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Swiss people's attitudes towards field margins for biodiversity conservation

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Summary

Arable land in Switzerland harbours low biodiversity and lacks permanent species-rich structures. To remedy this situation, improved field margins (IFMs) will be introduced as a new ecological compensation type in the Swiss Lowlands. IFMs are extensively managed, sown species- and flower-rich vegetation strips which provide both habitats for a wide range of species and valuable structures for the ecological network. However, the success of ecological compensation measures depends strongly on their acceptance by farmers and the general public. In summer 2004, we investigated in a case study the attitudes of 108 Swiss people to IFMs directly in the field. Study participants were asked to rate the attractiveness of IFMs of different species richness and composition that were presented to them, to explain their rating and to estimate the number of species present. In addition, they were asked to imagine a field margin of their particular liking, to describe it, and to state their opinion on several aspects of IFMs. Study participants responded very positively to species-rich vegetation. The more species-rich an IFM was perceived to be, the more it appealed to them. Species richness and general diversity were named as the main reasons for a positive rating. Study participants strongly approved the establishment of improved field margins. The positive rating and high acceptance of IFMs in this study indicate that they may be a successful new tool for biodiversity enhancement in intensively used agricultural landscapes.

Introduction

In recent years, the enhancement of floral and faunal diversity has become an important aim of

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agricultural policy in Switzerland and elsewhere, and specific measures to promote biodiversity in the agricultural landscape have been developed (Kleijn & Sutherland, 2003). While many studies have investigated the ecological effects of measures to enhance farmland biodiversity (Kleijn & Sutherland, 2003; Van Buskirk & Willi, 2004), little is known about the acceptance of such measures by the public (Soini & Aakkula, 2007). However, conservation should be both about biology, and about people and the choices they make (Balmford & Cowling, 2006) and attitudes expressed by the general public can provide valuable information to policy-makers in biodiversity management (Fischer & van der Wal, 2007). This article investigates the responses of 108 Swiss people (all non-farmers) towards improved field margins (IFMs), a new ecological compensation type in Switzerland.

Agri-environment schemes are considered to be the most important political instruments to restore and preserve farmland biodiversity (EEA, 2004). Since 1998, farmers in Switzerland have to prove that they meet a number of environmental standards in order to qualify for area-related direct payments (Schmid & Lehmann, 2000). One of these standards demands that each farmer has to manage at least 7% of his utilised agricultural land as so-called ecological compensation area. For establishing these areas, farmers are compensated financially. Ecological compensation areas may consist of a variety of vegetation types such as low intensity pastures, meadows and wildflower strips (Jeanneret et al., 2003). At present, wildflower strips and rotational fallows sown with indigenous wildflowers are the main types of ecological compensation areas on arable land in Switzerland.[1] The management of an ecological compensation area is regulated (e.g. by restrictions in fertilisation, pesticide use) in order to achieve environmental goals.[2]

For the maintenance of biodiversity within agro-ecosystems, border structures such as field margins are considered to be particularly valuable because they represent an important species pool in arable land, enhance landscape connectivity, and provide food, shelter and over-wintering sites for many organisms (Dennis et al., 1994; Lemke et al., 2000; Pfiffner & Luka, 2000; Von Arx et al., 2002). Moreover, field margins can provide benefits such as pesticide drift reduction (Burn, 2003), and enhance the abundance of both crop pollinators (Carvell et al., 2007; Pywell et al., 2005) and natural enemies of crop pests (Bianchi et al., 2006; Nentwig et al., 1998; Thies & Tscharntke, 1999).

In the Swiss Lowlands, most field margins are narrow, mown or mulched several times a year and consequently harbour a low biodiversity (Von Arx et al., 2002). To increase the floral and faunal diversity of arable land in Switzerland, improved field margins have been recently established as a new ecological compensation measure in several parts of the Swiss Lowlands. IFMs are extensively managed, sown species- and flower-rich vegetation strips along fields, meadows, pastures, pathways, ditches and groves (Jacot et al., 2005). Sowing seed mixtures reduces the initial flush of annual weeds, and is especially appropriate where the local flora is impoverished (Meek et al., 2002; Smith et al., 1999). Sown wildflower margins were found to be richer in plant and invertebrate species than naturally regenerated field margins (Bokenstrand et al., 2004; Smith et al., 1994).

