



Changes in the Evaluation of Rural Landscape Before and After Farmland Improvement

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Abstract Rural landscapes especially in hilly and mountainous areas have been attracting attention of urban people and some farmlands have become busy tourist destinations. Other rural farmlands suffer from low workability, aging farmers, and declining demand for rice which often results in abandoned farmland. To address this, farmland improvement is being carried out to encourage continued sustainable agricultural production activities. This causes the change of shape and layout of plots, which are the components of the rural landscape. There have been many studies on the economic evaluation of landscapes, the recognition and impression of cultural landscapes, and the ecology of farmland improvement projects, but there have been few studies on the changes in the impressions of farmland landscape before and after farmland improvement. Therefore, in order to clarify the differences in the impression of the landscape before and after farmland development, we conducted a survey in the farmland development area of Hyogo Prefecture. Specifically, we asked district residents which of 16 rice field landscape photos they liked the best, and we then used a semantic differential method to ask them about their impressions of the selected landscape photos. In a related question, we asked how the local landscape had changed as a result of the farmland improvement project, and whether the changes were viewed as positive or negative. This questionnaire survey asked all local residents, but farmers in particular were asked how much time they spent working on the farm had been reduced and how much their labor productivity had improved as a result of field maintenance. After analyzing the survey results, it was found that the farmland improvement project had improved labor productivity and created a beautiful landscape. On the other hand, there were also a few responses that assessed that the landscape had deteriorated, which requires deeper consideration.

Keywords farmland improvement, landscape impression, SD method

INTRODUCTION

The size of each agricultural land is small, and labor productivity is low, resulting in high rates of non-cultivation and abandonment of farms in Japan. In order to minimize this trend, it is necessary to improve farmland to increase labor productivity. Due to the implementation of the farmland improvement project, the area of one cultivation unit was expanded and the landscape changed significantly. Research on the changes in landscape impressions before and after farmland improvement project has been limited to only a few regions (Ito et al., 2003). There are a few studies that have focused on landscape changes before and after farmland improvement projects that take landscape aspects into account, and the authors' research was the only one (Fujimi and Yamaji, 2020).

Regarding the maintenance and improvement of the environment and the landscape of rural spaces, eight areas were incorporated in Articles 3 and 34 of the Food, Agriculture, and Rural Areas Basic Act (1999). The revised Land Improvement Act (2001) established “consideration for

harmony with the environment” as a principle when implementing farmland improvement projects. Against this background, considering the impact of field maintenance projects on the rural landscape, it is recommended that farmland maintenance be done in harmony with the environment and consideration of the landscape. In 2007, the Ministry of Agriculture, Forestry and Fisheries issued the “Guide to Landscape Consideration in Agricultural and Rural Development Projects” as concrete guidelines. And in order to disseminate the idea of landscape consideration, “Technical Guidelines for Landscape Consideration in Agricultural and Rural Development Projects” were published in 2018.

Previous Research

Fujimi et al. (2006) pointed to an abandonment of cultivation and farmland improvement, which changes the shape and arrangement of farmland, as possible causes of landscape deterioration. Previous plots that matched the conventional topography were changed to rectangular plots or contour plots; stone walls and soil slopes were replaced with concrete blocks. Looking at the landscape, local people estimate the landscape value of each. Yamaji (1992) states that the long sides of a plot should be curved rather than straight, as long as they are parallel. Hagihara et al. (2013) considered the impact of farmland maintenance on residents' awareness of the landscape and compared the effects of farmland improvement with village areas. However, it has been stated that the preservation of biological diversity is a factor that influences awareness of landscape conservation, but this was not applied to fields such as rice paddies and fields. After the field is improved, farmers will begin to accumulate farmland and form large-scale agricultural management entities. Hosokawa et al. (2005) conducted a case study on agglomerations in hilly and mountainous areas and identified low labor productivity in the area. Matsuoka et al. (2017) focused on and summarized the situation of farmland agglomeration and found the constraints on agglomeration for individual management entities. Such agglomeration may also develop into the selective use of improved field drainage facilities or the further expansion of farmland plots. Naturally, when the farmland area is expanded, the landscape of the farmland also becomes different.

