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Norsk Geografisk Tidsskrift - Norwegian Journal of Geography

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/sgeo20

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To cite this article: Grete Stokstad , Svein Olav Krøgli & Wenche E. Dramstad (2020) The look of agricultural landscapes – How do non-crop landscape elements contribute to visual preferences in a large-scale agricultural landscape?, Norsk Geografisk Tidsskrift - Norwegian Journal of Geography, 74:2, 111-122, DOI: 10.1080/00291951.2020.1754284

To link to this article: https://doi.org/10.1080/00291951.2020.1754284

Norsk Geografisk Tidsskrift–Norwegian Journal of Geography
2020, VOL. 74, NO. 2, 111–122
https://doi.org/10.1080/00291951.2020.1754284

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Short Article

The look of agricultural landscapes – How do non-crop landscape elements contribute to visual preferences in a large-scale agricultural landscape?

Grete Stokstad, Svein Olav Krøgli & Wenche E. Dramstad

Norwegian Institute of Bioeconomy Research (NIBIO), P.O. Box 115, NO-1431 Ås, Norway

ABSTRACT

Efficiency in agricultural food production has long been in focus and this has affected the spatial structure of agricultural land use. One outcome has been extensive criticism based on a wide range of negative consequences, such as for biodiversity, accessibility, cultural heritage, and aesthetics. In line with the European Landscape Convention (ELC), management of people's everyday landscapes is important. In Norway, agricultural landscapes are the 'everyday landscape' for a large proportion of the population. The aim of the article is to contribute to the understanding of landscape changes perceived as positive or negative by the inhabitants. The authors focused on grain-crop dominated landscapes and the impact of smaller non-crop elements on people's landscape preferences. They administered a photo-based questionnaire using manipulated photos to assess preferences for different agricultural landscapes. Additionally, people's perceived objectives for the agricultural sector and agriculture's primary functions were assessed. The results documented positive perceptions of added landscape elements and that people were both aware of and agreed on the multifunctional role of agriculture. The authors conclude that if the public's preferences are to be taken into consideration, such as during policymaking, it is important to maintain various landscape elements in the large-scale grain field landscapes of Norway.

ARTICLE HISTORY
Received 29 June 2018
Accepted 6 April 2020

EDITORS
Ivar Svare Holand, Kerstin Potthoff, Catriona Turner

KEYWORDS
landscape preferences, photo-based questionnaire, rural landscape

Stokstad, G., Krøgli, S.O. & Dramstad, W.E. 2020. The look of agricultural landscapes – How do non-crop landscape elements contribute to visual preferences in a large-scale agricultural landscape? *Norsk Geografisk Tidsskrift–Norwegian Journal of Geography* Vol. 74, 111–122. ISSN 0029-1951.

Introduction

Background

In the 1990s and early 2000s, the term multifunctionality was commonly used in discussions about agriculture and agricultural landscapes (OECD 2001; for a more detailed discussion, see Moon et al. 2017). Multifunctionality entails a broad acknowledgement that agricultural landscapes produce more than food alone (Renting et al. 2009; Moon et al. 2017). In discussions about subsidies, policy and trade, for example among members of the World Trade Organization (WTO), the main emphasis has been on the desirable functions or positive externalities, but a number of negative externalities such as nutrient runoffs have also been documented (Abler 2004; German et al. 2017). Since the mid-2000s, the term multifunctionality has appeared less frequently in the literature, and currently the focus is on sustainability (DeClerck et al. 2016).

In Norway, policies on agricultural development (e.g. St.prp. nr. 8 (1992–93)) have been developed to ensure production of the positive externalities while reducing the negative ones (Pretty et al. 2000; Daniel & Perraud 2009; Renting et al. 2009; Zasada 2011; Westhoek et al. 2013; Moon et al. 2017). Among the more common aspects discussed are how agricultural production and agricultural landscapes provide habitats and resources for large numbers of species (e.g. Stoate et al. 2001; Robinson & Sutherland 2002; Henle et al. 2008). Several studies also point to the importance of agricultural landscapes for tourism and recreation, as well as for the management of cultural heritage (Rønningen 1993; Hellerstein et al. 2002; Daugstad et al. 2006; Dramstad & Sang 2010; Kuiper & Bryn 2013). One driver of the discussion has been the recognition that certain changes in the agricultural sector, production methods, agricultural policy, and subsidy systems lead to landscape changes that affect the production of these positive externalities (Romstad et al. 2000).

CONTACT Grete Stokstad grete.stokstad@nibio.no
Supplemental data for this article can be accessed at https://doi.org/10.1080/00291951.2020.1754284

The spatial organization and structure of agricultural land use influences the land's capacity for the production of food crops. Efficiency in agricultural food production has long been in focus among agricultural organizations, farmers, and policymakers, particularly since WWII. Despite extensive criticism of what has been seen as a single-objective focus, with multiple negative side-effects (e.g. Harms et al. 1984; Smiley 1997; Stoate et al. 2001; Tilman et al. 2001), the trend of increased efficiency and intensity has continued in many regions, including those in Norway. In Norway, a slow but steady increase in farm size and field sizes has been observed (Fjellstad & Dramstad 1999; Dramstad & Sang 2010; Stokstad & Pedersen 2017). A typical landscape outcome has been the removal of various landscape elements that formerly divided the agricultural land into smaller units but were considered obstacles to efficient, large-scale grain crop production.