For sustainable agri-environmental measures not only ecological issues but also the perception and values of farmers should be considered (Van der Meulen et al., 1996). Recent studies on the acceptance of conservation measures show that in addition to monetary compensation, farmers' attitudes and perceptions are important factors in decision-making and for the involvement of farmers in agri-environment schemes (Berentsen et al., 2007; Kabii & Horwitz, 2006; Schenk et al., 2007; Siebert et al., 2006).

Although studies have shown that farmers are interested in agro-biodiversity conservation (Herzon & Mikk, 2007; Soini & Aakkula, 2007) neat, clean and ordered landscapes are highly symbolic for farmers (Brush et al., 2000; McEachern, 1992; Young et al., 1995). Thus, the perception of set-aside land as scrubby and unkempt by the farmers' community might be conflicting with practices promoting biodiversity because a neat and tidy crop field is a visible sign of a farmer's skills and engagement (Burton, 2004). Moreover, it has been shown that the attitudes of the non-agricultural public can have a negative influence on the farmers' attitudes towards agro-environment schemes (Luz, 1994) and it has been argued that a positive feedback from society, not only in financial terms, to farming measures for biodiversity is needed (Herzon & Mikk, 2007). However, there is concern that the public may not appreciate conservation measures that look different from the conventional 'horticultured' landscapes people are used to (Nassauer, 1988, 1995a; Parsons, 1995). On the other hand it has been suggested that there

[1]Swiss Federal Office for Agriculture (Ed.) (2006). Agrarbericht 2006 (in German). Bern: BLW.

[2]For further information (in German) see Swiss Federal Office for Agriculture (Ed.) (1998). Verordnung über die Direktzahlungen an die Landwirtschaft. Bern: BLW.

is an interrelationship between biodiversity and the aesthetic appreciation of a landscape (Gobster, 1999; Leopold, 1949; Soini & Aakkula, 2007).

A photo survey undertaken in Western Norway found that species-rich wildflower meadows in agrarian landscapes received high preference ratings by the study participants (Strumse, 1996) and it has been assumed that species- and flower-rich field margins play an important role in improving the aesthetic value of a landscape (Marshall & Moonen, 2002). However, landscape preferences are influenced by people's knowledge, expertise and familiarity with a setting (Kaplan & Kaplan, 1989), and different groups of people might hold different preferences.

Hardly any study exists on how people perceive agro-environment schemes directly in the field. We, therefore, used an on-site approach to study the perception of and attitudes towards IFMs as a new agro-biodiversity conservation measure in Switzerland by passers-by. This case study is part of the research project 'IFM for Swiss agriculture'. Study participants were asked to rate the attractiveness of IFMs of different species richness and composition that were presented to them, to explain their rating and to state the number of species present. In addition, they were asked to imagine a field margin of their particular liking, to describe it, and to state their opinion on several aspects of IFMs.

In particular, the following questions were addressed: (1) Which aesthetic value do people place on IFMs when they are presented to them? (2) How would they like an ideal field margin to be? (3) What are people's attitudes towards the establishment and retention of IFMs? (4) Do plant species richness, the proportional cover of herbs and the presence of certain species in an IFM influence people's appreciation? (5) Does age, gender and perceived plant species richness influence people's responses to improved field margins?

Material and methods

The research project 'IFM for Swiss agriculture'

To optimise the ecological compensation programme of Switzerland, the research project 'IFM for Swiss agriculture' evaluated the biodiversity of conventional field margins in Switzerland, developed and tested species-rich seed mixtures and management measures to establish improved field margins, assessed the abundance of bioindicators, as well as pest organisms in IFMs, and studied the perception and valuation of IFMs by the public. In 2008, IFMs will be introduced as a new type of ecological compensation areas for agriculture.

