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Research Article

Farmers' Interest in Nature and Its Relation to Biodiversity in Arable Fields

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Biodiversity declines in farmland have been attributed to intensification of farming at the field level and loss of heterogeneity at the landscape level. However, farmers are not solely optimizing production; their actions are also influenced by social factors, tradition and interest in nature, which indirectly influence biodiversity but rarely are incorporated in studies of farmland biodiversity. We used social science methods to quantify farmers' interest in nature on 16 farms with winter wheat fields in central Sweden, and combined this with biodiversity inventories of five organism groups (weeds, carabid beetles, bumblebees, solitary bees, and birds) and estimates of landscape composition and management intensity at the field level. Agricultural intensity, measured as crop density, and farmers' interest in nature explained variation in biodiversity, measured as the proportion of the regional species richness found on single fields. Interest in nature seemed to incorporate many actions taken by farmers and appeared to be influenced by both physical factors, for example, the surrounding landscape, and social factors, for example, social motivations. This study indicates that conservation of biodiversity in farmland, and design of new agri-environmental subsidy systems, would profit from taking farmers' interest in nature and its relation to agricultural practices into account.

1. Introduction

It is widely recognized that biodiversity in European farmland is declining [1–6]. This has been attributed to agricultural intensification at farm and landscape scales and loss of both crop and noncrop heterogeneity [5, 7–11]. To counteract these negative effects and to give farmers incentives to adopt environmental and nature friendly practices, agri-environmental schemes (AESs) have been established within EU. However, the effect of AES on biodiversity has in many cases been restricted [12–14]. It is also argued that AES fails to change farmers' attitudes to nature and the environment [15, 16].

There are many studies focusing on either farmland biodiversity or farmer attitudes (which will ultimately affect biodiversity), but the combination of the two remains rare (notable exceptions are, e.g., [17–20]). Studies of local ecological knowledge and traditional ecological knowledge highlight the role of farmers, that is, how farming practices are related to the ecosystem dynamics, how they interpret and respond to changes in ecosystems, and the resources that ecosystems provide [21, 22]. The decision making process of farmers regarding farm management is complex and depends on, for example, available markets, age of the farmer, education, family conditions, size of the farm, ownership of the farm, social norms, and attitudes to nature and nature conservation [23–29]. These factors should be considered to understand the effect of farming on biodiversity [25, 30–33]. Thus, the understanding of the factors affecting farmland biodiversity requires knowledge of ecological factors in combination with an understanding of farmers' motivations and their attitudes to nature.

In the present paper, we suggest a way to convert qualitative interview information to a semicontinuous variable that can be included in statistical analyses. Attitudes of farmers to nature are operationalised as *interest in nature*. In Swedish, "naturintresse" (*interest in nature*) is a commonly used everyday term. Farmers' *interest in nature* is here defined "by the extent of interest in nature, what farmers know and how they talk about and have feelings for nature" [34]. *Interest in nature* manifests itself in, for example, walks in the forest as well as in detailed knowledge about, for example, birds or bumblebees.

Farm management has been shown to have strong effects on biodiversity [35]. Farm management is influenced by factors such as economy and social norms, but potentially also by famers' relation to, knowledge about, and interest in nature. Here, we investigate if farmers' *interest in nature* is positively related to farmland biodiversity by using an *interdisciplinary* approach, by combining social science interview techniques and ecological field studies. We studied species richness and abundance of vascular plants, carabids, bumblebees, solitary bees and wasps, and birds, in 16 winter wheat fields on farms in south-central Sweden and interviewed the sixteen farmers of these fields about farming, nature, and nature conservation in order to interpret their *interest in nature*.

2. Methods

2.1. The Studied Farms. The 16 farms were situated in a landscape gradient in the county of Uppland in south-central Sweden. Eight of the farms were situated in an intensively managed agricultural area close to the city of Uppsala (59°50′N, 17°38′E). The other eight farms were situated in the mixed (forest-farmland) landscape close to the small town of Heby (59°56′N, 16°51′E), 50 km west of Uppsala. The two areas are situated adjacent to each other and mainly differed in the proportion of forest and farmland at the landscape scale (56% forest in Heby and 30% in Uppsala at the 2400 m radius scale).

