

Inventory and Classification of Agricultural land Resources in Taiwan

Tsai, Hsiu-Wan

Agriculture Land Resources Planning Section,

Department of Planning, Council of Agriculture, Chinese Taipei

Abstract:

For the sake of protecting agricultural land resource to ensure food security and stability, Taiwan has conducted agricultural land resource inventory in 2011. This task is not to survey the crops on the farmland, but to investigate the location which deserves for cultivation. According the location and characteristic, the agriculture land is defined the three kinds of land, production, conservation and non-production agricultural land. Besides, the classification of agricultural area has been conducted. Four types of agricultural productive areas are categorized to map out the high-quality agricultural production area. These results will be used to make the policy and management of the agricultural land.

Keywords: Agricultural land resources inventory, Classification of agricultural area

1.Introduction

The land of Taiwan is about 36,000 square kilometers, approximately 70% belongs to the hillside, and only 30% belongs to the plain area which is suitable for agriculture or urban or rural uses. Due to the rapid urbanization, industrialization, and the competition of land for other uses, the agricultural land is decreasing. Besides, the fragmentation, pollution and deterioration of farmland influence the sustainability of agricultural land resources and also affect the food sanitary. The issues of environmental impact, food production, resource conservation and food security matters are important in Taiwan's agriculture land. For the sake of improving the agriculture land use and food security matters, nationwide agricultural land use and food security conferences have been held in Jan. and May 2011. Their conclusions and suggestions such as to promote self-sufficiency ratio of food, to conserve and protect good agriculture zone for agricultural use etc, have been set up as the agriculture policy to be carry out. After the conferences shown above, a nationwide farmland inventory soon to be held in late 2011 in order to comprehend the present use of farmland as a basic data for land use planning and management.

2. Agricultural land resources inventory

The purpose of the inventory is to know the status and distribution of current agricultural land resource for the consideration of food security. The inventory not

only statistic the area of agricultural land, but also understand the farmland where is over reconstruction for agriculture facilities, farmhouse or other buildings or where is deserved for cultivation. In addition, the work is not to identify whether the farmland is legal use or not, but to grasp the area of superior farmland.

To understand the land use situation, the Ministry of the Interior conducted the first and second national land use inventories, which were carried out at 1993 and 2006. The results just revealed the existing status of land use nationwide. It did not analyze or classify the character of agricultural land resource comprehensively.

The other agencies in Taiwan also have made some surveys for their official needs. And the geographic information system (GIS) technology has become more popularized in the field of land use planning for special datum analysis. For the sake of making full use of existing data which were surveyed by other agencies in Taiwan, in order to reduce expenditure and improve the effectiveness of inventory, the Council of Agriculture (COA) collects relevant maps from other agencies firstly, and applies the GIS technique to analyses the data. Three kinds of agricultural land is defined of production, conservation and non-production land. The preliminary result also has been double checked by field investigation and aerial photographs.

In 2011, the framework of inventory job has been figured out first, and all of the relevant maps have been lumped together. The job for the most part in 2012 is to differentiate the discrepancy between the mapping data and the latest aerial photographs. Any site is doubted about discrepancy, it has to be checked on the spot.

2.1 Working flow chart

The overall procedure is divided into three phase of planning, inventory and analysis. Figure 1 shows the flow of those phases.

