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LAND USE CHANGES ON THE HAUTERE PLAINS:
A STUDY USING DIGITAL IMAGE ANALYSIS AND
GEOGRAPHIC INFORMATION SYSTEMS

A thesis presented in partial
fulfilment of the requirements for the degree
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SUMBANGAN BAJA
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ABSTRACT

An empirical study was conducted using digital image analysis and geographic information systems to undertake land use/land cover classification and change detection analysis of the Hautere Plains, near Otaki, North Island. The study area, comprising approximately 2000 ha, was mainly flat land where pastoral farming had been the predominant land use. The area, however, has recently undergone significant diversification into horticulture.

Land use changes between 1968 and 1993 were analysed. Aerial photographs taken at the two dates were scanned, registered and classified before the change detection process was carried out. Satellite imagery- a 1990 SPOT XS image- was also evaluated.

Accurate registration of all the images was essential for any analysis of changes to be performed with confidence. All the images were first rescaled to produce a uniform pixel size of 10 metres. Registration to the NZMS metric grid resulted in total RMS errors of 0.46, 0.41, and 0.42 pixels for the 1968 scanned aerial photograph (SAP), the 1993 SAP and the 1990 SPOT XS image, respectively.

In the image classification, eight relatively static land use/land cover categories were defined: pasture, orchards, market gardens, trees, residential sites,
commercial sites, river gravels, and roads. Due to the spectral confusion among particular categories, the results obtained from applying spectral-based classification were refined by incorporating information derived from visual interpretation which made use of photo-interpretation criteria. Merging of data sets was carried out using a binary mask created from the rectified-digital cadastral data and implementing GIS-based overlay functions facilitated in IDRISI. An assessment of the classification accuracy revealed that such procedures resulted in a significant improvement of all levels of classification accuracy (i.e., overall accuracy, user's accuracy and producer's accuracy).

A post-classification comparison technique of digital change detection was applied using the GIS-based operations to develop a quantitative land use/land cover change assessment and to identify the spatial location of changes on a category-by-category basis. The latter was undertaken by means of binary change masking. A similar procedure was also applied to the rasterised cadastral data sets to identify spatial locations of land parcels which had undergone subdivisions. The analysis confirmed that, in the study region, the most common change in land use was from pastoral land to orchards. Most of larger land parcels had been subdivided into smaller holdings ranging from 4 to 10 ha- i.e., the most favoured size for lifestyle blocks as well as properties where orchards and market gardens are found.
The results obtained suggested that the use of scanned aerial photographs at an appropriate scale, complemented by a wealth of site information, is sufficient for computer-assisted classification of land use/land cover types in the study area, and subsequent change detection analysis. If aerial photographs are unavailable for a desired date, it is possible to use satellite imagery as one of the multi-image pair. The processes of image registration, resampling, and data integration ensure that the spatial analysis of change detection can be performed accurately. The quantitative data generated may also give further insights to the land use changes.
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"Dedicated to my parents"
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