Motivation

Through their impact on farmers' incomes and the costs faced by farmers, agricultural policies significantly influence the choices farmers make and thus also how landscapes change. In Norway, official policy objectives such as expressed through government White Papers (e.g. St.meld. nr. 19 (1999–2000); Meld. St. 9 (2011–2012); Meld. St. 11 (2016–2017)), will lead to changes in landscapes over time. When formulating agricultural policy, an emphasis solely on productivity and efficiency will stimulate continued development in this direction. However, society is also concerned with other aspects of agriculture, such as environmental effects (Hellerstein et al. 2002; Hall et al. 2004; Westhoek et al. 2013; Moon et al. 2017).

Wilson (2001) suggests that the notion of a 'multifunctional agricultural regime' better encapsulates the diversity, non-linearity and spatial heterogeneity that can currently be observed in modern agriculture and rural society. Zasada (2011) stresses the topic of multifunctional agriculture, with a focus on peri-urban areas as areas of high demand for various functions. However, Hall et al. (2004) raise the concern that supplying non-market goods presents particular problems for optimal policy design, not least that of eliciting consumer demand for such goods, as little is known about how the public would prefer public support to be allocated. However, methods are available to elicit preferences regarding environmental issues, such as conjoint analysis, which has proved effective according to Alriksson & Oberg (2008). Furthermore, Moon et al. (2017, 276) argue 'in an economy where resource allocations are primarily determined by market forces, consumers'/taxpayers' preferences should play a substantial role in shaping the guidelines on multifunctional agriculture'. Their statement is in line with the requirements of the European Landscape Convention (ELC) which describes how each party signing the convention commits to 'establish procedures for the participation of the general public, local and regional authorities, and other parties with an interest in the definition and implementation of the landscape policies' (Council of Europe 2000, 11).

Given that it is well-documented that the agricultural landscape in Norway is changing, as in many other countries, it is relevant to ask whether the changes are in line with public preferences. In Norway, cropland covers only c.3% of the total land area (NIBIO n.d.). Furthermore, a large proportion of the population lives in close proximity to agricultural land (Aune-Lundberg 2017). As a consequence, the agricultural landscape is the major 'everyday landscape' (Council of Europe 2000) for a large proportion of the Norwegian population. Hence, addressing the question of whether landscape changes are in line with public preferences is even more timely.

Preferences for agricultural landscapes

A number of researchers have analysed public preferences for landscapes, including agricultural landscapes, in Northern Europe (Strumse & Hauge 1998; Kaltenborn & Bjerke 2002; Tahvanainen et al. 2002; Sevenant & Antrop 2009; Howley et al. 2012; Sang & Tveit 2013). Thus, we know for example that landscapes with water tend to be preferred to landscapes without water (Brush et al. 2000; Dramstad et al. 2006). In Europe, semi-natural areas in the agricultural landscape enhance preferences for the landscape. In a meta-study based on 41 studies from Western Europe, van Zanten et al. (2014) found that landscape attributes that described a mosaic-like land cover, included historic buildings, and the presence of livestock, in general scored higher on stated preferences. In studies that covered 'natural' landscapes or landscapes with 'wilderness', such landscapes tended to be scored higher than typical agrarian landscapes, at least by urban dwelling participants (Almeida et al. 2016). However, preference studies seldom yield the same detailed results for all participants (Howley et al. 2012). Some studies, such as the one conducted by Kupidura et al. (2014), have found that farmers had somewhat differing preferences compared with the population in general. Kalivoda et al. (2014) found that scores on aesthetic preferences tended to converge toward the extremes.

Grain production dominates the agricultural landscape in southern Norway, due to the national

agricultural policy, which is to promote and maintain grain crop farming in suitable regions. However, as previously mentioned (in the 'Background' section), the continued demand for increased efficiency influences the composition and configuration of the landscape. This affects the visual appearance of the landscape, which becomes more homogenous. The fact that Southern Norway is the country's most densely populated region emphasizes the role of the agricultural landscape as the 'everyday landscape' for a large proportion of Norway's population. This makes it relevant to policy development to analyse the landscape elements affected in terms of factors such as field size and the amount of semi-natural areas, and how they contribute to people's landscape perceptions.

The objective of the study reported in this article was to contribute to the understanding of what type of landscape changes should be encouraged or discouraged within large-scale agricultural landscapes dominated by the same type of crops. In order to be relevant to policy development, we assessed public preferences for changes that were so small that they could occur within the same landscape. We focused on the impact of typical elements in the form of field divisions and allées[1] in the agricultural landscapes of south-eastern Norway and investigated how different types of semi-natural areas and field sizes influenced people's preferences for agricultural landscapes with grain fields. Based on previous studies, we expected that the presence of such elements would be positive, but how much is enough? Accordingly, we also assessed whether people's perceived objectives for the agricultural sector appeared to be in line with which landscape they seemed to prefer.

