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‘Farming for Biodiversity’—a new model for integrating nature conservation achievements on organic farms in north-eastern Germany

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Abstract The new label ‘Farming for biodiversity’ was introduced to make nature conservation achievements visible to the consumer and to bridge the gap between limited consumer interest and government financial support. We developed a whole farm assessment system (WFAS) based on individual modules and credit points. A catalogue of measures, landscape features and target species help farmers and nature conservation advisors to enhance the achievements of the farm and increase biodiversity. Farmers have to achieve an overall total score of points as well as a special score of points for small-scale effective measures (SSEM), which are designed for sensitive target species. The system allows flexibility for the farmers and is effective for biodiversity. The assessment of 50 farms showed that extensive farming practices are widespread. High levels of biodiversity including endangered species were found in case of weed flora. Successful additional measures were implemented to aid a declining farmland bird, the whinchat. To ensure the successful implementation of measures, sound nature conservation advice and knowledge of the individual farm and species settings are required. The WFAS and the new product label could help to establish biodiversity as an added value of organic farming and encourage consumers to buy organic products.

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Introduction

The loss of wild flora and fauna species dependent on farmland habitats has been dramatic in the EU countries over the past few decades and the trends are still negative (BfN 2015). The main reasons for this are an increase in the intensity and specialisation of land use, as well as the abandonment of extensively farmed habitats. Organic farming has been proven to be strongly advantageous for biodiversity (Sandhu et al. 2010; Rahmann 2011; Tuck et al. 2014; Lichtenberg et al. 2017). In addition, the modified production measures implemented into farming practices are very effective in cases where conflicts arise (Stein-Bachinger et al. 2010; Stein-Bachinger and Fuchs 2012).

The achievements of the farmers with regard to biodiversity services should be honoured, either through agri-environmental schemes (AES) or by means of adequate product revenues. In any case, the achievements have to be quantified, or must at least be visible to consumers and politicians. Thus far, the visibility of the biodiversity services provided by organic agriculture and the awareness and appreciation of them by politicians and consumers are hardly noticeable. Marketing strategies in Germany focus on health and regionality, whereas in Switzerland, a label with a focus on biodiversity has been successfully introduced (Birrer et al. 2014). The goal of the new ‘Farming for biodiversity’

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label is the achievement of an added value component for organic farms in Germany. Consumers are informed about the positive effects of organic farming practices on biodiversity. Moreover, the biodiversity on the cooperating farms is enhanced by implementing additional measures or modifying farming practices.

A basic tool to help farmers attain these targets is a credit-point based assessment system on a whole farm level. Originally developed in Switzerland (Jenny et al. 2013; Stoeckli et al. 2017), the idea has been adapted to the conditions in north-east Germany (Gottwald and Stein-Bachinger 2016). A whole farm assessment system (WFAS) for biodiversity achievements is necessary in order to embrace the holistic approach of organic farms. It should be appropriate for different farming systems and geographical regions, and it should give farmers sufficient flexibility to integrate nature conservation demands with economic constraints. Here we present (i) the project structure to support biodiversity from field to fork, (ii) the whole farm assessment system and (iii) initial results showing the nature conservation achievements of 50 organic farms in north-eastern Germany.

Materials and methods

The 'Farming for Biodiversity' project

In 2012, farmers from the Biopark organic association in Mecklenburg-Western Pomerania and WWF Germany initiated the 'Farming for Biodiversity' project. In cooperation with 15 pilot farms, we have developed a catalogue of nature conservation achievements, comprising 50 modules (approx. 100 submodules), taking account of the site conditions and farming practices in north-eastern Germany (Gottwald and Stein-Bachinger 2016). This catalogue is based on expert knowledge, literature and our own results from the 'Nature conservation farm Brodowin' project (Stein-Bachinger et al. 2010; Stein-Bachinger and Fuchs 2012). Advisors identify target species and reasonable measures to promote them on the farms. They then advise the farmers how and where to implement which nature conservation measures. The benefits of organic farming for biodiversity are communicated to the consumers by means of a nature conservation label. A tracking code on farm products leads consumers to the project homepage where all the farms are presented and further information is available about the species and biodiversity achievements (www.landwirtschaft-artenvielfalt.de). Initially, the wholesaler EDEKA sells meat and potatoes from certified farms, rewarding farmers with a premium price for their products, while consumers do not have to pay any more.