In 2001 and 2003, 70 IFMs (each $5 \times 120\,m^2$) were randomly established in ten regions of the Swiss Lowlands. At all these sites, plant species had to be sown because initial studies had shown that a species-rich seed bank no longer existed. IFMs were sown between May and June 2001 and 2003 with different project-developed seed mixtures containing up to 38 annual and perennial grass and wildflower species for moist, fresh and dry conditions.

Typical species sown included *Arrhenatherum elatius, Centaurea jacea, Cichorium intybus, Daucus carota, Leucanthemum vulgare* and *Papaver rhoeas*. The selection and composition of species was derived from plant sociological literature (Klotz & Kock, 1986; Knop & Reif, 1982; Phillippi, 1971) and existing field margins (Theato, 2001). Except for some grass species, only seeds from Swiss regional ecotypes, available on the market, were used. Half of each IFM was mown alternately each year in the second half of August. The air-dried biomass was removed. No application of fertilisers and pesticides was allowed except for herbicides applied directly to problem plants, when mechanical control proves impossible.

The experimental sites were situated between a field track, another crop field or a gravel pit and a crop field and exclusively on arable soils. All IFMs were provided by farmers and were financially subsidised in the same way as the established ecological compensation area type "wildflower strips". This approach allowed coverage of a broad spectrum of site conditions in an usual on-farm context. Wildflower strips are strips of land at least 3 m wide running across or along the edge of an arable field. They are usually sown with a recommended mixture of indigenous arable weeds and species of ruderal sites. Thus, the seed mixture of IFMs differs from that for wildflower strips in containing grasses and perennial herbs. In contrast to wildflower strips IFMs are typical border structures. They are permanent elements on arable soils, whereas wildflower strips are usually two to six years old elements on arable land.

Design and data collection

The present study was carried out in five IFMs in the Cantons of Aargau, Baselland, Schaffhausen and Zurich. In each IFM, all plant species were recorded and the proportional cover of herbs was estimated.

IFMs contained a mean number of 43.3 plant species (range 36–56) with more than 90% of these species originating from the sown seed mixtures. The mean proportion of herbs was 40%. The five IFMs were selected according to their accessibility for passers-by, and were thus situated along field tracks that were used for recreation (taking walks, cycling and other activities) frequently.

In summer 2004, IFMs were presented to 108 passers-by (44% women). More than 90% of all passers-by addressed were actually willing to participate in the survey (between 9 and 39 participants per site). They were between 18 and 79 years old (mean age = 49). Due to the fact that the survey is a site-orientated case study, it was not designed as a representative opinion poll.

At each study site, the participants were asked with the help of a questionnaire to walk along the IFM, to rate the IFM by attractiveness on a six-step scale, ranging from 1: dislike it very much to 6: like it very much, and to explain their rating. In addition, they were asked to estimate the number of plant species present.

To investigate whether the project-developed IFMs corresponded with people's actual preferences, the same group was asked to imagine a field margin of their particular liking, to describe it, and to write down the plant species it should contain. Furthermore, study participants were asked to state their opinion about a number of statements concerning IFMs on five-step rating scales, ranging from 1 = strongly disagree to 5 = strongly agree, and to state whether IFMs should be left uncut during winter (yes, no), and to explain their answer. To visualise the winter aspect of IFMs, four photographs were shown to the study participants. They were also asked to discuss whether they approved or disapproved of the establishment of IFMs. Finally, demographic data were collected for all study participants.

Statistical analysis

To test for the appreciation of an IFM by the study participants, data were analysed by general linear models. Because of the hierarchical design of the study (different IFMs, study participants within IFMs), the effects of plant species richness and the proportional cover of herbs were tested against the residual variation among IFMs. In a second analysis, the effects of demographic variables (age, sex) and perceived species richness on participants' rating of IFMs were analysed in a general linear model (Type II sums of squares; Crawley, 2005). All analyses were carried out with SPSS for Windows 12.0.1.

Results

Neither plant species richness ($F_{1,3} = 0.32$, $p = 0.61$) nor the proportional cover of herbs ($F_{1,3} = 0.27$, $p = 0.64$) influenced participants' rating of an IFM. However, the appreciation of an IFM was influenced by the study participants' estimation of plant species richness (Table 1). The more species-rich a participant thought an IFM to be, the more he or she liked it. Moreover, older people scored higher in their rating of an IFM than did younger people.