The farm sizes varied from 34 to 600 ha, and the main production on the farms ranged from conventional piglet production to organic dairy production and from intensive cereal production to part-time farming with some cereal production. However, all farms grew winter wheat during the growing season of 2004. Winter wheat is the most common cereal crop in Sweden [36]. Winter wheat is regarded to hold a low biodiversity [37, 38], and it can be considered to represent baseline diversity with respect to the crops occurring in the region. The studied farms were selected by suggestions of the local chairman of the Federation of Swedish Farmers (LRF) in the two regions. In one of the areas (Uppsala), we did not receive enough suggested farmers, and therefore we asked the farmers we had visited for further suitable farms. We are aware, however, that our respondents might not represent the typical Swedish farmer, because of the fact that they agreed to collaborate in a study of farmland biodiversity. We consider this selection as randomized with respect to the location of the farm in the respective landscape and the production type and intensity of the farm. Still, our primary aim here is to study whether *interest in nature* has an effect on farmland biodiversity, not to make any generalizations for Swedish farmers in general.

2.2. Habitat Mapping. The landscape in which each winter wheat field was located was analyzed with ArcGIS 9.1 (ESRI) using (a) the terrain map (vector map) from the Swedish Land Surveying Authority and (b) the map of subsidized agricultural fields (given in field parcels) and the corresponding crop data from the Swedish Board of Agriculture. The GIS analysis was done within circles with different radii (300-600-1200-2400 m), but only data from 300 m was used in the statistical analysis due to the strong correlation between variables at the different scales (all P values < 0.06). All parameters that initially were measured are presented in Table 2. We subsequently reduced the number of variables in the final analyses (see below).

2.3. Biological Inventories. On every farm, the largest winter wheat field was chosen as the study field. On two farms, the second largest field had to be chosen because the largest fields were inaccessible. The size of the fields ranged from 1.5 to 60 ha. Species richness and abundance of the different organism groups were recorded in these 16 fields and at the field border. Inventories of bumblebees and birds were only conducted under good weather conditions.

Crop density (measured as per cent cover of the crop in 0.25 m^2 squares) was recorded in the same squares as the weeds (see below) during the period 25 May–4 June. Crop density is here considered a measure of farming intensity (the selected fields had good growing conditions), and it correlates with other measures of agricultural intensification, for example, yield ($r = 0.52$) and N-fertilisation ($r = 0.56$) [39].

Species richness and number of individuals of vascular plants (weeds) were recorded in seven 0.25 m^2 squares evenly distributed along a transect, from two meters from the field border to the centre of the field. No significant correlation between species richness and transect length was found in the data ($r = -0.15$ $P = 0.59$). All plants were determined to species level twice during the growing season (25 May–4 June and 20 July–5 August 2004).

Carabid beetles (determined to species level) were sampled using three pitfall traps [40]; one placed 2 m from the field border, one in the centre of the field, and one half-way between these two points. The pitfall traps were placed in the field from mid-May (17–19 May) until 30 July–5 August, and during that time they were emptied 5-6 times at regular intervals. The mid-July collection was not possible to use because the traps were totally filled with rainwater. No significant correlation between species richness in the centre of the field and distance between the border and the centre of the field was detected ($r = -0.37$ $P = 0.15$).

Bumblebees were recorded in early June and late July along a transect from the border to the centre of the field and one equally long transect along the border of the field (transect length 45–300 m). Transects were censused in normal walking pace, and all bumblebees within 3 m were recorded [41]. In cases where direct species identification was not possible, the individuals were caught and determined to species either in the field or in the lab. The transect length, that is, the sampling intensity for censuses of bumblebees, was positively related to field size which could have affected the results. Therefore, as a complement to the original species richness estimates, an individual-based rarefaction analysis [42] of the bumblebee species richness (estimating number of species after correcting for sampling intensity, i.e., number of individuals) was performed in Ecosim 7.72 (Acquired Intelligence Inc., Kesey-Bear).

Solitary bees and wasps, later collectively termed solitary bees, were studied by placing three trap nests at the field border [9]. The trap nests consisted of 29 paper cylinders (150 mm long) of three different diameters (7, 8, and 9 mm) and were placed on a pole at a height of 1.5 meters. The nests were placed along the field border (natural nesting habitat) on 28 April and collected 23 October 2004. They were stored outdoors but sheltered from rain and snow. In March, the nests were taken inside (20°C) and the hatching started 18 days later. All hatched individuals were determined to species (see [9] for details on methods).

