

Planning of the agricultural land use and water management system for preservation of ecosystem in the rural area

Kozue Yuge¹, Yutaka Oohira², Mitsumasa Anan³, Yoshiyuki Shinogi¹

1. Faculty of Agriculture, Kyushu University, Fukuoka, Japan
2. Kyushu Environmental Evaluation Association, Fukuoka, Japan
3. Takasaki Sogo Consultant Co., Ltd., Fukuoka, Japan

ABSTRACT

The objective of study is to clarify the effect of the land use condition on the surrounding ecosystem for planning of the agricultural land use and water management to preserve the ecosystem in the rural area. The field observation is conducted in the Tachiura reservoir command area, which located in Fukuoka Prefecture, south-west Japan. The kinds and number of the animals and plants are investigated in a conventional paddy field, paddy field applied the reduction of chemicals, ponded fallow field, upland field, and green house, respectively. The food pyramids are obtained using the investigations. In the ponded fallow field, the most various animals and plants are observed, comparing with other fields. The high-level consumers, including little egret and snake, are observed. The ecosystem is higher level, in order of the ponded fallow field, paddy field applied the reduction of chemicals, conventional paddy field, upland field, and green house. Using this result, the land use planning and improvement of the structure of the irrigation canal are designed to preserve the ecosystem.

Keywords: ecosystem, land use condition, water management, thermal environment, multi-functionality of paddy irrigation

1. Introduction

Paddy irrigation is used not only to supply water to crop, but also to create various environmental effects, including groundwater recharge, purification of the polluted water, flood mitigation, nitrogen cycle control, mitigation of local climate, preservation of ecosystem, and so on. The effect of the preservation of ecosystem is one of the most important functions of the paddy irrigation. The ecosystem in the rural area is affected by surrounding environment including water, thermal condition and so on. These environmental factors have a strong relationship with the land use condition. The objective of study is to clarify the effect of land use condition on the surrounding ecosystem for planning of the agricultural land use and water management to preserve the ecosystem in the rural area.

2. Study site



Figure 1 Location of study site.



Figure 2 Aerial photographic map around the study site.



Figure 3 Land use condition in the study site.

3. Field observation

The ecosystem investigation is conducted in a conventional paddy field, paddy field applied the reduction of pesticide, ponded fallow field, upland field, and greenhouse, located in the study site as shown in Figure 3. The number, kinds, and distribution of the living things are investigated. To clarify effect of thermal environment in the crop fields on the surrounding ecosystem, the surface temperature in the crop fields is observed using the infrared thermal imaging camera.

6. Conclusion

To clarify the effect of land use condition on the surrounding ecosystem, the ecosystem investigation and observation of the surface temperature are conducted in various crop fields. The observational results indicate that the thermal environment and water management condition affect the ecosystem in the crop fields. The highest-level ecosystem is investigated in the ponded fallow field. The improvement of the land use condition is suggested to create the habitat of frogs as a keystone species in the study site. From the observational results, field replotting and improvement of irrigation canal structure are effective to preserve the keystone species. It is an effective method for not only preserving the ecosystem, but also maintaining the agricultural productivity in the rural area.

4. Results and discussion

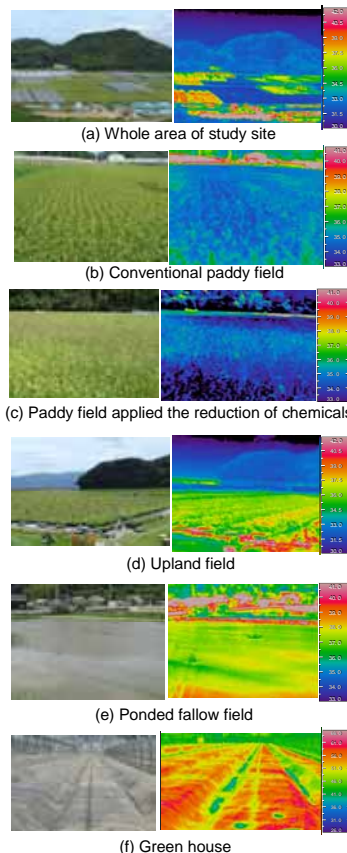


Figure 4 Thermal environment in the study site.

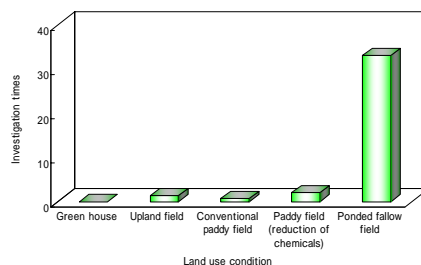


Figure 5 Investigation number of dragonflies (*Pantala flavescens*, *Orthetrum albistylum speciosum*, *Sympetrum frequens*, *Anax parthenope julius*).

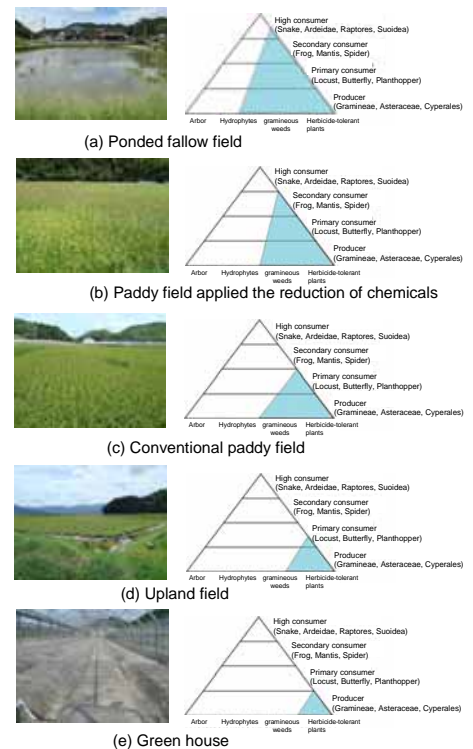


Figure 6 Food pyramids in the study site.

5. Planning land use condition for preserving ecosystem

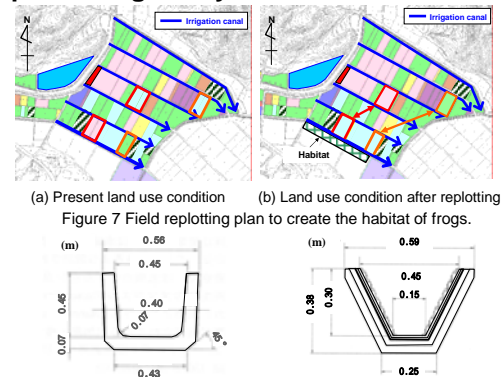


Figure 8 Improvement of irrigation canal structure.