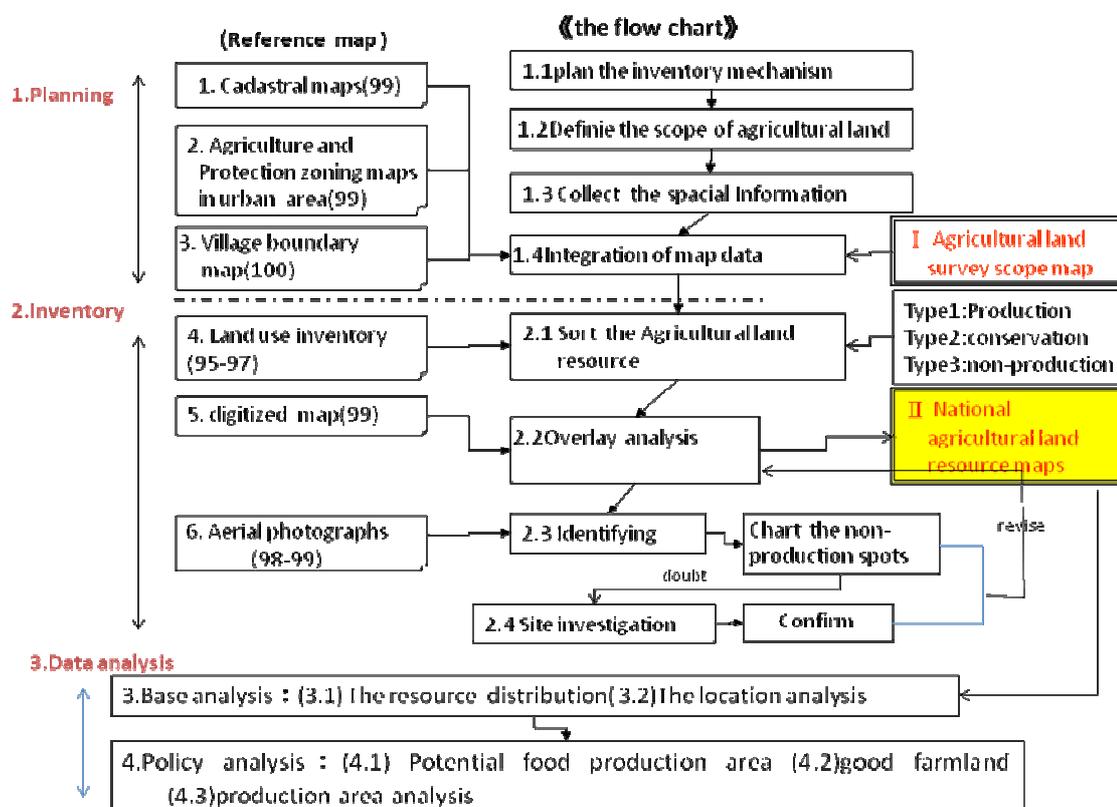


Figure 1: The inventory procedure of the agricultural land resources

2.1.1 Planning stage (Preliminary Analysis)

This is a stage of preparations. The work in this stage includes planning the overall schedules, defining the scope of the inventory, collecting the relevant maps which were made by other agencies. These data embrace the cadastral maps, agriculture and protected zones of urban planning area, municipalities (counties) boundary maps, land use map, digitized map, and aerial photographs.

2.1.2 Inventory stage

A. Classification of the agricultural land resource

In accordance with the cadastral map, land use map and the urban planning map, the boundry of agricultural land can be drafted. Based on the results of the 2nd national land use inventory the agricultural land resource is classified into the production, conservation, and non-production land.

Considering 3-4 years time lag of the 2nd national land use inventory , the digitized map which was done in 2010 is used to identify the non-production spots, and then the map of the agricultural land resources is accomplished.

Production land can be subdivided into farming, pasturage, and fishery. Conservation land can be subdivided into the forests, wetlands, shrubs, and disuse. The non-production land is the location of buildings or facilities, such as agriculture facilities, farmhouse, or other illegal buildings.

B. Interpretation of the aerial photograph

In order to improve the accuracy of the result, the latest aerial photograph has been used to distinguish the differences with the digitized map and identify the new location of non- agricultural use.

In this stage, the satellite image data is not used to analyze the variation, mainly due to the lack of precision of the satellite images for spatial analysis. The job of interpretation of the orthophoto consumes more manpower and time, but the accuracy is relatively well. In order to conduct the work, we also establish the principle of plotting the variations and the matter of pay attention to.

C. On-site checking

If the case is difficult to judge the status of production or non-production, on-site checking is necessary. The on-site checking is done by the official in the local government. In order to check actual status, the COA has set up the working procedures, held the training courses, edited the handbook, and prepared aerial photomap for their reference. The on-site checking is carried out by the township official, and then the official from county government makes a spot check randomly. The spot check also has to check its documents and confirm its legitimacy.

2.1.3. Data analysis stage

The results of the agricultural land resource inventory are used to do some basic statistical analysis, in order to understand the existing area of the agricultural land and its situated location. It has been used to make some policy analysis, such as potential food production areas, the boundary of the good agricultural land and agricultural production location.