Birds were studied by point counts [43] from the centre of the field. All birds seen or heard during five minutes were noted to species level. All fields were visited between 06.00–10.00 three times from early May to mid-June (13–19 May, 26–29 May, and 7–17 June 2004).

2.4. Biodiversity Index. In addition to species-richness of single groups, we also calculated an index of total biodiversity based on the selected five organism groups. First, the proportion of the regional species pool (estimated as the total number of species in the group on all fields) occurring on each farm was calculated for each of the five organism groups. The sum of the proportions of the regional species pools (i.e., the sum for the five organism groups) for each farm was used as biodiversity index. This gives an index that is independent of the species number of the different organism groups, that is, all organism groups have the same weight in the index.

2.5. Qualitative Farmer Interviews. The interviews with the farmers were open-ended and semistructured and covered topics regarding farm history, agricultural practices, and knowledge about, interest in, and feeling for nature and nature conservation. All farmers were interviewed three times during 2004–2006, except one farmer who was only interviewed twice. The second interview contained a presentation of the 2004 inventory results from their winter wheat field and a walk to a place on the farm that the farmers like to visit (for details on interview technique, see [33]). The interviews were transcribed, and the quotations were divided into categories containing similar topics, using the qualitative analysis program ATLAS.ti 5.0.66 (ATLAS.ti Scientific Software Development GmbH, Berlin).

2.6. The Interdisciplinary Approach. We converted the qualitative interview data into a semicontinuous variable, *interest in nature*, which could be used in a traditional statistical analysis. Our conversion technique was developed with influences of methods such as the Delphi technique and is partly similar to other studies using expert judgment methods [44–46]. We selected this method since interest in nature emerged as an interesting useful concept during the study. Furthermore, we wanted the farmers to discuss and express themselves freely without connection to expectations regarding what they thought the interviewer expected as an answer. Such expectations could influence the answers if the selected methods are based on predefined scales in, for example, conservation psychology [33, 34, 47] and we therefore chose to focus on self-reported opinions and attitudes among the interviewed farmers. Thus, we constructed a variable that we regarded as useful for analysing relationships between *interest in nature* and different variables describing biodiversity at the selected farms. However, it is a time-consuming method, and we realize that it is not a suitable tool that easily can be used in situations when a quick judgment of *interest in nature* or related concepts is needed.

The conversion of the interviews was done by constructing a matrix containing quotations from each of the 16 farmers including quotes from 11 subject areas, for example, species knowledge, nature descriptions, definition of nature conservation, and thoughts about pesticides (Table 3). Then, eight researchers (three natural scientists and five social scientists) independently ranked the farmers *interest in nature* based on these quotations (Table 4). The farmers were classified into three classes: (1) low, (2) intermediate, and (3) high interest in nature. Farmers classified to class 1 usually knew only a few wild species, talked very little about nature, and had a restricted knowledge about ecology. Production of cereals was the main focus of all farmers. It seemed hard for farmers in class 1 to combine conservation efforts with production. In contrast, farmers in class 3 combined cereal production with knowledge of wild species, talked much and vividly about nature, and had a good understanding of requirements of different species (e.g., habitat preferences and effects of different farming practices).

After the classification, the average value across all researchers for each farmer was used as the social parameter (*interest in nature*, ranging from 1 to 3) in the statistical analysis. The range of the farmers' interest in nature (mean values) was 1–2.9 with a mean of 2.1. The ranking was in general consistent between researchers (Table 4).

2.7. Statistical Analyses. All measured parameters are presented with mean, maximum, and minimum values in Table 2. The moderate number of farmsteads in this study ($n = 16$) forced us to reduce the number of explanatory variables. We selected three variables with the help of PCA (position of each farm along the first PCA-axis in a PCA including all variables presented in Table 2) and correlation analyses (i.e., we excluded highly correlated variables with $r > 0.5$). The final selected independent variables used in statistical analyses were crop density (initial variable

Table 1: Results from stepwise multiple regressions with the biodiversity index and species richness of different organism groups as dependent variables. P-values are presented both for the full models (p-model) and single independent variables (p var). R^2 values and F-values are presented for the full models. The direction of the effect is indicated by the +/− column.