Assessment system

The catalogue of nature conservation achievements and measures is classified into the categories of arable land, grassland and landscape elements. Furthermore, special species and existing habitats, such as hedges and ponds, are evaluated. Measures focus on a set of target species, including farmland birds, amphibians, insects, grassland and arable flora. The selected target species are still widespread in organic farming environments, but endangered or declining on a national scale. Each module of the catalogue has been evaluated by a group of experts, with credit points allocated according to its effectiveness in terms of nature conservation. Currently, a total of 120 points per 100 ha are required for a farmer to receive a nature conservation certificate (label). The modules comprise established extensive farming practices as well as specific conservation measures. Special attention is given to 'small-scale effective measures' (SSEM), which were designed for certain target species. These measures are effective in supporting the reproduction of the species, while at the same time having rather low negative effects for farmers. At least 20 points per 100 ha must be achieved through SSEM. We developed this system for farms in north-eastern Germany. The adaptation to southern and western Germany has started 2016/2017.

Farm sites

The site conditions in north-eastern Germany are characterised by low annual precipitation (< 600 mm) and mostly diluvial soils of low to medium quality. The evaluation included 50 farms covering about 21,000 ha of grassland and 15,000 ha of arable land. Seven farms exclusively manage grassland, 35 farms have more than 50% of grassland. The average size of the farms is 740 ha (min 60 ha, max. 4000 ha). Due to the relatively poor site conditions, the yields of cereals can range from < 2.0 up to 5.0 t ha^{-1} (Stein-Bachinger and Gottwald 2013).

Economic aspects

Within the 'Nature conservation farm Brodowin' and 'Farming for Biodiversity' projects, a number of measures have been calculated based on yield and quality reduction from field trials, taking standardised techniques and different justified assumptions into account (for more details see Stein-Bachinger et al. 2010; Rühs and Stein-Bachinger 2015). In this paper, we give examples of the costs incurred on arable land and grassland depending on different site conditions, animal husbandry and management options.

Evaluation of biodiversity and measures

On several cooperating farms, we collected data systematically for the target species groups in order to evaluate the existing biodiversity and to record changes in connection with certain nature conservation measures. Farmers receive credit points for high levels of biodiversity among wild flora, as well as for reproducing populations of certain rare fauna species. Here, we report initial results for the arable flora (weeds) and an endangered field bird, the whinchat (*Saxicola rubetra*).

Arable flora: We mapped a set of 50 characteristic species as well as other species from the Red List on three plots (60–100 m^2) per 10 ha arable field ($n = 218$) on 14 organic farms in the years 2014–2016. Additionally, we looked for rare species on special sites (poor field edges, dry hilltops). The method was developed in other projects (Meyer et al. 2010; BfN 2016) and slightly modified (Gottwald and Stein-Bachinger 2017a). For evaluation purposes, the fields were ranked into four classes ranging from 'low nature value' to 'very high nature value', according to the detected number of characteristic species (see classification of 'High Nature Value Farmland', BfN 2016).

Whinchat: This ground-breeding field bird is dependent upon extensive agricultural land use. The species is highly threatened by management practices in grassland and its population is declining strongly throughout Europe (Bastian and Feulner 2015). We registered territories, habitat requirements and breeding success for whinchats annually from 2014 to 2016 on six farms and 485 ha of grassland (Gottwald et al. 2017). As a conservation measure, the farmers left patches of meadows and pastures within preferred whinchat habitats unused during the breeding season from May to mid-July.

Results

Measures and achievements—farm statistics

In total, the 50 farmers have implemented 96 different modules from the catalogue on arable land, grassland and landscape elements. Additionally, we have assessed 11 result-oriented modules. The proportion of farmers that implemented specific modules, and the percentage of area they dedicated to those modules, show high variations ranging from < 10 to 100% (farms) and < 1 to 92% (area) (Table 1). The modules which have been implemented on large parts of the arable area are 'reduction in harrowing', 'low density in cereal crops' and 'high variety of crops'. In grassland, the modules favoured with respect to farmland area are 'reduction of rolling and levelling' and 'reduction in use of fertilisers' (Table 1).

Several large-scale measures were already practiced by farmers before the start of the project as part of their extensive farming practice (e.g. reduced fertilisation on fens, low cutting frequency). In contrast, small-scale measures were implemented for particular target species following the inspection of the farmland by nature conservation advisors.