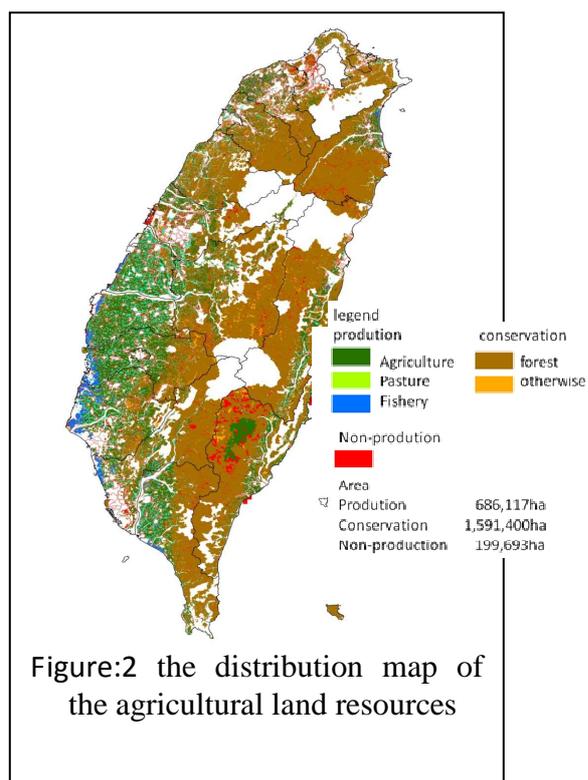


Figure:2 the distribution map of the agricultural land resources

2.2 Preliminary results

Around 2.48 million hectares of agricultural land has been surveyed. Within the area of this inventory, the production agricultural land (e.g. cultivation, pasture and fishery) is estimated about 686,000 hectares, the conservation agricultural land (e.g. forests, wetlands, etc.) accounted for 1.591 million hectares, and non-production agricultural land (e.g. water conservancy facilities, agricultural facilities, farmhouses, roads, public facilities and other buildings, etc.) accounted for 199,000 hectares.

The result shows that agricultural land surrounding the metropolitan areas or close to the main roads or large development areas, its fragmented or abandoned situation is more serious than in other regions. In the future, for the case of converting agricultural land to urban development or other uses is necessary, the location should be considered whether it will cause fragmentation of agricultural land resources or not.

3. Classification of agricultural development area

Due to the fact of that agricultural land resource in Taiwan is scattering over plains, hillsides and alpines. That agricultural land supports all kinds of agriculture, such as farming, forestry, fisheries, pastures, etc. Agriculture land resource not only provide food products for our demand, but also supply the open space, landscape features, maintenance of the ecological environment, and other multi-functions. The classification of agricultural land is for the purpose of ensuring food security, therefore, only the land in the main agricultural area has been classified. Forest or environmental sensitive areas, e.g. disasters sensitive areas, wildlife protected areas etc. are not involved. Besides, the classification is base on the conditions of the productivity and location land, in order to map out the high quality of production land, and the suitable way of agriculture land use.

3.1 Classification principle

The classification of agricultural area is evaluated based on the production and location of the agricultural land. To avoid too crushing of grading causing problems of integration of land use and being advantageous to policy analysis, four types of agricultural productive areas are categorized. The definition and characteristics of each type is described as follows:

- (1) Class I: With good agricultural production environment, and has invested the constructions of major agricultural facilities.
- (2) Class II: Still suitable for cultivation, and has the function of food production.
- (3) Class III: Still suitable for cultivation, but is affected by the external factors, such as neighboring the industrial zone, science park, or the highways and

interchanges.

- (4) Class IV: Located at the hillside for cultivation, but not in the environmental sensitive areas.

3.2 Process of classification

- (1) Defined boundary of farmland

Only the land within the agricultural area are for evaluation and classification, not including the areas of eco-resources conservation, landscape conservation, water conservation, and potential hazard etc..

- (2) Collect maps

Collecting related mapping data is the primary work for farmland classification. Some of those data have been collected via agricultural land resources inventory already. Some were completed by other agencies, e.g. productivity map, irrigation/drainage map, important crop production areas etc....

- (3) Develop the classification criteria

Criteria for classification are discussed through many times of the expert consultation.

- (4) Grading principle

By the definition of grading and the results of the expert meeting, the sequence of grading first is the class I, the second order is the class III and class IV, the last order is the class II. The grid system has been introduced into this analysis, but according to the road or river boundary to define the smallest partition unit. Those partition units have been integrated into polygon format and been analyzed via spatial data overlap techniques.