Dependent variable	Model R^2	F-model	p-model	Independent variable	+/−	p-var
Biodiversity index	0.549	7.90	0.0057	(1) Crop density	−	0.0100
				(2) Interest in nature	+	0.0293
Weed richness	0.581	19.44	0.0006	(1) Crop density	−	0.0006
Carabid richness	0.559	8.23	0.0049	(1) Interest in nature	+	0.0111
				(2) Crop density	+	0.0121
Solitary bee richness	0.244	4.52	0.0517	(1) Interest in nature	+	0.0517
Bumblebee richness			N.S			
Bird richness			N.S			

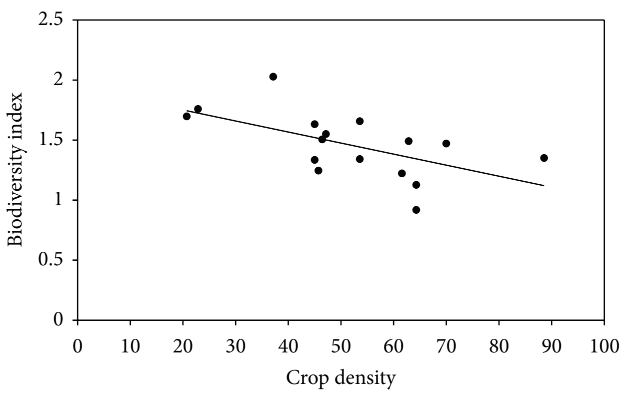

Figure 1: Relationship between the biodiversity index and crop density (percent cover). The relationship was significant (R^2 = 0.341, P = 0.0176).

representing the local farming intensity, incorporating differences between organic and conventional farms in crop structure), landscape composition (position along the first PCA-axis representing a gradient from homogeneous landscapes with a high proportion of annual crops to heterogeneous landscapes with noncrop habitats and forest), and farmer *interest in nature* (initial variable representing the farmer of the study fields). We used the biodiversity index and species richness and abundance of weeds, carabids, solitary bees, bumble bees, and birds as dependent variables in separate stepwise multiple regressions (SAS 9.1 Proc GLM) with forward selection of variables. Interactions between variables were tested when two parameters entered the model.

3. Results

In total, we found 48 weed species, 41 carabid beetle species, 14 bumblebee species, 18 solitary bee species, and 39 bird species in the 16 investigated farms.

3.1. Biodiversity Index. Local management intensity, estimated by crop density, and farmers' *interest in nature* both significantly explained variation in the biodiversity index (Table 1, Figures 1 and 2). The interaction between crop density and *interest in nature* was not significant. Farmers' *interest in nature* was positively related to the biodiversity index as well as the richness of carabids and solitary bees (Table 1).

3.2. Species-Richness of Different Species-Groups. Crop density was negatively related to weed richness but positively to carabid richness (Table 1). Landscape composition was not significantly related to diversity of any of the studied organism groups. Bumblebee species richness and bird species richness were not related to any of the three selected independent variables.

Rarefied bumblebee species richness was positively associated with landscape composition (regression analysis, F = 5.9, R^2 = 0.41, df = 1, P = 0.03), that is, a high specie richness in heterogeneous landscapes and low species richness in open landscapes with a high proportion of annual crops.

There was a tendency for an association between *interest in nature* and landscape composition (correlation analysis, r = 0.48, P = 0.06).

3.3. Deconstruction of Interest in Nature. Analyses of relationships (correlation analyses) between the variable *interest in nature*, derived from the interviews, and all original independent variables (not used in the main analyses, see Table 2) showed that *interest in nature* was positively correlated with the proportion of perennial crops (r = 0.76, P < 0.001) and the proportion of forests (r = 0.69, P = 0.003) and negatively correlated with crop yield per ha (r = −0.55, P = 0.03). However, there was no correlation between interest in nature and crop density (r = −0.05, P = 0.86). There were also tendencies for negative correlations with farm size (r = −0.47, P = 0.065), amount of spring-sown crops (r = −0.48, P = 0.058) and amount of fertilizers (N) applied (r = −0.43, P = 0.10).

