, $P = 0.001$ and $r_s = 0.368$, $P = 0.008$). Both willingness to preserve and establish were significantly higher in Estonia ($U = 153.0$, $Z = -3.273$, $P = 0.001$ and accordingly $U = 139.5$, $Z = -3.84$, $P = 0.0001$). In Finland the

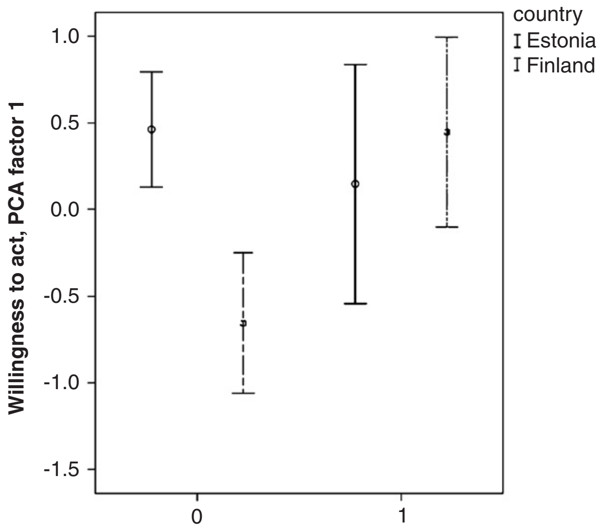

Figure 6. Farmers' willingness to employ wildlife-friendly management as summarised in the 1st PCA axis from all suggested management options in Estonia ($n = 27$, class 1 refers to 10 farmers from the pilot area), and Finland ($n = 24$, class 1 refers to six farmers with special agri-environment agreements).

number of elements farmers were willing to establish positively related to their plans to enlarge the farm enterprise ($r_s = 0.323$, $P = 0.021$), which may indicate that farmers who were more confident in continuing farming are more willing to make long-term investments in creating new non-cropped patches on their land.

To the question of whether they considered biodiversity preservation/enhancement as an important activity on their farm, 35% of the respondents answered positively, 47% said it was somewhat important, 4% not important, and 14% could not answer. The results were positively influenced if the farmer had a special agri-environment agreement in Finland or was from the pilot area in Estonia (Mann–Whitney $U = 121.0$, $Z = -3.502$, $P < 0.001$).

However, when later during the interview we asked farmers to give some examples of practical biodiversity enhancement measures they had been doing so far, as many as 30% of farmers failed to name any such activity, even those ones who claimed that this work has been important on their farm. The activities named in both countries were mainly the measures supported under the respective national agri-environment schemes: grazing on semi-natural meadows, creating ponds, keeping landscape open, planting trees or bushes, or practicing organic farming. In Estonia farmers who expected to be mostly paid for wildlife-friendly management came up with fewer activities ($r_s = 0.574$, $P = 0.002$).

Discussion

Our results confirmed that farmers' comprehension of the "biodiversity" concept was largely restricted to the realm of wild nature outside the fields, with weeds and pests often not accepted into the concept. Some other studies similarly showed that farmers' notion of "biodiversity" differs from academic definitions and may be very narrow (Beedell & Rehman, 1999; Jurt, 2003; Moore & Renton, 2002). This may impair the acceptance of schemes targeted at biodiversity conservation. Indeed, a review by Knierim et al. (2003) revealed that more opposition and resistance among farmers in Finland, Germany and France were shown specifically towards biodiversity protection as compared to general agri-environment measures. This is possibly because it is easier for farmers to incorporate the latter as part of their overall agronomical practice, while practical implementation of biodiversity conservation may be vague to those who most interact with it (Kaljonen, 2002).

In this context, farmers' attitude towards additional conservation-related work on farmland should not be undervalued. As Kleijn and Sutherland (2003) suggested, agri-environment schemes work best if farmers do things they feel positive about, rather than just working for financial reward. More demanding conservation-oriented agri-environment schemes may work better if linked explicitly to the support of specific species, which farmers themselves know well and feel positive about, rather than to the abstract concept of "biodiversity". Examples in Europe may include special management options for *C. crex* in several countries (Aebischer, Green, & Evans, 2000), *A. arvensis* or cirl bunting *Emberiza cirlus* L. in the UK (Morris, Holland, Smith, & Jones, 2004; Peach, Lovett, Wotton, & Jeffs, 2001), and *V. vanellus*, redshank *Tringa tetanus L.* and bar-tailed godwit *Limosa limosa* L. in the Netherlands (Musters et al., 2001). These species, the decline of which was considered as a "personal loss" in our study, may become potential candidates for similar schemes in Finland and Estonia.