- (5) Results review

According to the above-mentioned methods of classification and the application of geographic information system techniques, the classification of agricultural development areas has completed. In order to make the results more useful, the check mechanisms has been set up, which includes to check the results with the aerial photographs and on-site checking by townships official.

3.3 Classification criteria and designation of agricultural areas

- (1) Criteria

Table2: The classification indicators of agricultural areas

class	Characteristics	Mapping Criteria
Class I	(1)With good production environment	•Important Agricultural Development Area

	(2) Maintain food security	<ul style="list-style-type: none"> Rice suitability class I or class II areas Hillside classification criteria is class I to class II
	(3) Has invested in major improvements in agriculture facilities	<ul style="list-style-type: none"> Irrigation area Important agricultural operations area or agricultural production areas
	(4) Large-scale and full of agricultural land	<ul style="list-style-type: none"> analysis unit within the area of agricultural land greater than 25 hectares and % of agricultural use is ratio greater than 70%
Class II	(1) Still has good agricultural production environment	<ul style="list-style-type: none"> The same with Class I
	(2) Not reach a certain size or the situation is scattered	<ul style="list-style-type: none"> Agricultural land less than 25 hectares or agricultural use less than 70%
Class III	(1) can produce the food of agricultural land	<ul style="list-style-type: none"> Agriculture use
	(2) Vulnerable to external factors interfere with agricultural land	<ul style="list-style-type: none"> Neighboring the specific area of the high-speed rail, Interchange, Industrial Zone, Science Park, Urban development areas, and the use of agriculture is less 30%.
Class IV	<ul style="list-style-type: none"> located in hillside and does not belong to the conservation areas 	<ul style="list-style-type: none"> Hillside classification criteria is class III to class VI and not in the conservation area.

(2) Analytical methods

Many kinds of methods of land use suitability analysis techniques can be used to grade the agricultural development area, such as Point method, Factor combination method, and Land Evaluation and Site Assessment (LESA). The Factor combination method is adopted in this analysis. The evaluation criteria have been organized according to their characteristics, resulting in a variety of combinations, to define different of classes of the agriculture areas. In addition, the software of ArcGIS is used to analyze the spatial data.