4. Discussion

We found that farmer *interest in nature* was positively associated with biodiversity in agricultural landscapes. Our overall biodiversity measure was negatively related to farming intensity (here measured as crop density), but there was a clear additional effect of interest in nature (Figure 2) and

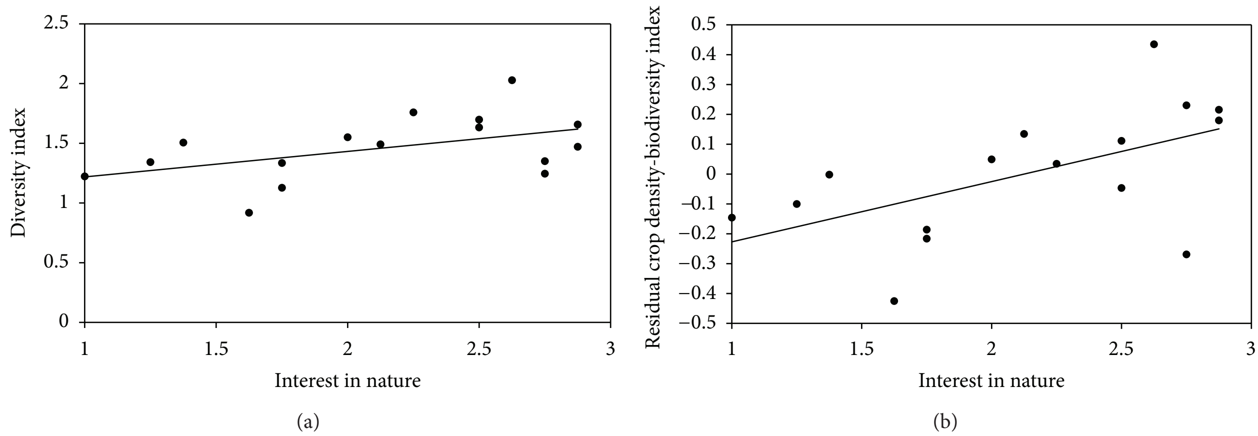

Figure 2: Relationships (with regression lines) between (a) the biodiversity index and farmers interest in nature and (b) the residual of crop density and biodiversity index and farmers interest in nature. Statistics: (a) $R^2 = 0.233$, $P = 0.0581$, (b) $R^2 = 0.315$, $P = 0.0237$).

Table 2: All measured landscape, field and farmer variables presented with mean, max and min values.

In field variables	Mean* (number of zeros); max; min
Crop density in June (% cover)	52; 89; 29
Crop height in July (cm)	105; 121; 83
Yield (kg)	5130; 7700; 1800
Nitrogen application (kg/ha)	103 (3); 168; 0
Farm manure/Green manure/chemical fertilizer (number of farms)	0/2/14
Number of herbicide applications	1 (4); 1; 0
Field variables	
Area (ha)	12.3; 60; 1.5
Perimeter (m)	1536; 3230; 593
Field islands (perimeter)	72 (7); 593; 0
Total number of trees, stones and shrubs in the field border	12; 32; 1
Landscape variables	
Proportion in % of (within 300 m)	
Forest	14 (4); 40; 0
Fields	62; 85; 14
Pasture	3 (12); 18; 0
Perennial crops (ley and fallow)	19 (3); 38; 0
Spring sown crops	38; 66; 18
Autumn sown crops	37; 70; 16
Length of roads (m)	836 (3); 1583; 0
Number of houses	1.9 (3); 5; 0
Farmer variables	
Interest in nature	2.1; 2.9; 1
Work (full or part-time)	8 full time and 8 part-time

*The mean value was calculated using only non-zero values.

together these two variables explained 60% of the variation in the biodiversity index. A deconstruction of the *interest in nature* variable suggests that the farmers classified as having the highest *interest in nature* lived in landscapes with more forests and perennial crops than farmers with a lower interest in nature. There was also a negative correlation between *interest in nature* and crop yield. However, the underlying mechanisms behind effects of *interest in nature* on biodiversity (and of biodiversity on *interest in nature*) cannot be established without further more detailed studies of relationships between *interest in nature,* and management and conservation measures made by the farmer, and the effects on biodiversity.