Ultimately, all the farms attained the necessary number of credit points required for the certificate or performed even better. The median of total credit points was 217, the median for SSEM was 32 credit points. 13.5% of the total points awarded were attained by means of result-oriented achievements (e.g. species-rich or wet grassland) and 22% through landscape structures (hedges, field margins, buffer strips etc.).

Economic aspects

The fact that economic calculations can only reflect the individual farm situation to a limited extent has to be taken into consideration. Table 2 shows the range of costs incurred for selected measures when implemented on the whole field. Costs resulting from the integration of nature conservation measures vary depending on the farming system (e.g. dairy or suckler cows), site conditions and farming intensity. For example, 8 weeks without farming operations during the breeding period of birds in legume-grass leys can cause more than 400 € loss per hectare for dairy farms. Leaving 10% as unmown strips within legume-grass leys would cost up to 120 EUR per hectare for dairy farms, whereas

Table 1 Nature conservation achievements of 50 organic farms (extract, without result-oriented achievements)

Module	Farms[1]	Area[2]	Credit points[3]	Credit points[4]
Arable land (15,442 ha)				
Reduction in harrowing	40	32.0	1.0	6.8
Leaving stubble over winter	16	1.1	0.3	1.7
Low density in cereal crops	30	21.7	5.3	34.7
Small-scale measures for weeds	10	0.1	0.1	0.4
Leaving strips or plots temporarily unmown in legume-grass leys	18	0.4	0.5	3.0
High variety of crops	46	60.3	1.6	10.5
Grassland (21,294 ha)				
Organic grassland management (moderately extensive)	100	92.1	2.4	4.9
Reduction of rolling and levelling	86	51.4	4.2	8.5
Reduction in use of fertilisers	92	68.6	8.2	16.7
8–10 weeks without farming operations during the breeding period of birds	66	18.5	11.1	22.5
Mosaic management	16	7.6	0.6	1.2
Leaving strips or plots temporarily unmown	58	1.6	3.5	7.1
Special measures for valuable habitats	28	1.0	2.3	4.6
Landscape structures				
Hedges, bushes and trees	100		7.6	
Buffer strips beside ponds for amphibians	10		0.1	
Leaving unmown margins alongside ditches[5]	70		1.9	
Nesting facilities for birds, bees, bats etc.	36		0.9	

[1] Percentage of farms implementing the specified measure

[2] Percentage of total area referring to arable land/grassland

[3] Percentage of total credit points on farm scale (36.716 ha)

[4] Percentage of credit points relating to arable land/grassland

[5] evaluated per 100 m length

implementing the same measure on grassland on poor soils would result in costs of 27 EUR per hectare for suckler cow farms. A number of measures can be implemented on a small scale, this will reduce costs considerably.

Achievements of project farms on arable land: the arable flora

In general, we found a high diversity of arable plant species on the cooperating farms, even on fields without supplementary nature conservation measures. 87% of the fields inspected could be assigned a value level equivalent to HNV farmland, 56% belonged to the categories 'very high nature value' and 'extremely high nature value' farmland (Gottwald and Stein-Bachinger 2017a).

Overall, we found 27 weed species from the Red Lists (Germany, Mecklenburg-Western Pomerania and Brandenburg, Korneck et al. 1996; Voigtländer and Henker 2005; Ristow et al. 2006). On a federal state level, we recorded 38 threatened species in Mecklenburg-Western Pomerania and 23 in Brandenburg. On several fields, we found critically endangered species (Cat. 1) like *Ranunculus arvensis*, *Stachys annua*, *Hypochaeris glabra* and *Filago vulgaris*. These are mostly found on special small-scale areas such as the dry, loamy hilltops of ground moraine or nutrient-poor, sandy field edges.

The frequent occurrence of Lamb's Succory (*Arnoseris minima*) is of particular interest. This species is endangered throughout Germany, and north-eastern Germany has a global responsibility for its preservation (Welk 2001). Lamb's Succory occurred on seven of eight farms investigated in Brandenburg and southern

Table 2 Costs of various nature conservation measures according to crop, animal husbandry and site conditions (guide values) (compiled from Stein-Bachinger et al. 2010; Rühs and Stein-Bachinger 2015)