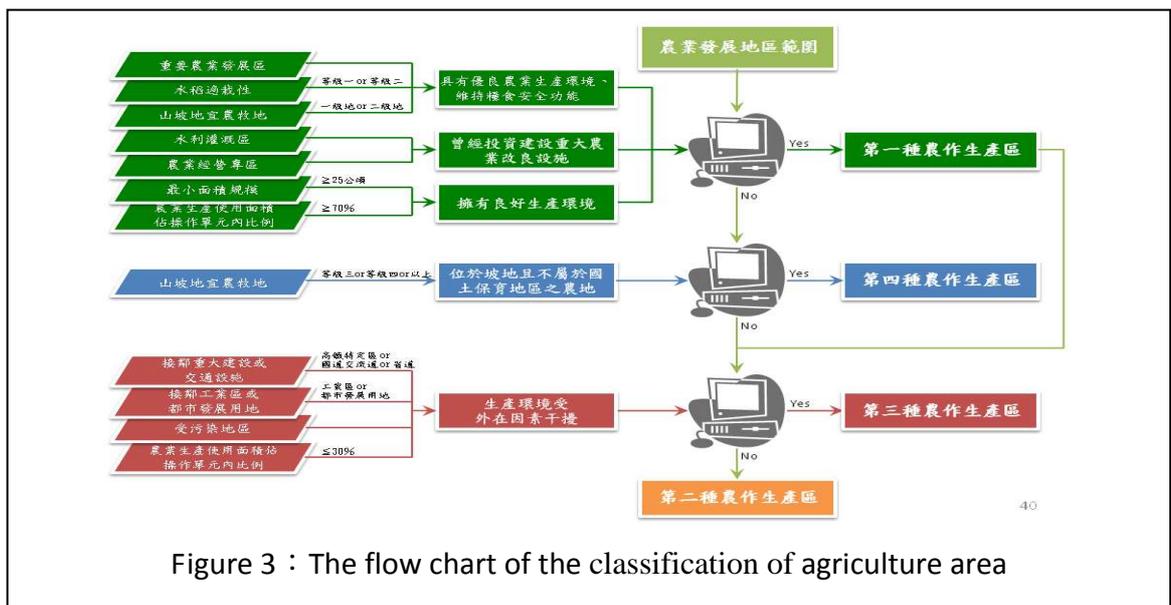


Figure 3 : The flow chart of the classification of agriculture area

3.4 The example of classification

In order to confirm the classification method is useful and suitable for the nationwide, Yunlin County was selected as a pilot project. Yunlin County is one of Taiwan's major food production county, with 20 townships and 130,000 hectares of land. The 78% of the land is located at plain area, and the other 22% at sloping area. The area of agriculture land is about 93,000 hectares, for growing rice, grains, vegetables and other crops.