OBJECTIVE

Therefore, in this study, we aimed to ask local residents to evaluate how the farmland landscape changed before and after the implementation of the farmland improvement project, and to clarify quantitatively, using adjective pairs, how they felt about the farmland landscape before and after the project.

METHODOLOGY

Selection of Experimental Site

The preferred study site was to select an area where field development was carried out after the creation of the “Guidebook for Landscape Consideration in Agriculture and Rural Development Projects.” We listed the areas and considered the contents of the project and the possibility of cooperation with local leadership.

As a result, we chose the Yakata district farmland improvement project in Ichikawa Town, Kanzaki Region, Hyogo Prefecture. This district-level farmland improvement project has been underway since 2018. As of the month of 2024, surface construction has been completed, and cultivation is being carried out on temporary allocated land. Land replacement is currently underway, and the final project completion is expected in the month of 2025. This 36.7-hectare (ha) farmland improvement area is relatively flat with an average slope of 1/61, and it is along a river. The number of each cultivation plot was 640 and the size of it was 0.05 ha before the project and it became 70 plots with the size of around 0.5 ha after the project.

Evaluation Method

The semantic differential method (SD method) was adopted for landscape evaluation. The SD method is a method of measuring a subject's impression of an object by converting their impression into a numerical value. We placed adjectives with opposite meanings at both ends, such as comfortable - uncomfortable, favorite - hate, sophisticated - rustic. Respondents are asked to choose one of five choices. For example, it is very fun, fun, intermediate, boring, and very boring. Adjective pairs were collected from those used in past research completed by the same authors. We examined them and decided to use 24 pairs of adjectives.

Preparation of Photos

To evaluate the impression of the landscape, we obtained 36 photos from the Ichikawa Town Construction Division. Photos were taken before the farmland improvement project. We attempted to identify the location for each photo by reviewing the topography, the orientation to roads, and the background landscape. We identified five of the 36 photos, and after additional review, we selected four photos for our study.

The results are shown in Figure 1. Place of arrows A, B, C, and D are the locations and directions of photos taken before the project implementation, and **A**, **B**, **C**, and **D** are the photos taken at the same locations before and after the project implementation. We also prepared four photos after the project, i.e. E, F, G, and H, the locations of these photos are shown in Fig. 1. We selected typical four photos before the project, which were not identified the taken place, are shown at the bottom of Fig. 1.

For the landscape evaluation, we showed 16 landscape photos, which were randomly arranged, to be scored on a scale of 1-10. Then, the participants were asked to choose the photo with the highest score (if there were more than one photo with the highest score, they were asked to choose one). Then we asked them to choose the impression of the selected landscape photo by 24 adjective pairs.

The evaluation was conducted from January to February 2024, targeting all residents and their families in the Yakata area.

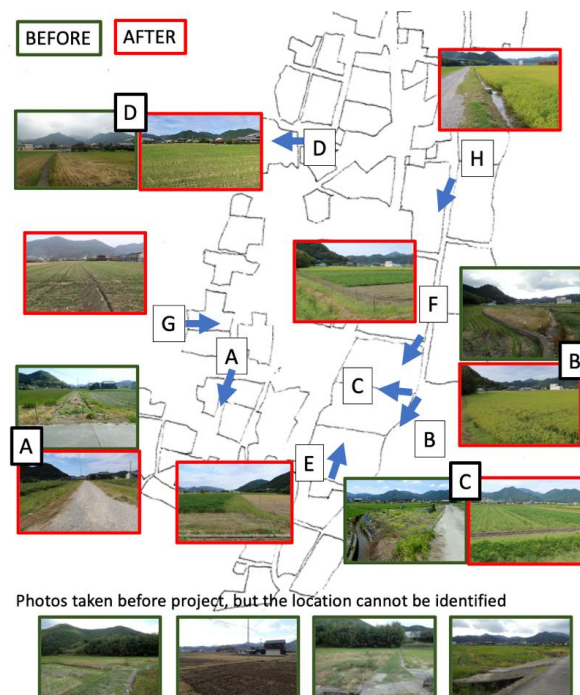


Fig. 1 Four sets and other eight photographs

RESULTS AND DISCUSSION

Execution of Questionnaire Survey

Four pages questionnaire sheet and three copies of the answer sheet were distributed by post mail to each of the 251 households in the Yakata district, and responses were solicited from residents of junior high school age and above. We asked each household to respond from at least one person, but we also informed them that, if possible, we would like to receive responses from family members living together. This is because if only one person answered, there was a risk that most of the answers would be by men. If two or more people respond, we can expect responses from women and young people as well.

