Farmer's participatory approaches to improve cultivation for sustainable agriculture and G-contents and Ubiquitous information infrastructure using photo interpretative and interactive methods of remote sensing data

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Abstract - Since the computer power was restricted once, they needed special facility to analyze satellite data or they must do the photointerpretation. But by the downsizing of the computers, they can perform the analysis using their personal computer. But the residents in rural areas including farmers will not be familiar with such computer analysis. Therefore the author intends to revive the photographic interpretation for agriculture. In the rural planning, inhabitants including cultivator's participatory workshop method are effective. Large scale chart or aerial photograph are used at such workshop. If they used multispectral data, they could obtain crop conditions from it.

1. INTRODUCTION

Recently, there are many earth observation satellites equipped with visible sensor and microwave radar. Addition to that, its ground resolution for each pixel was quite improved and it is almost equal to the aerial photograph. But the computational procedure of remote sensing data is rather complicated for an amateur. The size of agricultural field is a little small comparing to the pixel size of remote sensing data in Asian countries. Therefore its application to agriculture is rather difficult from the point of view for the traditional ways of thinking. Then the author will propose the restoration of outdated photo interpretation method. It is now trial methodology, which is situated as one stage of the interactive and cyclic feedback procedure between farmers and scientists or consultants including administrative staffs.

The followings show the concrete procedure. The group work for brainstorming should be hold among farmers, specialists or consultants and local administrative staffs. The attendees make efforts to find various things about their farm lands by discussing soil moisture, meteorological components, and a vegetable growing stage, harvest timing of each field, management condition of fields, etc. viewing hard copy of satellite data. Depending upon the demands, specialists suggest something at that time or bring the data to the laboratory in order to analyze those digital media by means of computational method. The specialists will make the checking information with geo-data of rural areas as GIS database or G-contents. Therefore those results will be feed back to the group work and the group work should become deeper. If those sorts of farmer's participatory approaches and interactive and feedback process, employed information technology, applied to the GeoWeb, distributed and cooperative server design as G-contents and Ubiquitous information infrastructure, those could extend to Asian countries and might form the next generation information system or the promising Asian type of precision farming system.

2. STUDY AREA AND SATELLITE DATA

The study area is a village located at approximately 100 km northwest of Tokyo, on the northwest foot of Mount Akagi. The region is rather an inclined plane up from South-East down to North-West. The difference of sea level in this region is approximately 100 meters. And it is agricultural filed reclaimed after the World War II. Such agricultural fields are used as mainly vegetable field and its each area is larger than the ordinary Japanese field lot. The sort of vegetable is *konnyaku*, lettuce, cabbage, Chinese cabbage, brown beans, etc. The Akagi land improvement district manages irrigation facilities such as irrigation pipe lines, farm ponds in this district.

Figure 1 Showa village in this study area

Satellite data information

Satellite	IKONOS-2
Data acquisition date	November 18th, 2003 10:43am(JST)
Ground resolution	4m
Number of data bits	8 bit
Systematic correction	done
Cloud coverage	0

Figure 2 IKONOS natural color composite image (R-red, G-IR, B-green)

3. WORKSHOP

There is the cooperative group for agricultural production in this region, “Yasai club”, the vegetable club in English. The author planned the workshop when the leaf vegetable section meeting and the fruit vegetable section meeting were held. The IKONOS satellite data was prepared as a large size (over A0 size) photo printing paper of the natural colour composite set and it was presented to the vegetable producers at the workshop. They are amateurs in photo-interpretation or satellite remote sensing data analysis, and most of them are in their early 30s, rather young people. The workshop is not appropriately prepared in this time. Actually there is not any preliminary seminar on the interpretation of remote sensing data for them. Therefore the

participants of the workshop told many kinds of opinions and thoughts from their ordinary common knowledge as follows.

(1) The passing way of hailstorm was changed after the construction of “Kan-etsu” highway. (2) The portion of the remote sensing data photo printing image shows rather dark colour at the ravine where the drainage is not so well. (3) The green colour of the image should mean the spinach fields because of the season. (4) The summer in 2003 was the very hot season, therefore the lettuce was suffered from the high temperature. Can we detect such kind information from the photograph? (5) Can we find or analyse any relation between the amount of fertilizer or yield and the remote sensing image on a computer? (6) Can we find the driftage of agricultural chemicals in sprinkling? Because the authorization of organic farming requires such kind information. (7) The cost of remote sensing data is rather expensive than soil diagnosis or leaf colour measurement. (8) It is desirable that the vegetable fields of each farmer are located at the different sea levels by means of rental agreement of upland fields. Because it will be risk averse when the hailstorm or typhoon come. And the shipment of same kind of vegetable will continue longer than at plain fields, the farmer can use the same growing technology. (9) From the view point of the cooperative group for agricultural production, it is very important that they report the location of pest growth or the appearance of harmful insects or vegetable growth or content by amount of nitrate nitrogen to the group office after each farmer walk around their fields everyday, after that, the group officer should predict the vegetable production and shipping amount according to such information and meteorological data.

Figure 3 The office and meeting room of “Yasai club”, the cooperative group for agricultural production

Figure 4 Some members of “Yasai club”

4. FUTURE PLAN

The author’s purpose of restoration of the photographic interpretation of remote sensing data for the improvement of agriculture didn’t go well. But it is too early to conclude the failure judging from only one workshop.

In the future plan, the author let the specialist of such kind workshop in rural planning lead the meeting and explain the intention to the residents in order to get used to it. And as the targeted farmers were very young and they can easily use personal computer in this time, there is no digital divide.

5. CONCLUSIONS

The author and farmers have lacks of experience in handling farmer’s participatory workshop in this time. It was expected that the cultivators pointed out some farming notices by the photo-interpretation using printed out remote sensing data and the things which the specialists can’t notice should be found out. But since the gathering farmers were not the cultivators in the areas of the remote sensing data at this workshop, the result was against the author’s plan.

But it should be very important that they try to expand the satellite data application to the ordinary people as the entrance to Ubiquitous information infrastructure or g-contents, in which any content is attached to its located information and the content is distributed among telecommunications services.

6. ACKNOWLEDGEMENTS

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