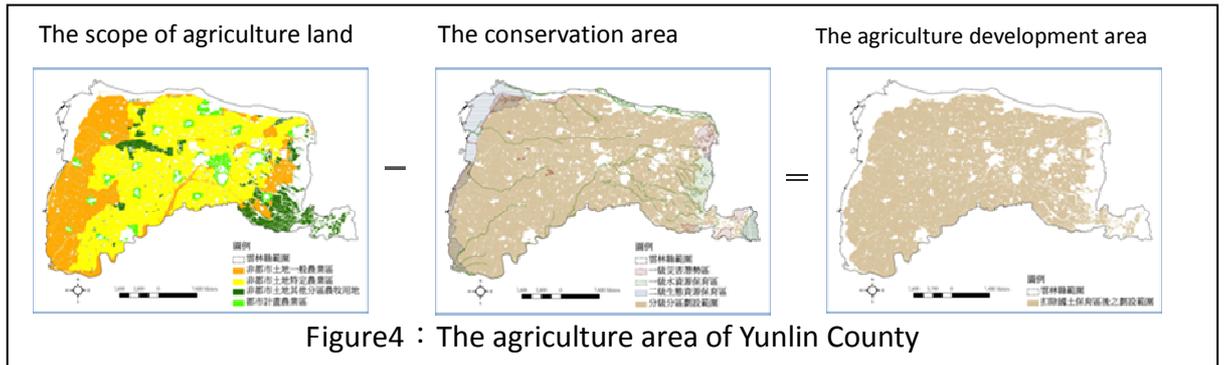


Figure4 : The agriculture area of Yunlin County

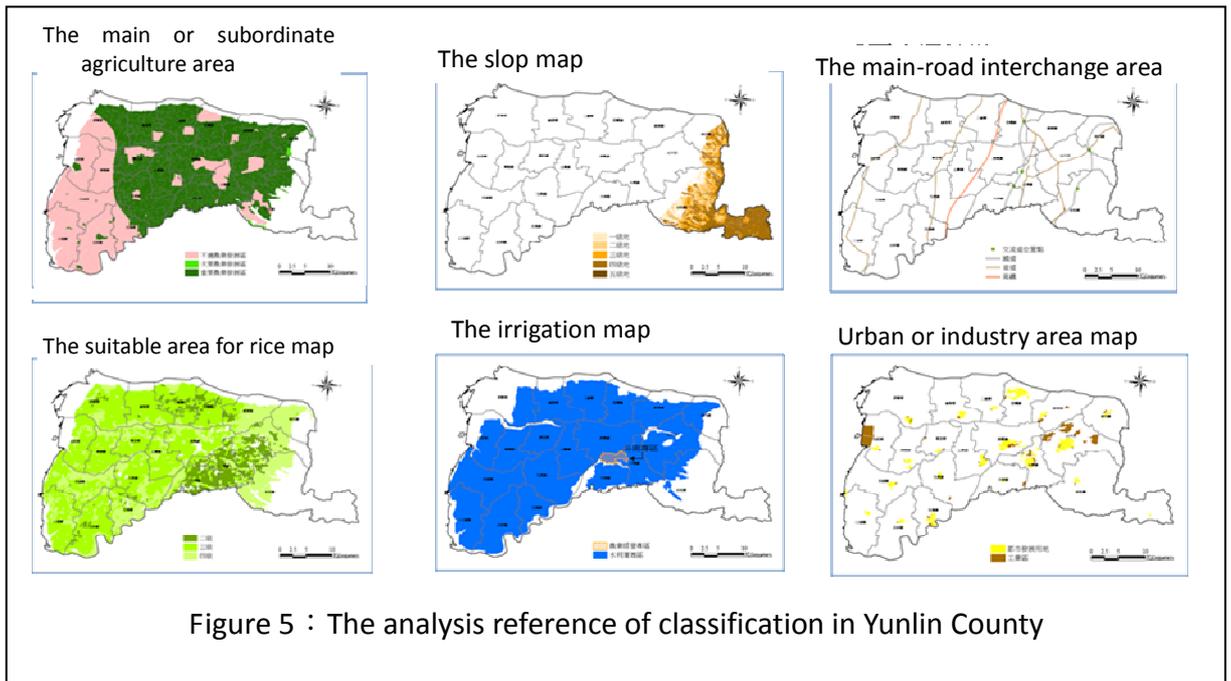
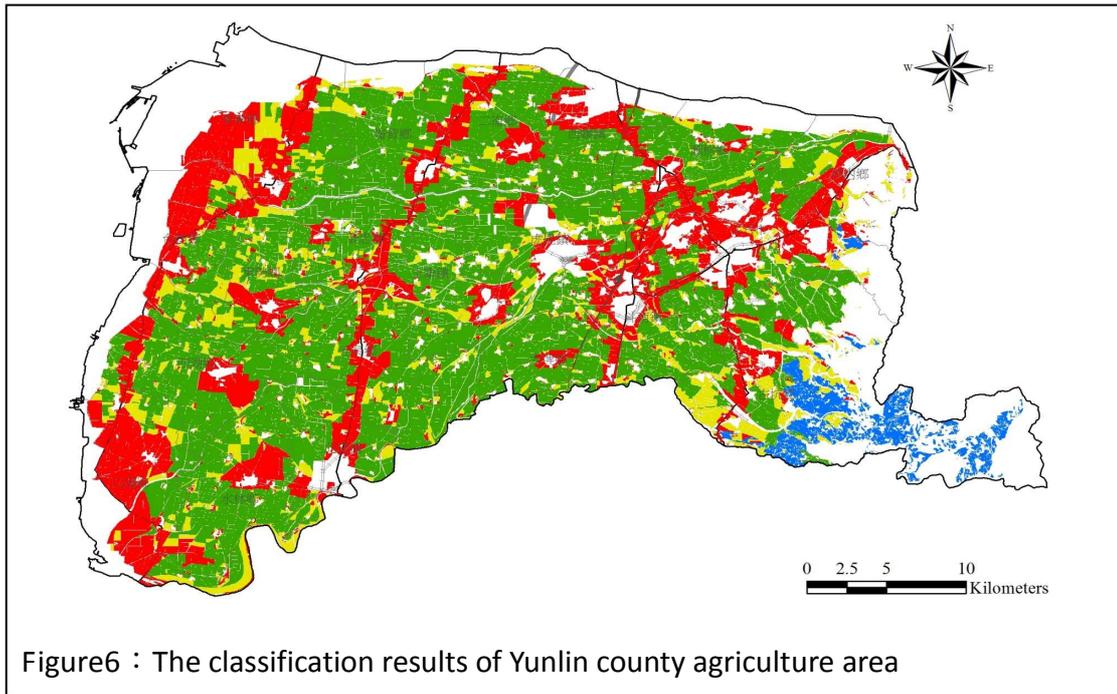