Methods

Images

To identify preferences for landscapes or landscape attributes we used computer-manipulated images. The main reason for this choice was that we wanted to compare relatively small changes in the landscape. Having images with a similar colour tone and horizon simplifies comparisons and emphasizes landscape change. Moreover, the composition of photos may influence preferences (Svobodova et al. 2014). We thus aimed to reduce unintentional effects of changing the image composition and tried to maintain a balanced picture, as far as possible. We carried out a questionnaire survey in which participants were asked to rank photos in relation to which landscape the participants liked the most. Participants were not asked to rank photos based solely on the photographic quality.

Using a Likert scale to rank photos is a common practice in research (Hagerhall 2001). As we compared relatively small changes in the everyday landscape, we did not expect our study participants to use the total range of a Likert scale. Rather, we expected that the participants would have quite different images in mind when they thought about the most beautiful scenery and possibly when they thought about the ugliest agricultural landscape. We asked for a full ranking of sets of six photos. We limited the study to three sets of photos to limit the time used to answer the questionnaire. The three sets, each consisting of six photos, are respectively shown in Figs. 1–3.

The survey

The survey was conducted via the Internet and the questionnaire was available in English and Norwegian versions. We first asked for some demographic variables (for details, see Supplementary Appendix 1). Additionally, we asked: 'What are the most important factors to consider in the agricultural landscape?' We provided a list of five alternative objectives, from which more than one alternative could be chosen, and we included an additional possibility for participants to enter their own opinion. Although this reduced our alternatives regarding analyses of factors considered important to people, we decided to include the free text option because we would still be able to analyse differences between those who found only one or a few functions important and those who perceived multiple objectives as important for the agricultural landscapes in Norway.

Later in the photo-based questionnaire, six smaller images were shown in random order, side by side, at the top of the screen. Image Set 1 (Fig. 1) with the green field, which we thought would be the easiest photo to rank, was the last photo in the survey. The participants were asked: 'Please rank these photos based on which landscape you like the most (on the left) to the one you like the least (on the right).' If participants hovered the mouse over a particular photo, a larger version of that image was shown below the six photos. The smaller images could be dragged and dropped, so that the order of the photos changed. After ranking all three sets of photos, the participants were shown their own

[1]In Norway an allée is traditionally a line of trees or large shrubs along each side of a path or a road. In most cases, the planted trees belong to the same species or cultivar, thus giving uniform appearance.

