5. CONCLUSION

Spatial information were extracted from scanned orthophoto mosaic and integrated with GIS for land use classification and changes detection in this study. This was implemented through various vector and raster GIS such as ARC/INFO especially GRID module, PhotoGIS and IDRISI. Aerial photographs, the main source of spatial data in this study could provide adequate details of ground cover for estimating rice cultivated areas.

Geocoding of aerial photographs were absolutely essential for combining different aerial photos taken in different years and positions. The more GCPs and the higher accuracy in identifying their positions, the more reliable information would be obtained for land use changes. This can be achieved by differential GPS survey of GCPs and careful selection of GCPs from a topographic map. The elevation surface in form of Triangulated Irregular Network (TIN) was also the essential spatial data for producing orthophoto images.

PhotoGIS was found to be useful to integrate geocoding functions of ARC/INFO with orthophotos. The program gave the accurate orthophoto images output that could be completely stitched together using GRID module in ARC/INFO to generate the orthophoto image of the entire study area. The on-screen digitizing in ARC/INFO enhanced visualization and delineation of the ground cover features in an orthophoto image and produced land use coverages of the study area in 1954 and 1983.

Two sources of information were used for assessing rice sufficiency, formal interviewing of the selected households, spatial information analysis, and the crop cutting exercise. The formal interview could provide average paddy and upland rice yield, average paddy and upland rice area owned by households, total rice production and consumption, rice shortage and adaptive strategies to cope with rice deficiency problem. However, this could not accurately reveal changes in rice area over space and time.

The spatial analysis provided the extent of different land use types in the study area and their changes over two periods of time. It revealed that the area of forest cover was sacrified to the expansion of both paddy and upland rice area, bush fallow, village settlement and other land uses.

The rice supporting capacity investigated by using formal interviewing suggested that rice production was sufficient for supporting 82% of total population in 1993, whereas the result from crop cutting and land use classification provided the higher supporting capacity. However, adjusted average rice yield due to the possible losses of rice product during and after harvesting, revealed the 5% of rice deficit in this community. The scenario projection from 1954 through 1994 also confirmed the strategy of community to cope with rice deficiency problem by expanding the paddy rice area.

The kinship and social institution played an important role in mitigating the rice deficiency situation for this community. Off-farm wage employment and animals trading were also the strategies used by some households. The introduced cash crop was additional option for some farmers in this community.

The scenario analysis provided the trend of both rice supporting capacity with two levels of paddy rice yield as the results of potential improvement practices and population growth rates. This could lead to alternative plans to improve rice output and productivity in order to meet the increase in population in the future. However, the agronomic improvement of rice would reach a certain limit rice output, other potential cash crops currently exist such as vegetables and fruit trees should be promoted. However, re-designed cropping pattern should involve farmer participation together with an evaluation of farmer technology and adaptation to achieve effective new cropping patterns. Moreover, small-scale home industry that supply the value-added products to meet the high demand of outside markets is one of alternative that should be taken into the consideration.

The assessment of rice sufficiency in this study depended largely on two major components, rice cultivated area and the average grain yield. Thus, in order to fully investigate food sufficiency level of such a community, potential sites for expanding the arable land resources, socio-economic and institutional factors, should be further investigated. Future scenario projection for land potential supporting capacity required more up-to-date population growth rate and other sources of food and income so that alternative plans to sustain the equilibrium between human and available resources in the highland can be wisely developed.