Responses were collected by post mail. We received 75 answers; 52 were by one person, 20 were two persons from one family, and 3 were 3 people from one family. So, the total number of respondents was 101. The attributes of respondents are shown in Table 1. In terms of gender, there was almost an equal number of men and women, so it can be said that this is a good group of respondents. By age group, most of the responses were from elderly people, but since the original population distribution was also dominated by elderly people, we judged this to be unavoidable.

Table 1 Sex and age of respondents

Sex	Ratio
Female	47 %
Male	46
NA	8

Age	Ratio
10-19y	2 %
20-29y	3
30-39y	2
40-49y	5
50-59y	21
60-69y	18
70-79y	30
80y-	15
NA	5

Evaluation of 16 Photos

Respondents were asked to rate all 16 rice field landscape photos on their preference with a scale of 1 to 10. The fourth line of Table 2 shows the average evaluation scores. After scoring all the photos, they were then asked to choose the one they liked best among the 16 rice field landscape photos. The fifth line of Table 2 shows the number of people chosen as the top. 12 photos are selected as top by 1 to 21 respondents. 4 photos are not selected as the top by any respondent.

Seven of the eight photos taken after farmland improvement were selected as top. Five out of eight photos of the landscape before farmland improvement were selected as top. From this, it was found that there are many people who choose pictures of the landscape after farmland improvement, however, some people choose pictures of the landscape before the project.

Table 2 Average score and number of chosen as the best landscape

Photo Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Place	D	E	D	A	-	-	G	-	B	A	C	F	B	C	H	-
Before / After	B	A	A	B	B	B	A	B	A	A	B	A	B	A	A	B
Average Score	6.1	6.1	7.5	5.6	5.4	6.0	6.6	5.0	7.0	6.6	5.2	7.2	4.9	7.4	7.4	5.5
Chooed TOP	2	0	21	4	2	0	2	0	11	3	4	6	1	21	15	0

We prepared four sets of corresponding photos before and after farmland improvement. Figure 2 shows the evaluation result of four sets. At all points, the scores were higher after farmland improvement, especially at points C and B.

Evaluation by Using 24 Adjective Pairs

The landscape photos that received the most first-place votes were evaluated using adjective pairs to see how they were perceived. No. 14 and No. 15 are landscape photos taken after the project, and the average adjective evaluations are shown with orange dots and lines. No. 4 and No. 11 are

landscape photos taken before the project, and the average adjective evaluations are shown with blue dots and lines.

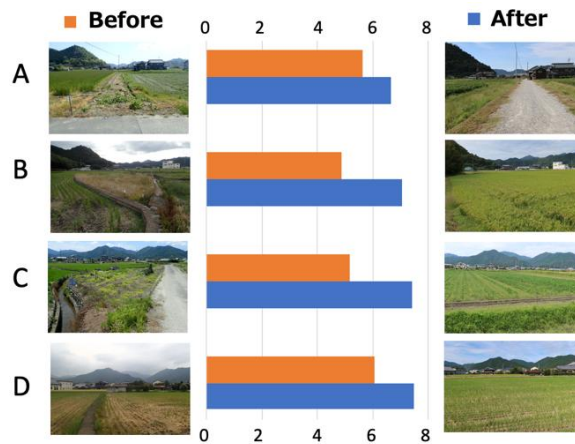


Fig. 2 Landscape evaluation of before / after project

These two sets of evaluation results are somewhat similar, but there are also differences. The landscape photos taken before the project were evaluated as rustic, rich in variety, cluttered, natural, rich in living things, and dynamic. The landscape photos taken after the project were evaluated as sophisticated, monotonous, artificial, and static.

Many people praised the landscapes taken after the project for being well-organized, but at the same time, they were also evaluated as monotonous and boring. This makes it clear that there is a certain number of people who think that the landscapes taken before the project were better.