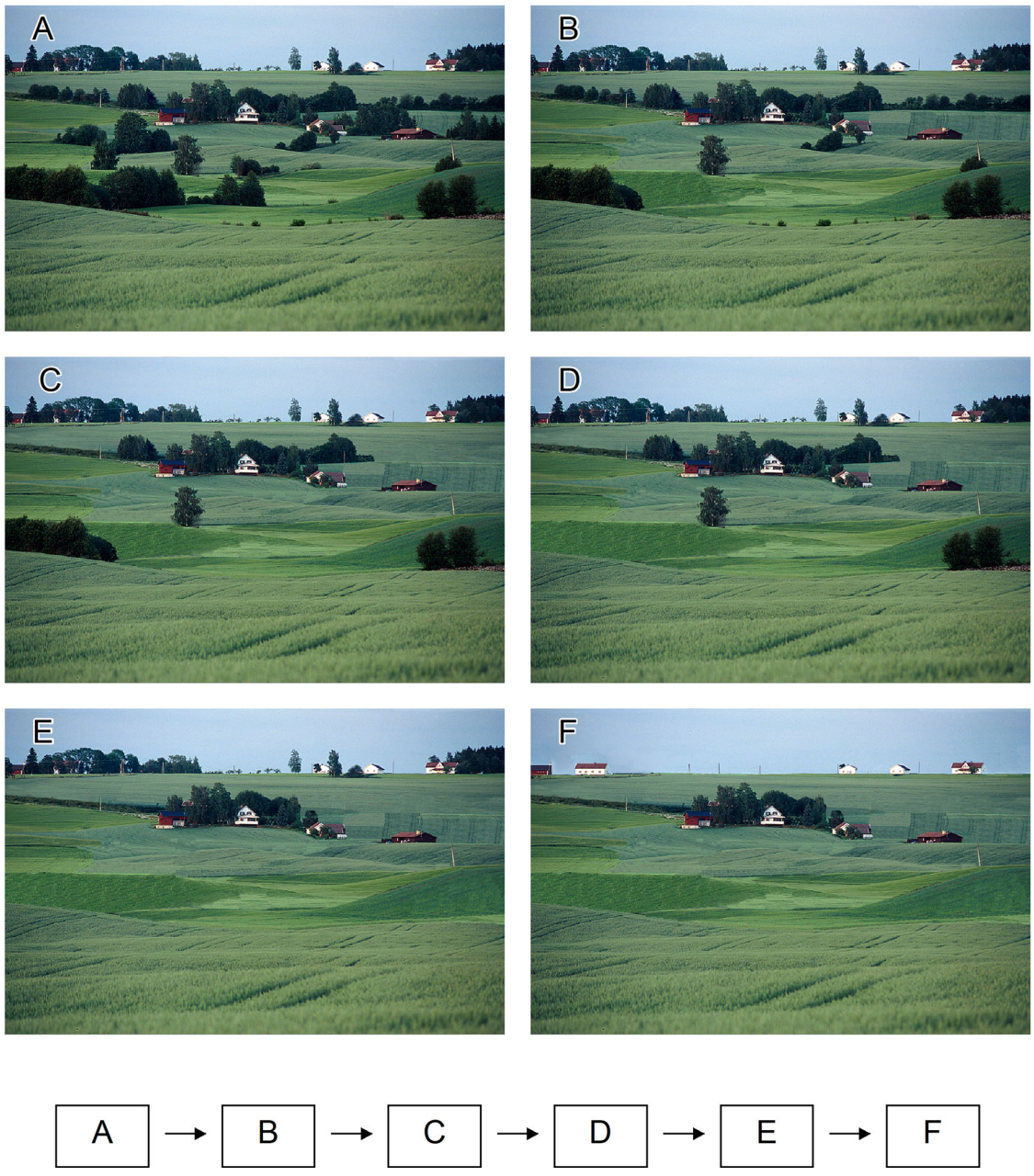

Fig. 1. Image Set 1 ('Green grain field'); the arrows show the order of removal of elements from the original photo (photo manipulation) (Photo: Oskar Puschmann, 7 July 2004)

rankings of the photos and given the possibility of changing the ranking.

Participants

We were concerned that some participants might perceive our survey as slightly complex and therefore we decided to focus on a limited number of specific groups as potential participants. We assumed that an introduction to the study by someone already familiar with the method would increase our response rate and ensure that potential participants would be committed to completing the entire survey. The choice of groups to approach was based on a desire to obtain participants from all age groups. However, the age of participants in the different groups was not known in advance. Unfortunately, we did not entirely succeed in this regard, as only a few of our participants were in their thirties. Still, our results did not show any large differences between the various age groups.

Our data sample was divided into three groups, respectively named 'Students', 'Choir' and 'Workplace'. Answers from 'Students' were collected with the help of students, often at social gatherings at the Norwegian

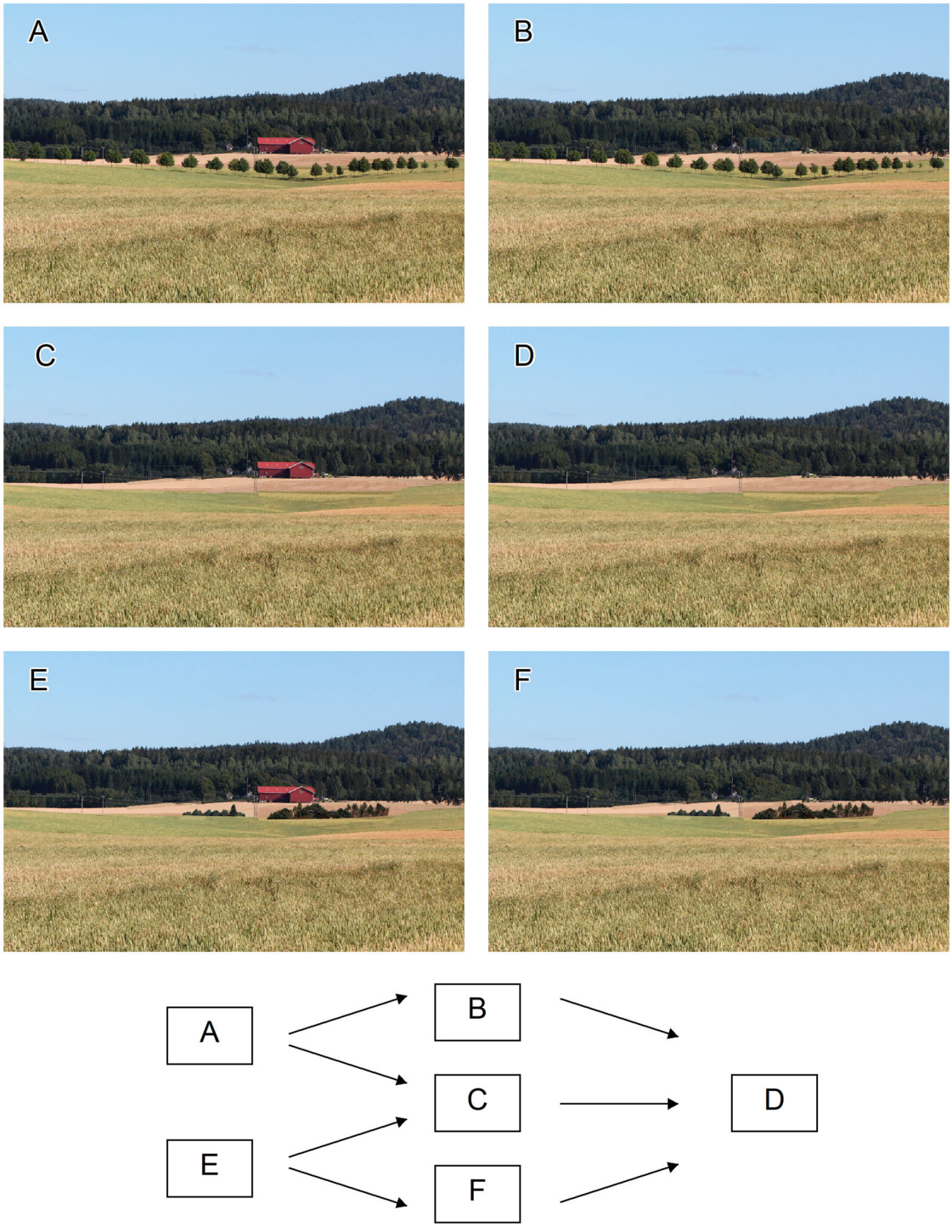

Fig. 2. Image Set 2 ('Yellow large grain'); the arrows show the order of removal of elements from the original photo (photo manipulation) (Photo: Oskar Puschmann, 18 August 2016)

