THE IMPACT OF ENVIRONMENTAL CHANGE ON THE HAKKKA VILLAGE CHUNGLIN TOWNSHIP OF HSINCHU

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ABSTRACT In the past one to two decades, the environment nearby the Taiwan High Speed Rail stations has been changed dramatically and caused a substantial impact on the local culture. In this study, it is aimed to assess the impact by taking Hsiaosan village, Chunglin Township, Hsinchu as a case study. The adopted methodology involves the typical research practices of humanities and scientific disciplines. It consists of three major tasks, literature review, interviewing the residents, and analysis of scientific data as described hereafter. Literature review is conducted to understand the evolution of agricultural activities, especially from the aspect of historical viewpoint. In addition, interviews with the local residents of the area are performed to reveal their innermost feelings towards the human-made land-use change and resulting life style alternation. Furthermore, multi-temporal satellite imageries are utilized to provide a quantitative description of the change in land-use and landscape. A simple distance-dependent model for quantifying the change is thus developed to characterize the significance of the degree of the impact.

KEY WORDS: Hakka Village, environmental change, land use, Remote Sensing

1. INTRODUCTION

From the aspect of historical viewpoint, the land-use policy plays an important role on the environmental ecology that relates to the process of the environmental change. Due to the fact that the humans consume resources without moderation for economic growth, the humans are thus putting themselves in jeopardy. The place of Hsiahan village, Chunglin Township, Hsinchu County, Taiwan nearby the Taiwan High Speed Rail stations has been changed dramatically recently. From ancient times, this place has been famous for growing paddy rice, and designated as a special area for agriculture with policy's protection that produced high-quality rice. With time goes by, the transportation infrastructure has brought about much convenience, which also makes the Hsiashan village to be an optimum place for economic investment. Thus, a lot of peasantry sold out their farms, and abandoned their original life style and land-use model.

In this study, we start with literature review to understand the evolution of agricultural activities. Subsequently, multi-temporal satellite imageries are utilized to provide a quantitative description of the change in land-use and landscape. Then, interviews with the local residents of the area are performed to reveal their innermost feelings towards the human-made land-use change and resulting life style alternation. Finally, we incorporate all the information to analyze the main factors to cause the long term environmental changes on the studied place.

2. STUDY AREA

This study area is Hsiashan Village, the center of Hsinchu County, located in the north of Chunglin Township (shown as Fig1). The Toucian River is to the south of Hsiashan and there are mountains in the north. Hsiashan connects Hengshan Township and Kansai Town in the northeast and Jhudong Town in the south. It is close to Chubei City in the west and Hsinpu Township in the north. The Freeway No.3 that was started to operat in 1997 crosses by Hsiashan in the east, and the Chunglin Cloverleaf is set. Besides, the high-speed railway, Hsinchu Station, was established in 2007 in the north-western side. The traffic here is quite convenient.

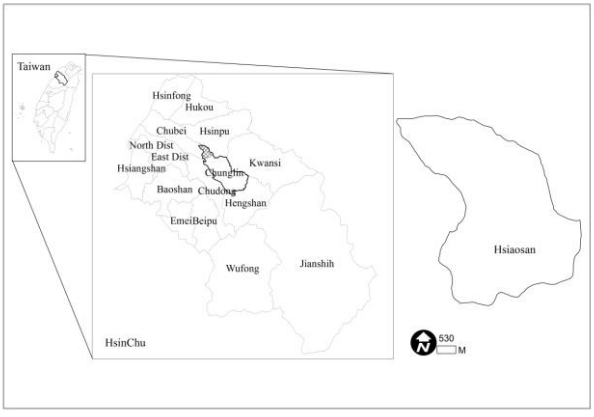


Fig.1 the study area

3. METHODOLOGY AND STEPS

The main approaches include satellite images processing, literature review, and resident interviews, which were used to obtain comprehensive understanding of the impact of environmental change on the community as shown as Fig. 2. The four steps executed in this study are addressed as follow:

1. the satellite images processing

The multi-temporal high-resolution satellite images were collected for the study area, including radiometric correction, geometric correction, pixel extraction and change analysis etc.

2. the literature reviews

The related activity record and the community development of Hakka area in this study were collected, integrated and analyzed, and the literature of remote sensing technology for processing images was also conducted.

3. the interviewing

We visited a Hakka community in the study area to conduct the interviews, take records and pictures, and integrate information.

4. the data integration and analysis

The data of the forward results about Hakka community were integrated, established and analyzed, and the comprehensive conclusions were obtained in this study.