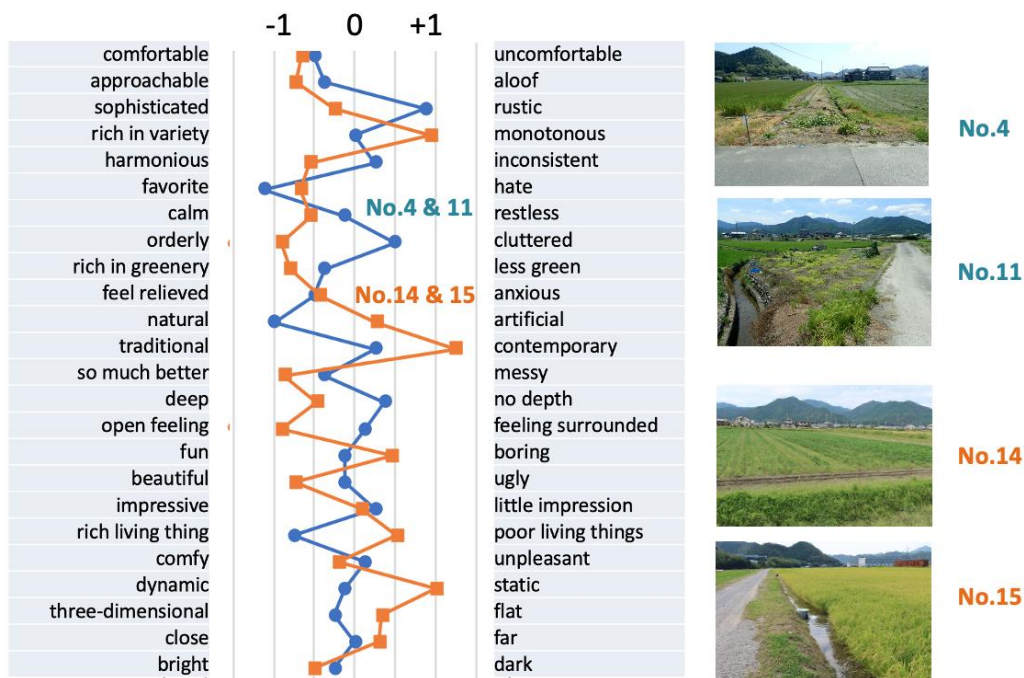


Fig. 3 Comparison of SD between two landscape groups

DISCUSSIONS

As mentioned in the previous section, it was found that the elements that show changes in landscape evaluation before and after farmland improvement projects can be described by specific

adjectives. Although the landscape after improvement is generally considered to be a good landscape, it is also important to point out that some good landscape elements before improvement have been lost. It was shown that in future improvement, it would be beneficial to add vegetation or establish a biotope to avoid evaluations such as monotony or poor living things.

In this field development, the previous 640 plots (average 0.05 ha) will be rezoned and changed to 70 plots (average 0.43 ha). In addition, irrigation canals that were previously open canals will be converted into pipelines. Of these things, the local government office estimated the agricultural work time per 0.1 ha will decrease from 39 hours to 15 hours.

This questionnaire survey asked all residents, but farmers, in particular, were additionally asked how much time they spent working on the farm had been reduced and how much their labor productivity had improved as a result of field maintenance. They answered much decrease in each farming work except for weeding. The first target of the project to increase labor productivity was achieved. On the other hand, the survey results regarding the scenery showed that the scenery is generally good. However, some respondents assessed that the landscape had deteriorated, so deeper consideration is required.

All photos used in the questionnaire survey had a known date and time. When taking photos after field preparation, I tried to take photos under similar lighting conditions as much as possible. However, the effects of seasonal differences on vegetation remained. At first, we considered processing the photo to make it look as if all the rice fields were being cultivated, but this was not done due to technical difficulties and the issue of what to do with elements other than the rice fields. In the future, we should deepen our consideration of the evaluation bias caused by these influences.

CONCLUSION

An attempt was made to ask not only the farmers who would benefit from the farmland improvement project but also all local residents, about the changes in the landscape caused by the improvement of rice fields. Although the response rate was only 30% in the household base, due to the method of requesting and responding by post mail, the ratio of male and female respondents was almost even, and some responses were from the younger generation. Regarding changes in the landscape due to the farmland improvement project, many respondents said that it had improved, which is an achievement, but it is necessary to examine the validity of the photos used in the survey and conduct a deeper analysis.

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