University of Life Sciences, in Ås. The group numbered 112 participants. The 'Choir' group responses were collected from 51 members of two local choirs; the majority of the participants were in the age group 50–70 years. The 'Workplace' data were gathered from 52 participants who mainly worked at a research institute in Ås. The group did not rank Image Set 1, which means that overall there were fewer rankings for that particular set.

People with a background in farming or knowledge of farming were probably overrepresented in our sample. The workplace group accounted for a larger proportion of answers from people with work and/or an education related to agriculture than the general public (Table 1).

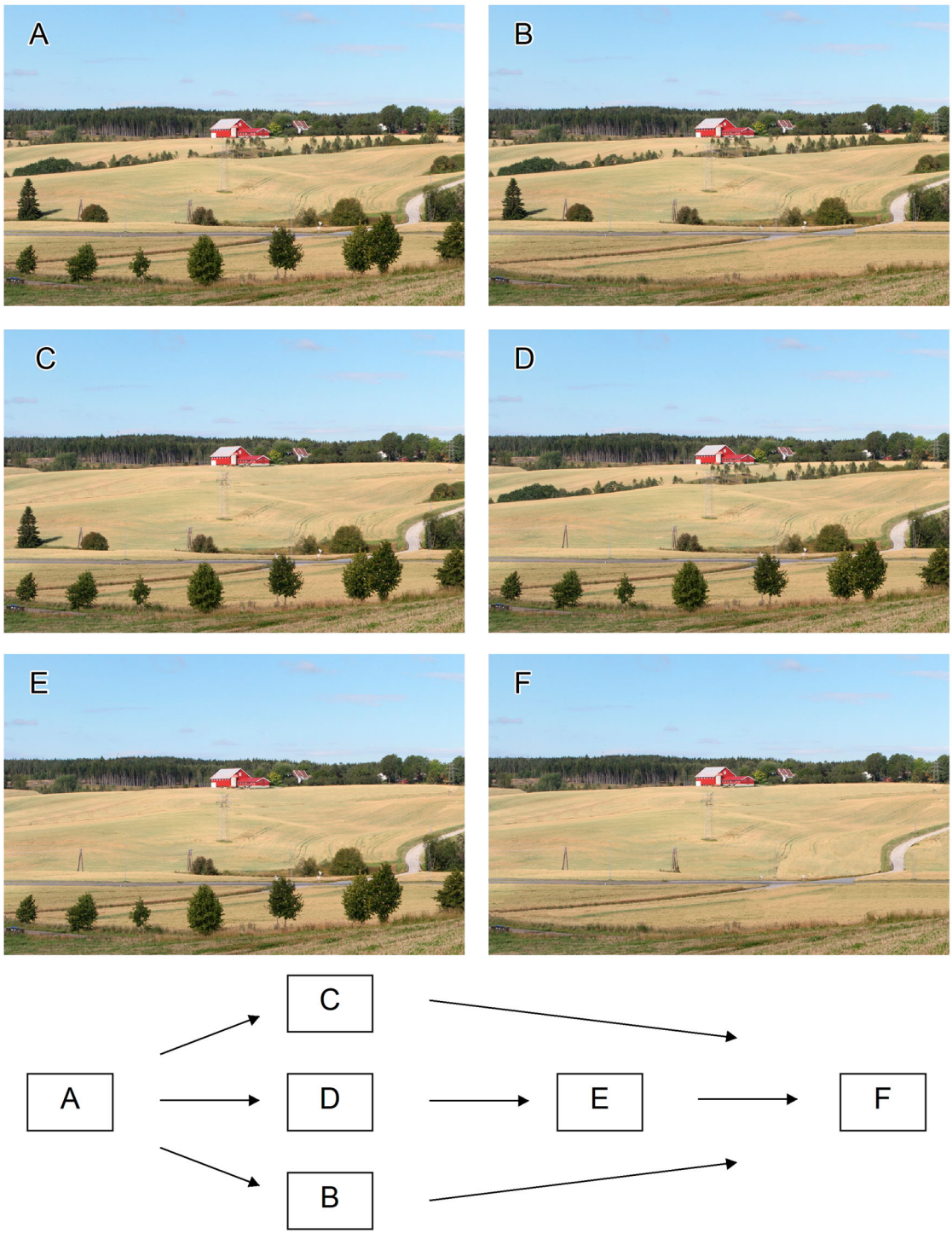

Fig. 3. Image Set 3 ('Grain field and green elements'); the arrows show the order of removal of elements from the original photo (photo manipulation) (Photo: Oskar Puschmann, 18 August 2016)