Nature conservation measures	Costs (€ per hectare)	Calculation remarks
No harrowing, delayed stubble breaking	< 150	Poor to medium soil quality
Blossom strips	300 up to > 1000	Strongly influenced by duration, different crops and site conditions
8 weeks without farming operations during the breeding period of birds in legume-grass leys	200* up to > 400**	Medium soil quality
Leaving strips unmown on 10% in legume-grass leys	90* up to 120**	Medium soil quality
Leaving strips unmown on 10% in grassland	27*	Poor soil quality

*Suckler cow farms

**Dairy farms

Mecklenburg-Western Pomerania and was locally frequent (Gottwald und Stein-Bachinger 2017b). The species only grows on nutrient-poor, acid sandy soils, which are problematic sites from an agronomic viewpoint. On the cooperating farms, these sites occurred mainly on a small scale and therefore could be tolerated by the farmers.

Achievements of project farms on grassland: the whinchat

Grassland with extensive grazing turned out to provide good habitats for whinchats: we found abundances up to 2.2 territories per 10 ha (Gottwald et al. 2017). Most territories were located along linear structures like ditches, fences and field margins. Agriculturally unused strips and patches alongside these structures are important for nest site selection. Grassland currently being grazed is avoided when nest-building. On the other hand, whinchats seem to prefer settling in the vicinity of grazing cattle, presumably because of the rich food supply and because fences serve as ideal perching places. Nevertheless, the breeding success of these field birds was poor in sites without special protective measures (mean 46% of nests with at least one fledgling, 2014–2016, $n = 116$). SSEM (delayed use of small areas of grassland) significantly increased breeding success (mean 83.5%, 2015–2016, $n = 23$, Gottwald et al. 2017).

Discussion

The whole farm assessment system allows the evaluation of achievements for biodiversity on the level of the farm. As farmers can choose between a broad range of nature conservation options, this system offers a high degree of flexibility for the farmer to acquire the nature conservation certificate. At the same time, the measures can be chosen conform to local habitats and target species, offering specific optimization strategies from a biological point of view. It also can be used by farmers to direct their individual farm development towards more biodiversity (self-evaluation tool, Birrer et al. 2014). Furthermore, the point scoring as well as the measure options can be adjusted to suit other site conditions and species settings.

Measures and achievements on the farms

Most of the farms easily achieved the total number of credit points required for the nature conservation certificate, but had to make extra efforts with regard to the additional small-scale effective measures (SSEM).

Several large-scale measures were already being implemented by farmers before the project began as part of their extensive farming practice (e.g. reduced fertilisation, low cutting frequency). This can be attributed to the fact that most of the farms involved are situated on poor to medium soils, e.g. sandy arable soil or wet fen soils. Under the frame conditions of organic farming (e.g. limited nitrogen input) and the rather large farm and field sizes in north-eastern Germany, the rather extensive farming practices on these sites also make sense for economic reasons. Furthermore, some farms are partly inside designated protected areas with special regulations of land use intensity, such as national parks or biosphere reserves. Hence, the preconditions for biodiversity on the project farms are rather favourable. This holds especially true for the arable flora, which showed high species diversity and abundance even without

special measures. Accordingly, with regard to points scored, most of the farms performed better than the fixed threshold necessary for the certificate.

Nevertheless, the nature conservation advisors identified optimization possibilities for any farm. For certain target species like the whinchat (and other field birds), additional measures are essential. One of our favourite extra measures is to leave small strips or patches of grassland unused for a prolonged time. These patches serve as an important refuge area for insects (Buri et al. 2013; Bruppacher et al. 2016) or the brown hare and as nesting habitat for field birds.

Finally, the combination of a general point score with special points for SSEM turned out to be a suitable method for assessing the farmers' achievements. The latter is important to ensure that special measures are implemented even if the farm gets a high ranking based upon its general extensive farming practice.

Economic aspects

Most of the nature conservation measures that are implemented into farming practice require financial compensation, either due to reductions in yield and/or quality, or because of the additional time expenditure, e.g. the marking of strips that are to be left unmown or time-consuming harvesting techniques. Moreover, certain measures can result in further costs such as additional weed infestation in subsequent years.