Study participants responded positively to IFMs presented to them (mean score 5.4 on the six-step rating scale). When asked to explain their rating, they most often referred to the natural and aesthetically pleasing appearance of an IFM (Table 2).

To investigate whether the project-developed IFMs correspond with people's actual preferences, all study participants were asked to describe a field margin of their particular liking. Participants would like species-rich field margins with colourful flowering plants (Table 3). Moreover, their ideal field margins should look natural, wild, (structurally) diverse and similar to IFMs presented in this study.

The study participants were also asked to write down which plant species a field margin of their particular liking should contain. Respondents most frequently listed wildflowers at the genus or species-level such as poppy (*P. rhoeas*) and marguerite (*L. vulgare*; Table 4).

Table 1. General linear model (Type II sums of squares) of the influence of the identity of an improved field margin (IFM) and socio-demographic factors on people's rating (six-step rating scale) of the visual attractiveness of an IFM.

Source of variation	df	MS	F	*p*-Value
IFM identity	4	2.54	3.41	0.068
Estimated plant species richness	1	4.28	5.74	0.018*
Age	1	3.13	4.21	0.043*
Sex	1	0.38	0.51	0.479
Residual	99	0.38		
Total	107			

All effects were tested against the residual.
*$p < 0.05$

Table 2. Reasons given by 108 passers-by for their on-site rating of the visual attractiveness of an improved field margin.

Reasons	Responses (%)
Natural appearance	26.7
Aesthetically pleasing	22.3
(Plant) species richness and diversity	18.9
Flowers and colours	15.6
Increase in landscape diversity	14.4
Habitat for animals	13.3
Ecological enrichment, nature conservation	7.8
Habitat for rare species	6.7
Many grasses	1.1
Too many grasses	2.2

The reasons were grouped into broad categories. Multiple answers were allowed.

Table 3. Characteristic elements of the mentally created field margins.

Characteristic elements	Responses (%)
(Many) flowers and flowering plants	29.6
(Plant) species-rich	22.4
Similar to the extended field margin presented	21.4
Natural	19.4
Colourful	18.4
Diverse	13.3
Wild	8.2
(Many) grasses	8.1
Structurally diverse	7.1

Study participants were asked to describe how they would like an ideal field margin to be. The descriptions were content-analysed and characteristic elements to which people ($n = 98$) referred were grouped into broad categories.

We investigated study participants' opinion about a number of statements concerning IFMs. Participants responded positively to the characteristic features such as the naturalness and structural diversity of IFMs, and the establishment of IFMs (mean scores >4.0; Table 5). They did not think that IFMs should look tidier.

About 95% of participants agreed that field margins should be left uncut during winter. Uncut field margins were considered to be especially valuable during winter because they provide food, cover and hibernation opportunities for animals (Table 6). Moreover, participants thought them as natural and aesthetically pleasing.

Table 4. Plants that should occur in a field margin of people's particular liking.

Categories	Responses (%)
Local wildflowers	90.1
Poppy (*Papaver rhoeas*)	(29.7)
Marguerite (*Leucanthemum vulgare*)	(19.8)
Cornflower (*Centaurea cyanus*)	(9.9)
Mullein (*Verbascum spec.*)	(5.5)
Other wildflowers	(25.1)
Many different plants[a]	23.1
Typical plants for habitat or region[a]	18.7
Flowers[a]	15.4
Wildflowers[a]	15.4
Grasses[a]	12.1
Grasses in combination with other plants	(11.0)
Grasses alone	(1.1)
Colourful plants[a]	5.5

The answers were grouped into broader categories. 91 study participants answered the question. Multiple answers were possible.
[a]Not further specified.

Table 5. Opinions given on eleven statements concerning improved field margins.