With regard to the student sample, the majority of participants were not studying agriculture-related subjects, and only 21% indicated that they had work and/or an education related to agriculture. As documented by Damstad et al. (2006), it might have been the case that certain interests were overrepresented in the student group, thus making them a slightly skewed subset of the Norwegian population

Our total sample for Image Sets 2 and 3 consisted of 215 participants. There were few participants in the age range 30–40 years, while younger participants accounted for almost 50% of all participants. Particularly the

Table 1. The study participants in the three samples and the total sample

Demographics	'Workplace'	'Students'	'Choir'	Total
Average age (years)	51	23	57	
Work/education related to agriculture	73%	21%	20%	33%
Female participants	42%	71%	69%	64%
Education:				
Up to secondary school	12%	58%	27%	40%
Up to 4 years at university	13%	32%	37%	29%
More than 4 years at university	75%	10%	35%	32%

workplace group had a large share of participants with higher education. All groups were dominated by female participants. Although gender has frequently been used as an explanatory variable in similar studies (e.g. Gao et al. 2019), gender is rarely a significant variable (Howley et al. 2012).

Results

Factors considered important in the agricultural landscape

Food production and biodiversity stood out as the most important alternatives in participants' responses regarding objectives that were important to consider in the context of agricultural landscapes. In total, 82% of the participants chose food production as the most important objective, while 77% chose biodiversity (multiple choices were allowed), regardless of whether the participants selected one, two, three, or four objectives. Culture and the provision of an open view were considered important objectives in agriculture primarily by participants who also appreciated at least one other aspect of the agricultural landscape. A large share of participants were both aware of and appreciated the multifunctional role of the agricultural landscape (Fig. 4). A mere 7% selected only one of the given alternatives as an objective, while most participants selected two or three objectives. Within the group 'Choir', which was dominated by older participants, almost 30% selected five objectives, compared with 12–15% in the other groups. For the group 'Workplace', a larger share tended to select only two objectives. Within the group 'Students', most participants chose three of the objectives.

Of the 254 participants, 10 added their own alternative objectives for the agricultural landscape. In most cases, their suggestions could be assigned to one of the other alternatives that they had already marked, for example 'paths for people and horses' (i.e. recreation) and 'maintaining soil' (i.e. food production).

Images ranking

The average ranking between the three groups of participants was fairly similar (Table 2). Image Set 3 was the most complex of the three sets and the participants spent the most time on ranking the set. In Table 3, only the order of the ranking of pairs of images is shown, not the distance between the image rankings. Thus, our results were not influenced by how far apart the rankings were, or more importantly which other alternatives were included in the ranking. The results might have differed if we had used a mean score rank test, in which also the distance in ranking would have mattered. The value in Table 3 shows how many times an image (row) was ranked higher than another image (column). The ranking of the images based on the sign test is shown in Table 4.

The results of a Friedman test based on scores for the rank of Photos A–F for three sets revealed significant differences in ranking within each image set. This implies that some of the participants had relatively similar preferences with respect to the ranking of at least some of the landscape images. The results of a post hoc Dunn's test and Wilcoxon signed ranks for paired data led us to draw similar conclusions to that for the sign test, with two exceptions. The former two tests did not reveal any significant difference between the mean scores for

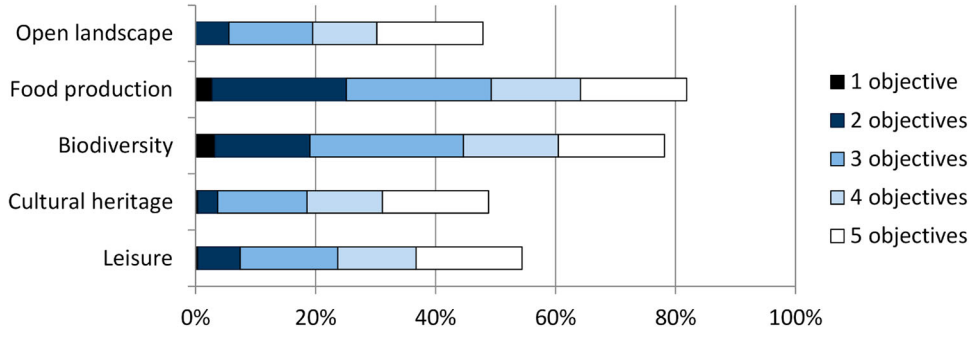

Fig. 4. The proportion of participants who selected each objective, and the proportion of participants who marked the same objective either as the only goal or as part of two or more goals for the agricultural landscape

Table 2. Percentage of images with a rank score from best (rank 1) to worst (rank 6), with average rank score for the images, and average rank score for each group of participants