There did not appear to be a link between knowledge of wildlife and any form of contingent or actual action, which is in agreement with Jacobson et al. (2003). It was instead the expressed interest in wildlife and nature which throughout the analysis positively correlated with willingness to act. Thus it is of utmost importance to promote and support the interest of rural populations in the "living creatures out there". The potential to develop farmers' knowledge of wildlife on their farms, based on their own interest, is vast. Only in Finland with its long established traditions of birdwatching and local clubs actively communicating information about birds to the general population, was farmers' interest in and knowledge of birds correlated. Kellert (1993) confirmed that farmers express mostly aversion to invertebrates, and are largely ignorant about the group.

A discussion about a specific wildlife taxon – birds – revealed that farmers who were most knowledgeable about birds were also all positive towards them. Feeling predominantly positive about the birds was related to the farmers' willingness to employ some bird-friendly management options. Knowledge also contributed to being more observant about changes in species occurrence and abundance on the farm. The decline in conspicuous and well-known species was disconcerting to farmers. The feeling of loss, however, did not generally extend to less conspicuous species, with which the farmers shared their space but were not part and parcel of their everyday lives.

The farmers were predominantly aware of the (potential) adverse impact of their farming enterprises on farmland wildlife, which is different from farmers' denial of the wider environmental impact of farming, such as pollution (Pyrovetsi & Daoutopoulos, 1999). Our results are comparable with a recent study in the UK (Kynetec, 2003), in which factors related to farming intensification were suggested by farmers as the most likely reasons attributed to bird declines. There remains a large proportion of farmers, though, who seem to be still unaware about the effects of their own enterprise on wildlife. Predation was ranked high in our study and got the highest rank in the UK study (Kynetec, 2003). There are indications that predation becomes a serious problem only in combination with farming-related causes such as changes in the landscape or crop structure (Evans, 2004). Farmers need to be better informed about this additional link to the impact of their farming enterprise.

Estonian farmers were less critical about some of the intensification-related factors and were less clear about potential losses in farmland wildlife than Finnish farmers. This points to the need for better strategies to raise awareness about this undesirable by-product of intensifying production before it actually happens. The understanding of the consequences, as well as acceptance that solutions by and large also rest with them, might promote farmers' interest in agri-environment schemes aimed at conservation. Positive publicity is crucial here since conservation is for farmers more an issue of values and emotional concern than, for example, pollution prevention (Smallshire, Robertson, & Thompson, 2004).

Estonian farmers showed greater enthusiasm in adopting some wildlife-friendly management options and preserving diversity of non-cropped patches within their farms, which is known to be important for supporting farmland species diversity (Benton, Vickery, & Wilson, 2003). It may partly reflect the fact that farmers in Estonia who applied to the newly introduced agri-environment support programme were more enthusiastic and innovative than the average farmer in the country. The near total enrolment into the Finnish agri-environment programme cannot be regarded as an indicator of the programme's efficiency in addressing conservation needs. We could not find indications that the programme, though in use since 1995, has added to farmers' understanding of farmland biodiversity or practical measures to enhance it. A better incorporation of conservation-oriented options into the basic level schemes is clearly needed as suggested also by the programme evaluation (Kuussaari, 2004).

Our finding about farmers' willingness to participate in wildlife-friendly management in Estonia is a good sign for the schemes' potential in the region. Even a demanding option such as postponing mowing, the most important in protecting the globally endangered corncrake (Green, Tyler, Stowe, & Newton, 1997), might have an uptake if financial loss in terms of poorer quality fodder is reimbursed. Development of a zonal support scheme similar to that of environmentally sensitive areas (ESA) in some European countries (Kleijn & Sutherland, 2003), under which traditional agricultural systems are supported to prevent loss or modification of semi-natural habitats, may be feasible for Estonia in areas of generally extensive farming and abundant semi-natural grasslands. Once they are lost, the restoration of diversity on intensive grasslands is expensive and difficult (Kleijn et al., 2004).

Of course, willingness to act cannot be viewed as action itself. It only reflects certain specific behavioural tendencies in relation to the attitudinal object, i.e. a "readiness to act". Some studies demonstrated weak relation of farmers' attitudes or willingness to act to actually carrying out the action itself (Carr & Tait, 1990; Wossink & van Wenum, 2003). When motivation (or willingness to act) faces constraints to acting, whether lack of resources, social acceptance, or practical skills, it may not get realised into action. Farmers' experience with agri-environment schemes is an important learning tool here. Not surprisingly, farmers in both countries who could name some biodiversity-benign practices, quoted almost exclusively management options supported under the respective agri-environment programmes as the ways to enhance biodiversity. It stresses the importance of including the most effective measures into the support schemes, delivering sufficient advice (see also Bradbury, Browne, Stevens, & Aebischer, 2004; Smallshire et al., 2004), and facilitating positive feedback. Sufficient funding to cover the incurred costs and income loss is another imperative in order to make agri-environment participation competitive with intensification of production or afforestation (Eden, 2004; Genghini, Spalatro, & Gellini, 2002).