IFMs	Mean score
Diversify the landscape	4.7
Beautify the agricultural landscape and increase its recreational value	4.8
Should look tidier	2.1
Appeal to me because of their diverse structure and height of plants	4.6
Appeal to me also when not in bloom because of their plant and animal diversity	4.5
Contribute to biodiversity conservation	4.7
Are an important habitat for beneficial organisms and endangered species	4.7
Bring natural elements back into the cultural landscape	4.8
Should be established more often	4.6
Are only beautiful when flowering	2.8
Improve the farmer's image	4.2

Study participants ($n = 108$) were asked to state their opinion using a five-step rating scale: 1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; 5 = strongly agree.

All study participants approved of the establishment of improved field margins, because IFMs most of all provide a habitat for species, maintain and enhance species and landscape diversity and are aesthetically pleasing (Table 7).

Table 6. Reasons why study participants ($n = 81$) approved of uncut field margins in winter.

Responses to uncut field margins	Responses (%)
Valuable habitat for animals	42.0
In general	(14.8)
Cover for animals such as hare, deer and insects	(12.3)
Hibernation opportunities	(8.6)
Food source for birds	(3.7)
Aesthetically pleasing	21.0
Natural process	18.5
Valuable habitat for plants (seeds, perennials)	13.6
Enrichment of landscape	9.9
Ecologically important	7.4

The answers to the open question were grouped into broad categories. Multiple answers were allowed.

Table 7. Reasons why improved field margins (IFMs) should be established.

Reasons	Responses (%)
Valuable habitat	38.2
For animals such as insects, birds, wildlife	(28.4)
For plants and animals	(9.8)
Important for biodiversity and nature conservation	27.4
Maintenance and enhancement of biodiversity	(18.6)
Nature conservation	(8.8)
Aesthetically pleasing	26.5
Enrichment of landscape diversity	24.5
Enhancement of landscape diversity	(14.7)
Natural element in landscape	(9.8)
Ecologically important	9.8
Integral part of ecological compensation scheme	2.0

A total of 102 study participants answered the open question. The answers were grouped into broad categories. Multiple answers were allowed.

Discussion

Study participants responded very positive to species-rich vegetation. The more species-rich an IFM was perceived to be, the more it appealed to them (measured by rating scores). Furthermore, study participants often justified their respective ratings of IFMs presented with terms such as 'species-richness' and 'general diversity'. Recently, Lindemann-Matthies and Bose (2007) have shown similar results. A high plant species richness was a typical feature of meadows that people created by themselves, and diversity was explicitly stated as a main assemblage criterion.

Study participants' preference for species-rich field margins increased with age. This might be explained by a greater familiarity of older people with species-rich plant communities (see also Lindemann-Matthies & Bose, 2007). In the last decades, due to the destruction of habitats and intensification of agriculture, both in Switzerland and elsewhere, species-rich plant communities strongly declined and thus the possibilities of the general public to become familiar with such vegetation types also declined.

The results of the present study are particularly remarkable because, in contrast to previous studies, the participants could directly observe and evaluate IFMs. Previous research on landscape preferences has typically relied on photographs as a tool for examining people's preferences and studying what features of vegetation are aesthetically pleasing (Scott & Canter, 1997). However, there is a growing debate within the area of landscape perception as to the suitability of using photographs as a substitute for the direct observation in the field (Daniel & Meitner, 2001; Scott & Canter, 1997).

In the present study, participants mentally created species-rich field margins full of flowering plants. This is a pleasing result because it shows that the people's actual preferences nicely correspond with reality, i.e. the project-developed species- and flower-rich IFMs. Some study participants even stated that their imagined field margin resembled the one presented to them in the field. Moreover, participants imagined an ideal field margin as 'natural' and 'wild-looking', justified their ratings of a real IFM in the field with its 'natural and aesthetically pleasing appearance', and agreed that species-rich field margins bring natural elements back into the cultural landscape. Other studies have also shown that naturalness was a particular positive feature of biodiversity for non-farmers, whereas farmers had different views of nature, for instance a more pragmatic and functional view of biodiversity (Fischer & Young, 2007; Visser et al., 2007). It can be assumed that non-farmers look at field margins with a layman's eye, and are thus probably more interested in the general appearance of the landscape than farmers might be (Soini & Aakkula, 2007). Previous research has shown that farmers' beauty ratings of landscapes were even negatively related to biodiversity (Van den Berg et al., 1998). However, in a recent Finnish study, the participating farmers pointed out that field margins were the only places within the

productive landscape where 'wild' species diversity could be allowed (Soini & Aakkula, 2007).