Image set	Rank (best–worst)							Sample:	52	112	51
	Image	1	2	3	4	5	6	Mean rank		Student	Choir
1. Green grain field	1A	49%	9%	7%	6%	18%	12%	2.7		2.7	2.9
n = 163	1B	18%	52%	10%	13%	6%	1%	2.4		2.3	2.5
	1C	13%	15%	53%	10%	6%	3%	2.9		2.9	2.8
	1D	9%	13%	16%	51%	9%	2%	3.4		3.5	3.2
	1E	8%	7%	10%	15%	54%	6%	4.2		4.2	4.2
	1F	4%	4%	4%	4%	8%	76%	5.4		5.3	5.5
2. Yellow large grain fields								Mean rank	Workplace	Student	Choir
n = 215	2A	62%	21%	9%	4%	3%	1%	1.7	1.8	1.7	1.5
	2B	9%	24%	25%	22%	12%	7%	3.3	3.8	3	3.3
	2C	4%	5%	24%	18%	35%	15%	4.2	4	4.3	4.2
	2D	3%	3%	5%	5%	15%	70%	5.3	5.4	5.2	5.6
	2E	18%	40%	24%	11%	6%	2%	2.5	2.1	2.8	2.4
	2F	3%	7%	13%	41%	30%	5%	4	3.9	4.1	4
3. Grain field and green elements								Mean rank	Workplace	Student	Choir
n = 215	3A	55%	16%	10%	5%	7%	7%	2.1	2.3	2	2.2
	3B	11%	12%	42%	14%	19%	2%	3.3	3	3.3	3.5
	3C	9%	12%	18%	55%	6%	1%	3.4	3.5	3.3	3.4
	3D	15%	48%	18%	9%	7%	3%	2.5	2.6	2.6	2.4
	3E	6%	11%	8%	16%	58%	1%	4.1	4.3	4.1	3.9
	3F	4%	2%	4%	1%	3%	86%	5.6	5.4	5.6	5.5

Table 3. Number of times the different versions of each image was ranked higher than another version of the same image (e.g. 1A was ranked higher than 1B 85 times)

Image set	Image	**1A**	**1B**	**1C**	**1D**	**1E**	**1F**
1. Green grain fields	**1A**	0	85*	97	105	109	137
	1B	78*	0	111	120	131	150
	1C	66	52	0	114	129	145
	1D	58	43	49	0	126	142
	1E	54	32	34	37	0	141
	1F	26	13	18	21	22	0
	Sample 1					n =	163
2. Yellow grain field		**2A**	**2E**	**2B**	**2F**	**2C**	**2D**
	2A	0	159	182	190	194	202
	2E	56	0	133	176	194	193
	2B	33	82	0	151	138	188
	2F	25	39	64	0	117*	182
	2C	21	21	77	98*	0	172
	2D	13	22	27	33	43	0
	Sample 2					n =	215
3. Grain field and green elements		**3A**	**3D**	**3B**	**3C**	**4E**	**3F**
	3A	0	143	162	166	167	193
	3D	72	0	151	157	169	193
	3B	53	64	0	128	147	196
	3C	49	58	87	0	170	200
	3E	48	46	68	45	0	198
	3F	22	22	19	15	17	0
	Sample 3					n =	215

Note: *No significant difference at the 5% level between a random draw and the observed ranking of the two images

Photo 1A and Photo 1C, or of Photos 3B and 3C (Table 4). However, the mean scores for Photo 1B and Photo 1C were different.

In each image set, the relationship between the photos in terms of landscape elements is shown by arrows in Figs. 1–3. During participation in the survey, the landscape elements were either changed (only in Fig. 2) or removed between one photo and the next, indicated by the direction of the arrows. It should be noted that with one exception, namely the Dunn's test (and Wilcoxon signed ranks test) for Photos 1C and 1A which were ranked below Photo 1B, an image was never ranked significantly higher than the photo to the right, which was the image with fewer landscape elements.

Our general result was that when elements in the landscape were removed from an image of a large-scale grain-field landscape, the rank score tended to drop. The photo with the least number of elements in the landscape and thus also the largest field size was ranked lowest by the majority of the participants. However, for Image Set 1, most participants ranked Photo 1A as 'number one' and Photo 1B as 'number two', although the mean score for Photo 1A was higher (which implies it was less appreciated) than the mean score for Phtoto 1B. The results of all tests suggested that Photos 1A and 1B were not significantly different at the 5% level, while all other combinations had a sign score that was significantly different at the 5% level.

The distribution of the rank score for Photo 1A had a wider and different distribution than the other photos (Table 2). It appeared to be either highly preferred or not at all. Thus, we divided the participants into two groups based on the ranking of Photo 1A. The first group consisted of participants who gave Photo 1A a higher score (rank 1, 2 or 3) and the second group comprised those who gave a lower score (rank 4, 5 or 6). The difference in age between the two groups was minor. However, participants who had grown up or lived on a farm, as well as those who worked in a sector related to agriculture, were more likely to rank a large-scale landscape higher. While 84% of those who gave Photo

Table 4. Scores for images that differed at 5% significance level, based on the sign test, the Dunn's test and Wilcoxon signed-rank test for paired data

Image set (no. of scores)	Test	Best score*	Intermediate score	Intermediate score	Intermediate score	Intermediate score	Worst score
Image Set 1	Sign test	1B-1A		1C	1D	1E	1F
n = 163	Dunn's test	1B-1A	1A-1C		1D	1E	1F
	Wilcoxon signed rank test (paired)	1B-1A	1A-1C		1D	1E	1F
Image Set 2	Sign test	2A	2E	2B	2F-2C		2D
n = 215	Dunn's test	2A	2E	2B	2F-2C		2D
	Wilcoxon signed rank test (paired)	2A	2E	2B	2F-2C		2D
Image Set 3	Sign test	3A	3D	3B	3C	3E	3F
n = 215	Dunn's test	3A	3D	3B-3C		3E	3F
	Wilcoxon signed rank test (paired)	3A	3D	3B-3C		3E	3F

Note: *The ranking of best to worst scores was based on mean scores

1A a high rank selected biodiversity as an important factor, fewer participants (67%) who gave Photo 1A a low rank selected biodiversity.