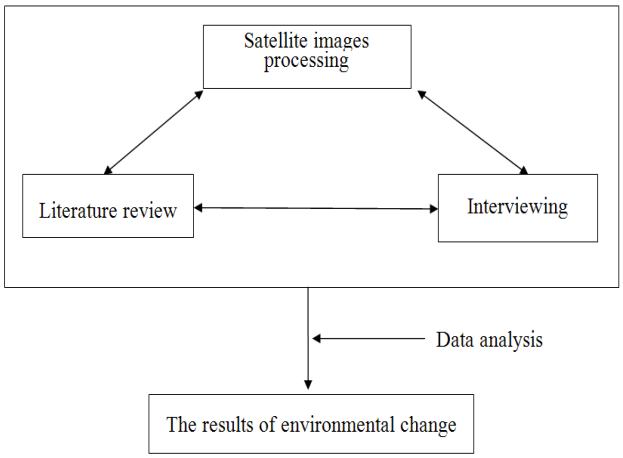


Fig.2 the research flowchart of this study

4. RESULT AND DISCUSSION

4.1 Changes of land-use by multi-temporal satellite imageries

In this study, two satellite images are utilized to classify the land-use status of Chunglin Township. They consist of one FORMOSAT-2 image taken in 2010 (as shown in Fig. 3-A) and one SPOT image taken in 1997 (as shown in Fig. 3-B). The ArcGIS software is used to resample the resolution of the two satellite images into 30 m. The differences in two images are then derived by using ArcGIS and ERDAS IMAGINE software packages. By analyzing the differences, the regions with significant changes in land-use status around Hsiashan Village, Chunglin Township, Hsinchu in the 13-years period may be easily identified as shown in Fig. 3-C. In this figure, white areas represent the change in land-use, mostly falling into the regions surrounding of the area encircled by the yellow line (Hsiashan Village).

To further investigate the impact of the constructions on the surrounding environment, two circles are drawn with the Hsin-Chu high-speed rail station (diameter = 25km, red curve) and the Chunglin interchange (diameter = 38km, blue curve) as center points, respectively, as shown in Fig. 3-D. The two centers are indicated as S and H, respectively, in Fig. 4. To quantify the impact of the constructions on the surrounding, changes in land-use versus distance from the center are derived and thus the number of pixels is determined. It is observed that there is a good correlation between the land-use change and the distance from the location S, but not for the location H. Our interpretation is that the people would reside near the high-speed railroad station for convenience of transportation, but there is no need to do so for the convenience of highway interchange for the same purpose.

4.2 Evolution of culture from interviews with the local residents

By interviewing with the local residents of Hsiashan Village, the findings are obtained from three areas of concern:

1. Lifestyle and landscape

With improvement in economics, the landscape is significantly changed as traditional houses replaced by high buildings, industrial/country roads by avenues/boulevards, …etc. Lifestyle is no doubt to be modified, and so does the culture, such as social activities, value, thinking …etc.

2. Traffic factors

Interestingly speaking, the interviewed residents claim that there is nothing different except for the improved transportation for work. That is, they do not consider themselves to gain any economic benefits, while such thinking may differ from that of the other people.

3. Government policy

Due to the Government land acquisition policies, most of people sold out their farm and got a plentiful of money so that the living of the famers may be improved. Some of the farmers chose not to farm anymore. Furthermore, some of residents in Hsiashan Village migrated to other neighbouring villages or towns.

5. CONCLUSION

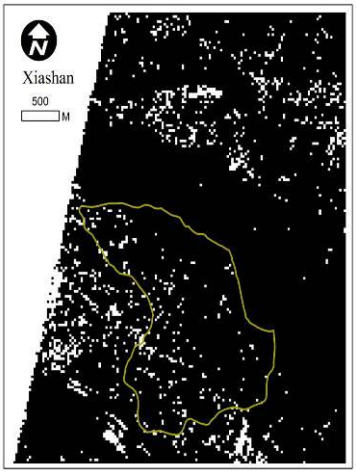
In this study, we intend to understand the differences and changes of land-use condition of the Hsiashan village people through environmental changes by using satellite images analysis, literature review, interviewing the residents. The results indicate that a change in the land-use around the Hsiashan village is obvious by the satellite images analysis and distance-dependent mode, especially, after the Number 3 Freeway of north Taiwan and Taiwan High Speed Rail stations were finished and started to vehicular traffic on 1997 and 2007 respectively. The area located nearby the two important transport hubs with a radius of approximate 20 km became a quintessence area.

Thus, this place has been obviously improved in some aspects, likely due to the transportation infrastructure.