Conclusions

In this study we revisited the relationship between farmers' interest in wildlife, knowledge and attitudes towards it, and willingness to act on its behalf, showing that this interest was related to the willingness to take wildlife into account in farming operations. The most pronounced difference between the farmers in Estonia and Finland was in their understanding of the potentially adverse impact of farming on wildlife, and the level of awareness of the losses in typical farmland species. Farmers' experiences with agri-environment schemes could be linked to their willingness to manage for wildlife, and was reflected in their knowledge of management options.

Our results indicate that (a) biodiversity related measures of the national agri-environment scheme in Estonia should be reinstated and should be better incorporated into the basic level schemes in Finland, (b) farmers' interest in wildlife should be encouraged, and their understanding of different aspects of biotic diversity increased in order to enhance their acceptance of biodiversity conservation within farmland, (c) awareness work about possible severe declines in farmland wildlife in connection with agricultural intensification is important, especially in the CEE region, (d) sufficient demonstration and advisory work is invaluable in putting conservation into practice, (e) and, finally, positive feedback from society, not only in financial terms, to farmers' work for biodiversity is needed.

The limitation of this study is that it is exclusively based on interviews with farmers already participating in or applying for agri-environment schemes. Being aware of the recent critique of behaviour studies (Rob & Burton, 2004), we also acknowledge the lack of attention here to other important social and cultural factors influencing farmers' decision-making, which are identified within the conceptual framework of the theory of planned behaviour (Ajzen, 1991). Further research, especially involving farmers both participating and not participating in the newly established agri-environment schemes in the CEE region, and including qualitative assessment of the social and cultural background, is needed to develop effective biodiversity-related measures in the region, and to win farmers' support. We were encouraged to find that farmers were predominantly positive about the topic: 82% of them expressed a high interest in the subject.

Acknowledgements

We thank Kimmo Härjämäki and Argo Peepson for conducting fieldwork, Natalia Gerzon and Minna Kaljonen for professional advice in sociology, Paul Donald and Juha Helenius for encouragement and valuable comments, and Marcus Walsh for revising English language. The manuscript improved greatly from advice of an anonymous referee and the editor's help. The Ella and Georg Ehrnrooth Foundation, Finland, supported the study financially.

Appendix A. Questionnaire questions and multiple choice answers used in the study

Question	Answer
(1) What would you regard as part of "biodiversity" of your farm? (may choose several answers)	Variety of crops and domestic animal breeds Wild species only outside the fields (not within the crop) Wild species on the whole farm All species of the farm, including weeds Variety of all farmed and non-farmed patches within your farm
(2) How would you assess your personal knowledge of the following groups: wild plants/insects/birds/mammals/whole nature?	Poor/Moderate/Good

(3) How would you assess your personal level of interest in the above groups? (may choose several answers)	I am very interested in the group Not interested at all I would like to know more about the group I would like to know more about useful species I would like to learn more about harmful species I know already enough
(4) Has biodiversity preserving/enhancing been important in your farm?	Yes/Somewhat/No
(5) What bird species have you noticed on your farmland?	A list of 23 common species was given
(6) Can you name the habitats they are connected?	As above
(7) What kind of feelings do birds evoke?	Possible answers suggested as: they are useful to me, pleasure, curiosity, indifference, nuisance, annoyance, something else
(8) How would you assess changes in bird numbers and presence on your farm in the last 10 years? What species have declined or increased?	
(9) Would disappearance of some species from your farm be experienced as "personal" loss?	
(10) How would you order the following factors, which could negatively affect farmland birds?	Afforestation/ Increase of predators/Hunting/ Climate change/Land abandonment/Wide use of pesticides/Farming intensification and specialisation/Loss of crop diversity/Something else (four point score: no influence – major influence)
(11) Is there any "piece of nature" (non-cropped habitat) on your farm, which you would like to preserve or establish?	Hedge/ Shrubbery/Tree groups and forest patches/Alley/Old tree/Wide margins around fields/Semi-natural grassland/Stone wall/Stone heap/Pond or wetland/Something else
(12) Which of the above do you think are most important for preserving wild species?	
(13) Could you name any activities beneficial to wildlife you have been carrying out on your farm?	
(14) Which of the following and to what extent would you be willing to undertake on your farm to help wild plants and animals to survive?	Leave unsprayed crop edges/Limit applications of fertilisers and pesticides/Avoid mechanical destruction of the nests in crops/Mowing after the 1st July on sown grasslands/Mowing after the 1st July on natural grasslands/Mowing after the 15th July on sown grasslands/Mowing after the 15th July on natural grasslands/Planting hedges, tree groups/Putting up nest boxes/Providing feed to birds and mammals in winter Scored along the grade: No interest in doing/Only with full coverage of costs of both expenses and time/With partly paid costs of only real expenses such as petrol/Even without support
(15) Was the topic interesting to you?	Yes/No

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