Discussion

Responses to the introductory questions in the photo-based survey showed that in general the participants were both aware of and agree on the multifunctional role of agricultural landscapes. Nevertheless, when asked about the objectives of the agricultural landscape, the participants were reminded that an agricultural landscape could also be important for reasons other than agriculture. However, a large share of the participants chose biodiversity as an objective. Hence, the general result of a higher preference for a landscape with more potential habitat for biodiversity made sense. In general, we found that participants with a background in farming tended to be less critical of large-scale agricultural landscapes. Despite this, the overall result from the total sample demonstrated that more elements were preferred to fewer elements in the agricultural landscape.

Moreover, the results of the study imply that the landscape with the largest fields and the least amount of natural and/or constructed elements (houses and vegetation) was the least preferred landscape. This is also a landscape where we would expect lower biodiversity. However, it is possible that a greater number of 'other elements' within the agricultural landscape increased the appreciation of the landscape only within certain limits for some groups. This suggestion is based on results relating to Image Set 1, in which Photos 1A and 1B, the two photos with the greatest number of elements, were not significantly differently ranked. In addition, Table 3 and results of two of the tests shown in Table 4 show that the mean scores for Photos 1A and 1C were quite similar. We know from other studies that solitary trees are valued elements in the landscape (Kupidura et al. 2014; van Zanten et al. 2014). However, we suspect that for a solitary tree to 'stand out' and be highly valued, the specific location and surroundings will be important. Thus, despite Photo 1B having fewer green elements overall, it does show a tree that stands out as a solitary element.

Image Set 2 had fewer elements in the landscape than the other two sets. When elements were removed, the average rank score decreased. In the latter case, the images with an allée were ranked higher than photos in which the allée was substituted with natural vegetation. The allée dominated somewhat more in the photo than the division of fields with natural vegetation. This might have influenced the ranking, as we found that a greater number of 'other elements' improved the ranking in Image Set 1. Our results are in line with those from other studies that found that signs of stewardship influenced the value that people placed on the landscape (e.g. Sang & Tveit 2013). Photos 2C and 2F were ranked quite similarly. Photo 2F has more colours due to the barn, whereas Photo 2C has a green division of fields with natural vegetation. Both photos represent landscapes with some type of variation compared with Photo 2D, the lowest ranked photo.

The ranking of Image Set 3 strengthened our conclusion that fewer green elements, which also implies larger fields, suggested a less appreciated landscape. Photo 3A was preferred to Photo 3D by 66% of the participants (Table 3), despite only small differences between the two photos. Larger changes led to a higher share of participants preferring the alternative with more green elements to the alternative with fewer green elements. The landscape in Photo 3F was ranked lowest; the image also had the highest consensus in the ranking.

The results relating to Image Set 3 showed that positive elements in the foreground generally offset negative changes in the background. For example, keeping an allée in the foreground, as in Photo 3C, compared with increasing the field size and losing natural elements in the background might have offset the results for each photo, as exemplified by Photo 3B. The mean scores for the total sample were quite similar, 3.4 and 3.3 respectively and similar to those for the student sample. The two photos in Image Set 3 were also those for which the relative preference rankings were most similar to what was expected from a random draw.

Conclusions

Norwegian agricultural farming landscapes vary considerably. Our study focused on landscapes with grain farming. The photos represented an agricultural landscape at the larger end of the scale in Norway, a landscape in which farms as well as field sizes have increased steadily for decades. When farm size increases, neighbouring properties are often farmed by the same operator. This may cause field divisions such as grassy banks and rows of trees to disappear. However, it matters to the public how the landscape changes. To some extent, the findings from our study support those of previous studies, as we found some differences between participants with a farming background compared with participants with other backgrounds. Thus, based on our results, we cannot conclude that participant background did not influence the rankings of the photos to some extent. Simplification of the landscape, namely by removing landscape elements, can be profitable from a farming point of view. However, such actions may not be in line with maintaining biodiversity and general public preferences for the landscape. Also, we found that the least attractive grain field landscape had the fewest landscape elements. Thus, it seems that the study participants preferred some additional elements in the agricultural landscape. Therefore, in order to take the public's preferences into account, it is important to maintain landscape elements in the large-scale grain field landscapes of Norway. However, the details regarding the type of elements and the amount remain to be ascertained.

Acknowledgements

The research reported in this article was conducted as part of the Norwegian Research Council project Agrispace (no. 233810). Oskar Puschmann at NIBIO provided and manipulated the photos used in the survey. We also thank Graeme Bell of Balmourne Ltd., who programmed the web-based questionnaire, as well as all study participants, and the anonymous referees for their helpful comments.

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