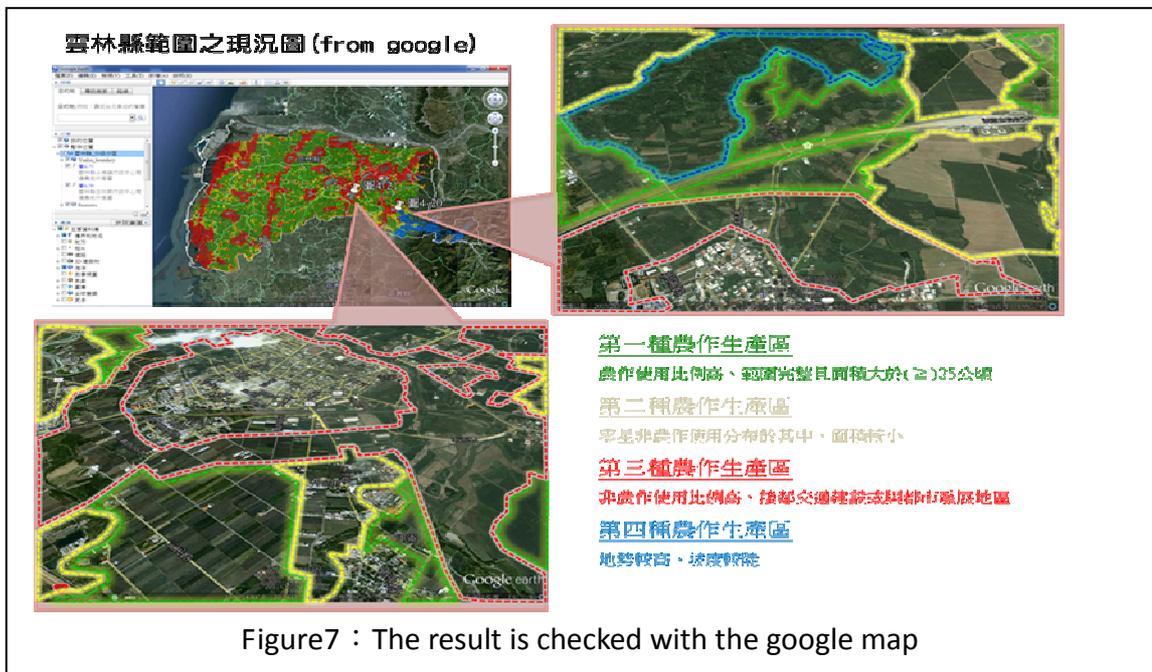
Figure 5 : The analysis reference of classification in Yunlin County

In accordance with the processes mentioned above, Yunlin County, the result of classification is as follows:

Class I area in Yunlin County's is t about 54,000 hectares, approximately 58% of the agriculture area. Class III is about 24,000 hectares, approximately of 26% , Class II is about 12,000 hectares, accounting for 13%, and Class IV is 3,000 hectares, approximately of 3% of agriculture area.



In order to check the reasonableness of this analysis, some sentinel points has been chosen for spot checking, including the Google map and on-site inspection. Through this inspection, it is confirmed that the analysis is good for the farmland classification in Taiwan.



4. Management strategy of agricultural land

In order to achieve the policies of maintaining agricultural production environment and implementing agricultural land for agriculture use, four types of agricultural zone are as follows:

(1)Class I:

The agricultural land in this class is primarily for food production. It is the main agricultural production areas in Taiwan. These areas are also the primary areas need to be actively engaged in public facilities for agricultural production by the Government, e.g. subsidies of production and marketing facilities, farmers counseling measures etc. in order to maintain agricultural production environment. Furthermore, not only the fallow land in this class has to be limited, but also prohibit the conversion of agriculture land in this class to other uses. In case the conversion is inevitable, the buffer zone between the converted area and the agricultural area has to be set up to protect the agricultural production environment.

(2)Class II:

This area is maintained for agriculture use as well. Some agriculture resources will also be invested to improve the agriculture environment, but mostly to support non- production use, such as leisure agriculture. When it is inevitable to alter the agriculture land for non-agriculture use, the feedback mechanism and the buffer zone for conserving the agriculture land have to be designed and built up.

(3)Class III:

The current situation is for agricultural use, but the region is suitable for large-scale agricultural marketing or processing facilities. The place can be allowed for converting to another use.

(4)Class IV:

The region is located on the hillside but still good for agricultural use. Soil and water conservation are the first priority consideration. The agricultural practice in this area should not affect the eco-environment.

5. Conclusion

Taiwan had never conducted a comprehensive survey or land evaluation for agricultural land resource. This task compiled basic spatial data of agricultural land, and the distribution of agriculture area. The mechanism of correction and adjustment data will be established, and the results can be applied into the

agriculture policy making. The principle of designating agricultural areas is based on the conditions of production and the location of the agricultural land. The results of this task can be used for choosing the land which is suitable for fishery, pasture or other uses. Follow-up, the outcomes of space analysis will guide the input of the resources into specialized production areas, and the rational use of the agricultural land. In the future, continuing inter-ministerial communication and improving the laws of agricultural land management are important works for maintain the agriculture resources. Besides, in order to avoid improper conversion of agricultural land, it is necessary to check its necessity, reasonableness and irreplaceable into consideration, and review carefully.