It has been suggested that people might not appreciate species-rich semi-natural vegetation such as field margins in set-aside land, because they may appear disordered and scrubby during long periods of the year (Hands & Brown, 2002; Nassauer, 1995b). Such attitudes might be deeply rooted in cultural conventions and customs which influence people's belief of how a setting should look (Burton, 2004; Nassauer, 1988, 1995a, 1995b; Soini & Aakkula, 2007). However, participants in the present study disagreed with the statement that species-rich field margins should look tidier. Furthermore, none of the study participants were concerned that IFMs might look untidy or scrubby, even in winter. They strongly agreed with the establishment of IFMs because they thought them to be a valuable habitat for animals and plants. This is in line with studies that found biodiversity in agriculture as being a vague but positive issue for local residents (Soini & Aakkula, 2007), and a growing nature-friendliness of the public in Western countries in general (Van den Born et al., 2001).

In the view of the study participants, an ideal field margin should contain local wild plants with large and colourful flowers such as poppy (*P. rhoeas*) and marguerite (*L. vulgare*). Other studies have also found a strong preference of humans for showy, brightly coloured large flowers (Lindemann-Matthies & Bose, 2007), and it has been suggested that such a preference may be related to the fact that bright colouring signalled food sources for people throughout evolution (Heerwagen & Orians, 1993). Annual plants such as *P. rhoeas*, although deliberately included in the project-developed seed mixtures to enhance the attractiveness of field margins at the outset of establishment, will disappear over time. However, it can be assumed that IFMs will not lose their appeal to people over years, because first experiences with the now six-year old IFMs indicate that they become more flower-rich over time, because of perennial species included in the seed mixtures (unpublished data). In a study by Asteraki et al. (2004), the percentage cover of perennial forbs in sown field margins increased in the second year after sowing.

The site-orientated nature of this study only allowed using a convenient sample (asking passers-by) and involving overall only eight IFMs and 108 people. Due to our non-random sample, our study participants are probably not representative of the Swiss public in general. As a consequence, great caution should be exercised in generalising results. However, the advantage of this method is the direct observation of an IFM in the field instead of using photographs (Scott & Canter, 1997). Moreover, people who actually spent their leisure time in agricultural land by walking or cycling are the ones who are directly confronted with agri-environmental measures, such as IFMs, and will most likely approve or disapprove of such measures.

Conclusions

Agricultural landscapes are part of the everyday environment for a large number of people, since they are often located in populated areas (Dramstad et al., 2001). Kaplan et al. (1998) have suggested that nearby natural areas should be designed and managed in ways that are beneficial for people and appreciated by them. Following this approach, the integration of people's ideas and preferences is seen as indispensable for a sustainable development of landscapes (Breuste, 2004).

With regard to the design and implementation of agri-environmental measures and programmes to enhance biodiversity in intensively used agricultural landscapes, the following findings of the present study might be of particular importance:

- Study participants placed great importance on the diversity and species richness of an IFM. Ecological compensation measures that aim to increase species richness in the agricultural landscape might, therefore, meet the preferences of the general public. However, more detailed investigation is needed.
- The assumption that people might dislike IFMs because they look somewhat scrubby and disordered, especially when uncut, was not corroborated. On the contrary, uncut field margins were considered to be especially valuable during winter, because they provide food, cover and hibernation opportunities for animals, which meets the biodiversity/conservation requirements.
- Study participants strongly approved of the establishment of IFMs due to ecological/conservation considerations and visual appearance criteria. These are pleasing results because the non-farmers' commitment to their natural environment might motivate farmers to get involved in on-farm nature conservation schemes (Herzon & Mikk, 2007; Luz, 1994).

The present results indicate that the well-designed ecological compensation measures such

as IFMs can enhance both biodiversity and the aesthetic quality of landscapes, and might become a successful new biodiversity conservation measure in intensively used agricultural landscapes both in Switzerland and elsewhere.

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