The farming system has an important impact on the acceptance among farmers for implementing nature conservation measures into management practice. Especially for dairy cows, any delay of the cutting date in grassland or grass-clover ley results in lower fodder quality (Mährlein 1993; Stein-Bachinger and Fuchs 2012). To balance these losses, the farmer has to compensate either with fodder production from other fields or he has to purchase additional fodder from outside. Organic farming standards only permit organically grown fodder for ruminants, which is in turn rather expensive. That means that higher costs arise for dairy farmers in comparison to suckler cow farmers when implementing measures, e.g. for protecting whinchats (Rühs and Stein-Bachinger 2015). The costs of different measures in grass-clover leys (e.g. 8 weeks between first and second cut, unmown strips) are up to 60% higher for dairy farmers (Stein-Bachinger et al. 2015). Without adequate remuneration, they cannot implement these measures.

Consequently, for several measures, the benefits of the 'Farming for Biodiversity' certificate are not sufficient as compensation for the costs and must be supported through e.g. agri-environment schemes (AES). So far, some of these measures have been integrated in AES based on project initiatives: farmers can receive payment for leaving unmown patches in grassland (Mecklenburg-Western Pomerania) or in grass-clover leys (Brandenburg).

Arable flora: achievements of organic farming

Our studies on the project farms showed that high diversity of arable plant species are widespread as are populations of endangered species. As stated above, the rather low to medium production level of cereal fields is an important factor in this situation, leading to sparse stocks of crop plants (Thies et al. 2010). Furthermore, many farmers are renouncing mechanical weed control in some crops, e.g. in winter rye. Another factor supporting floral diversity is the rolling landscape of the Pleistocene moraines, exhibiting highly variable soil types and small-scale sites with special soil conditions, e.g. on hilltops. This characteristic feature of north-eastern Germany favours the existence of specialised species in small populations even on fields with generally better soil conditions.

In turn, this situation allows the farmers to support specialised species on a small scale. Important SSEM, in context with the preservation of endangered plant species, are e.g. reducing manure and liming (target species: Lamb's Succory), forgoing stubble breaking immediately after harvesting (target species: e.g. *Nigella arvensis*) or renouncing mechanical weed control on hilltops.

Small-scale effective measures: top up of nature conservation achievements

The example of the whinchat demonstrates that some species require additional measures even under organic farming. As some of these measures cannot be implemented in modern agriculture on a large scale (e.g. delayed cutting till the end of the breeding period of the whinchat), these measures must be implemented on a small scale exactly on those sites where they are beneficial. In many cases, this calls for help from nature conservation advisors who can identify the target species and suitable habitats. At best, the farmland area should be mapped, and endangered species or potential

habitats for endangered species located. However, this procedure takes time and current AES are currently not coping with this challenge. On the other hand, the evaluation of AES in the EU countries highlighted substantial deficits in effectiveness (Pe'er et al. 2014). The SSEM are particularly effective in preserving wild flora and fauna, and result in only minor losses for the farmers. Therefore, it could also be an economically rational strategy to invest in the evaluation of farm areas and expert advisory services rather than simply distributing subsidies non-selectively.

Conclusions

The whole farm assessment system using credit points allows to compare the benefits of different farming practices for biodiversity. It can support farmers on a voluntary basis in enhancing biodiversity on their farms and make their achievements visible to the consumer. In this way, organic farming products gain additional value.

The innate achievements that organic farming systems provide for biodiversity can in part be significantly improved through targeted measures. This often only requires minor changes in agricultural management. Additional measures are particularly effective if they are directed at special target species which are either on the farm or potentially could be. This requires close cooperation between biologists and farmers and a good knowledge of the agricultural and biological conditions on the farm. This is why sound nature conservation advice is a key factor for the improvement of nature conservation achievements in agriculture. Consequently, the nature conservation advice can be supported up to 100% within the EU Common Agricultural Policy (CAP), which is also put into practice in some of the federal states in Germany (e.g. MV 2017).

If the achievements of organic farming for biodiversity are socially and politically better regarded, acknowledged and also financially rewarded, the farmer can view himself not only as a producer of food but also as a producer of biodiversity in the cultural landscape (van Elsen 2000). This would open up a new perspective in the cooperation between nature conservation and agriculture.

The decline in biodiversity in the agricultural landscape can be halted if environmentally sound and nature friendly agriculture, which ensures the quality of our life, is highly regarded on a broad social basis and this is also expressed in people's consumer behaviour. Organic agriculture should be further developed into an agri-food system which also integrates social and environmental aspects, thus becoming a model for solving the problems our current agri-food systems are facing (Rahmann et al. 2016). The 'Farming for Biodiversity' project can support farmers to generate surplus income and we hope that this helps to develop organic agriculture as the leading sustainable farming system.

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