To our knowledge, we are the first to use variation in farmer attitudes (*interest in nature*) in the same analysis as variables describing landscape, and farming intensity when analysing factors explaining variation in farmland biodiversity, although some previous studies have examined similar questions. In an Austrian study [32], mentality of farmers, land-use intensity, and biodiversity were examined through the use of farming styles. Farming styles can be seen as a set of strategic notions about the way in which farming should be practised that guides practical actions [48]. Schmitzberger [32] showed that farmers characterised as "yield optimizers" had lower biodiversity on their farms than other farmer styles. The abundance and distribution of meadow birds have been shown to be related to the knowledge of farmers, called "eye for birds" [20]. In a similar vein, Busck [26] argued that diversity and number of landscape elements and their management could be explained by differences in farming styles among Danish farmers.

Crop density and *interest in nature* are both factors dependent on the farmer. Thus, in this study factors related to the farmer and farm management were most important in influencing biodiversity. Farmers experience nature and know nature from their management. They relate to and experience nature and biodiversity through management, and different aspects such as to see the sunset and to hear the skylarks (*Alauda arvensis*) singing are important to farmers [17, 34]. *Interest in nature* seems to be a useful indicator of farm management incorporating many actions taken by

Table 3: Parts of the matrix used to classify farmers' interest in nature. Here are examples from three farmers representing the three classes of interest in nature and their quotes for 8 of 11 subject areas.

Farm	2	8	10
Interest in nature*	1	2	2.9
Species knowledge	I am rather poor in birds.	Well, it could have been much better. That I can tell you.	When showing the inventory result the farmer miss Lapwing, Crane, Common Gull, Barn Swallow, Nuthatch, Starling, White Wagtail and Bullfinch.
Nature and species narratives	Going to the forest to pick mushrooms, I like. . . I enjoy that.	As a farmer you are still in the hands of nature that is unavoidable. Sure, you can go in and steer and think that this and that I can manage with this and that but there will be a set back if you are too though.	When the wood anemones sits there in their most beautiful shade. I find that amazing. I think that's the best nature experience I can. . . Birch hills you enter and it is completely white, that is wonderful.
Ecological knowledge	That there is so many different. For me a bumblebee is a bumblebee. . . there is so many species (He explains that there can be so many bumblebees and birds due to the river and the hills with trees.)	If it can be of any good for something in the ecosystem, sure I can have a spray free zone. That is ok, and I can have it in this extent, it is not of any major problem for me.	As soon as we did not harvest (hay) there they disappeared (Cowslip *Primula veris*). The grass choked them.
Governmental nature conservation	There are some species being in these habitats. (Woodland key habitats, a conservation measure.)	I know that there were here someone who found something that was called finnögontröst (*Euphrasia rostkoviana* spp. *fennica*) and he thought that was nice. Now, to be honest I do not really remember how it looked like, but of course you could think that if you got a better presentation since it has been a substantial work done so maybe it could be presented to the manager in a nice and simpler way so that you could see and have access to it.	The nature reserve, they do not manage it well enough! I think! This area should be a Nature2000 area. I think it is neglected. Before it was always mowed. Cowslips and things are about to disappear. I think it is shameful that they do nature reserve after nature reserve but do not manage them properly.
Farm nature conservation	No, you know I do not have so much we. . . we have cereal production so I do not have that. . . the field islands here you cannot do anything with.	An oak in the middle of the field is kept and cherished.	Nature conservation agreement, yeah. They gave a lousy bid, 13,000 for 50 years. You almost get by as good without that.
Interest in nature	No, not really!	Well interested in nature I am, but then to take it down to the species level!	Yes I think so. I run orienteering and do cross country skiing.
Definition of nature conservation	To be a bit careful about nature. . . and. . . to help nature a little bit maybe.	Nature conservation is to take responsibility for the nature we have.	That can be anything.
Pesticides	No, I am not a spray maniac so. . . last year I did not spray everything. . . I go out and look. You do not just drive out you have to go and look. I do that more or less every evening so I have an eye for if it is needed.	In any case for me it is naturally built in that I do not want to use more chemicals than urgently required.	I have checked out if it really needs to be sprayed or not.

