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REMOTE SENSING FOR URBAN GROWTH IN NORTHERN IRAN

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ABSTRACT

In urban regions of rapid growth and change, typified by Amol, in the north of Iran, urban planners need regular information on what is happening on the ground. Through the analysis of aerial photographs and KFA-1000 stereoscopic data, over 20 years, a variety of change has been recognised and the relevance to planners and developers confirmed. This paper concentrated on the identification and characterisation of the burgeoning informal settlement areas from space. The use of aerial photographs data in its provision of structural information is explored as is the potential combination of KFA-1000 stereo data with field surveying towards producing a unique signature for informal settlements.

INTRODUCTION

In the last century, urban areas all over the world have experienced rapid and exponential growth. For the larger cities in most developing countries, the rate of population increase has been an almost constant six percent per year. This means doubling the population every 12 to 15 years (Beek and Juppenlatz, 1987; Rogers, 1992). Probably the most dramatic feature of urban area development is the phenomenon of land invasion, a trait of cities in the third world countries. Bombay, for example, has grown by an estimated average of 225000 inhabitants per year (Misra, 1987). The population of Tehran has grown three-fold since 1976 and the total population of urban area in Iran will grow from less than 45 percent in 1970 to some about >50 percent by the year 2005. The main objective in this research was to test remote sensing data (arial photographs and KFA-1000 satellite stereo images) in providing urban growth map-using simple techniques that still provide reasonable accuracy. The test area was the city of Amol, Mazandaran province in the north of Iran, a city of some 200000 inhabitants on the Haraz River alluvial fan (the largest river in important catchment in Mazandaran) with elevation between 65 and 80 metres. The trend for satellite sensors to have an increasingly high spatial resolution, initiated during the mid-1980s with Landsat TM and Spot, is set to continue with the launch of the new satellite (<5m) in 1996-97 (Blamire and Barnsley 1995). However, using a high resolution Russian KFA-1000 satellite image and stereoscopic technique for integrating remote sensing data in a CIS, it found that a second-level classification can be made easily, depicting the built-up areas.

METHODOLOGY AND RESULTS

The Russian satellite, KFA-1000 of June 1990 was chosen for its optimum spatial resolution. Also material used for this study included the Iranian Geographical Organization (IGO) aerial photographs of September 1976 and a 1985 city map of Amol at scale of 1:10000. The images were incorporated with vector data such as roads, river channels and urban extent, digitized from the 1:50000 Amol urban area map (Riply, 1994). Immediate benefits of combining these data types were evident. The need for a comprehensive research program to develop a robust strategy for using remote sensing in planning was apparent (Cope Bowley, 1994, 1995). The steps of study included:

- a stereoscopic analysis of the different Russian satellite data in black an white and colour print
- digitizing the 1985 city map
- aerial photographs at 1:50000 scale of September 1955-95
- related maps to the study area at 1:50000 and 1:10000 scale of 1955 and 1995
- and field surveying during 2000-001 from control area

Since the main objective was to assess the growth of urban area, only limited information was digitizes from the Amol city map:

- the Haraz river main channel
- the 1976 city boundary
- the main roads and streets
- and orchards and ricefield

The last one was digitized for reference purposes only. The colour KFA-1000 images were used, combined to extract information about the spatial distribution of the main land types (see Figure 1). Because the aim was interested only in urban growth, only four classes were required as orchards, ricefield, open space and urban areas. Any land use type that was not classed as mentioned classes could be assumed to be urban. Urban physical growth surveying and detection done through the interpretation of multidate aerial photographs and Russian satellite data of the purposed area. Figure 1 illustrates the changes in an urban fringe of Amol over a period of 10 years.

CONCLUSION

The results indicate that simple CIS and remote sensing techniques can be used to assess very rapidly the growth of urban areas which are very easy accessible in developing countries. If there are more complex pattern of land use may not given good results which probably requires multispectral remote sensing data classification. The aim of this study, however, of using simple methods to differentiate all areas with known information content before studying the more complex areas simplifies the analysis. One of the main advantages is that the assessment can be done rapidly and accurately by a town planner having only modest knowledge of CIS and remote sensing without being a computer, photogrammetry or remote sensing expert.

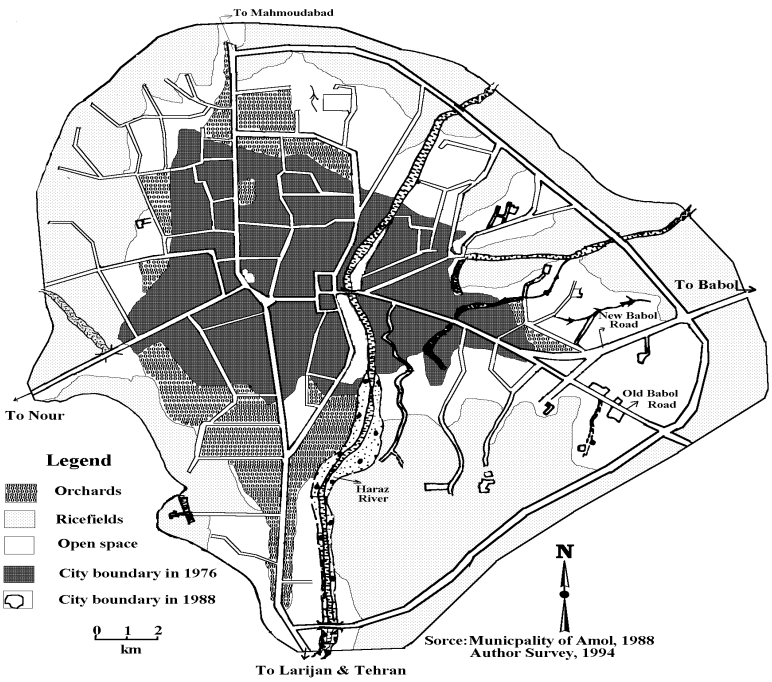

Figure 1: Urban expansion of Amol (extracted from remote sensing data, 1955-1990).

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