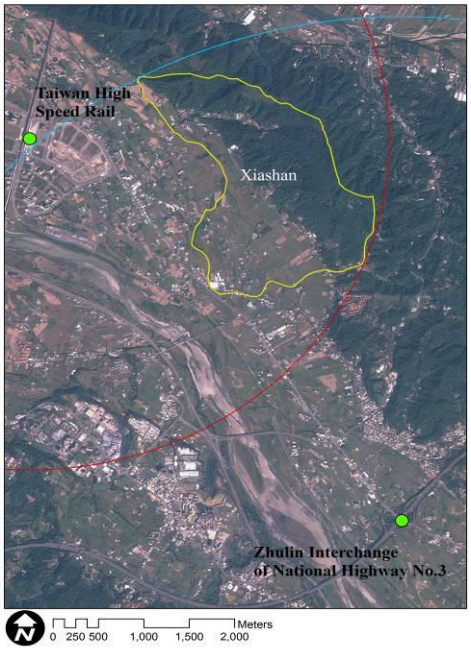
By interviewing the residents, we have discovered the reasons why the change in the living style of the residents is mostly linked to an improved economic condition, although the residents do not agree so.

A. 2010 Formosa-2 satellite image

B. 1997 SPOT satellite image



C. image of change detection analysis



D. distance-dependent model analysis image

Fig.3 1997-2010 the Hsiashan Village's analysis images by change detection and distance-dependent model

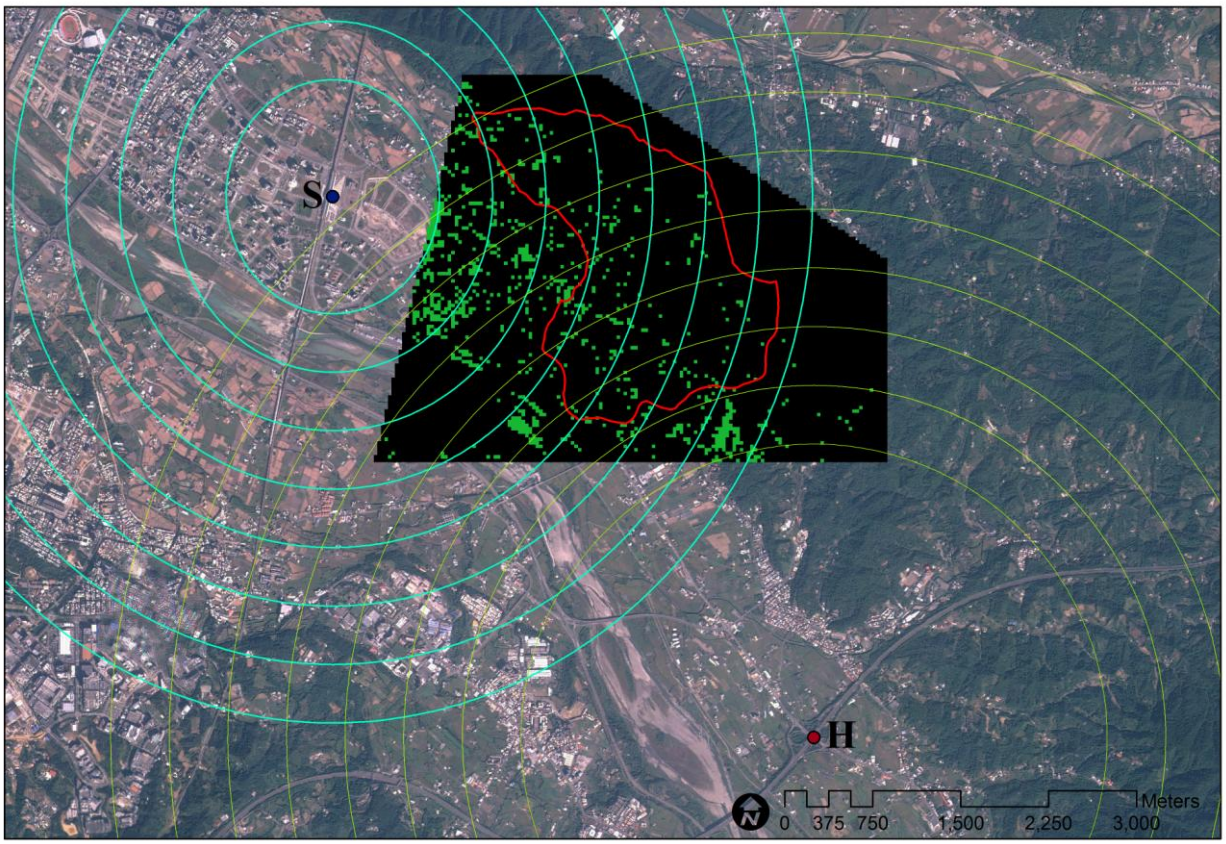


Fig. 4. Change in land-use surrounding the Hsin-Chu high-speed rail station (point S) and the Chunglin interchange (point H) as detected by satellite images

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