*Average of eight researchers classification.

farmers but possibly also influences of the landscape that the farmers live and work in. When and how an action is taken may be as important for biodiversity as, for example, the amount of fertilizers or herbicides that are used. More research is needed to understand how and through which mechanisms farmer *interest in nature* may affect biodiversity. Many actions taken based on *interest in nature* may be subconscious rather than conscious, but despite these

Table 4: Classification of farmer's interest in nature per farmer (F) and per researcher (N mainly natural scientist and S mainly social scientist) doing the classification. The quotes that they based their classification on are shown in Table 3.

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	Mean per researcher
Res1N	2	1	3	2	2	2	2	2	3	3	2	1	2	3	3	3	2.3
Res2N	2	1	3	2	1	2	3	2	2	3	2	2	2	3	3	3	2.3
Res3N	3	1	3	3	2	2	3	1	2	3	2	2	2	2	2	3	2.3
Res4S	2	1	2	2	1	1	3	2	3	3	2	2	2	3	3	2	2.3
Res5S	2	1	2	2	1	1	3	2	2	2	1	1	1	3	3	3	1.9
Res6S	2	1	3	3	1	1	3	2	3	3	2	1	2	3	2	3	2.2
Res7S	2	1	2	2	1	2	2	3	3	3	2	1	2	3	3	3	2.2
Res8S	2	1	2	2	1	2	3	2	2	3	1	1	1	3	2	2	1.9
Mean per farmer	2.1	1	2.5	2.3	1.3	1.6	2.8	2	2.5	2.9	1.8	1.4	1.8	2.9	2.6	2.8	

farmers' actions, decisions have direct and indirect effects on many organisms.

Landscape measures such as heterogeneity have been shown to be good predictors of farmland biodiversity [5, 18, 49–51], but in our study *interest in nature* emerged as a stronger predictor than landscape measures. There was a weak relation between *interest in nature* and landscape composition ($r = 0.48$ $P = 0.06$) in our study. *Interest in nature* might both be influenced by and have influence on the landscape and crop composition. Examples of the latter are selection of crops (perennial versus annual crops) and management intensity at the field level (amount of fertilizers and yield). This suggests that socioeconomic factors, farmer attitudes and behaviour have effects on farmland biodiversity that need to be better understood. There is a growing research interest for attitudes and behaviour in the farmland context, but there is also a critique of the overemphasised belief that attitudes always leads to actions [3, 52–56]. However, our study suggests that there is a link between attitudes and biodiversity that is affected by management.

Among the individual organism groups, diversity of carabids and solitary bees were related to farmers' *interest in nature*, while diversity of weeds, bumblebees, and birds were not. Solitary bees and carabids are organism groups that few farmers know much about, suggesting that no management strategies focused on promoting these organisms specifically.

Weed diversity decreased and carabid diversity increased with crop density, while diversity of other organism groups was not significantly related to this factor. Earlier studies of carabids at the European scale have also shown that they, in contrast to other organism groups, are not negatively associated with agricultural intensification [57]. Differences in responses between organism groups are in line with earlier comparisons within farmland landscapes [58–61], and supports suggestions that broad studies of several organism groups are needed when discussing factors related to farmland biodiversity in general.

Agri-environmental schemes (AESs) have been widely imposed in the EU and elsewhere to counteract the negative trends for farmland biodiversity. Eleven of the 16 farmers participated in agri-environmental schemes, and the interest in nature seemed to be similar between farmers participating in AES (mean = 2.2) and farmers not participating in AES (mean = 2.0). However, it was not possible to analyse this further with the restricted sample size and large differences between different AES types (e.g., ley production and management of seminatural pastures). The farmers are central for conservation of biodiversity, because without implementation of the prescribed actions, the schemes would not have any effect at all. Effective schemes ought to include regional, local, and manager considerations [62] and be developed with stakeholder perceptions and cultures in mind [16, 63]. Our results indicate that conservation of biodiversity in farmland to a substantial degree is dependent on understanding farmers' attitudes and motivations concerning biodiversity management and agricultural practices [16, 35]. This implies that AES based *only* on ecological and agricultural information are less likely to be successful.

In this study, we used qualitative social science data (see also [64]) within a natural science environment and are aware that such qualitative data should not be generalized to populations but to theories [65]. We are aware of the simplifications and drawbacks resulting from dividing the rich qualitative social science data into a few categories regarding nature interest. However, we think that this approach might give new insights and further crossings between disciplines, especially in biodiversity research related to management of landscapes, which are urgently needed.

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