

Evaluation of Influencing Factors of Land Development for Sediment Disasters Due to Heavy Rainfall in Eastern Taiwan by Using Genetic Algorithms

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ABSTRACT

In this research, genetic algorithms and satellite images classification technologies are used to evaluate influencing factors of land development for sediment disasters due to heavy raining in eastern Taiwan. With the application of geographic information system as a working platform, Arc/Info for spatial reasoning, sediment disaster prediction maps with high success rate are made successfully.

KEY WORDS: satellite image; remote sensing; sediment disaster; genetic algorithms; geographic information system

INTRODUCTION

Most of the mountain regions in Taiwan are sedimentary and metamorphic rocks which are fragile and highly weathered. Severe erosion occurs due to intensive rainfall and rapid flow, the erosion is even worsen by frequent earthquakes and severely affects the stability of hillsides. Rivers are short and steep in Taiwan with large runoff differences in wet and dry seasons. Discharges respond rapidly with rainfall intensity and flood flows usually carry large amount of sediment. According to Water Resources Agency, Ministry of Economic Affairs of Taiwan, there were 350 typhoons and over one thousand storms occurred in Taiwan from 1897 to 1997. Losses due to natural disasters reached 12.8 billion NTD from 1983 to 1995. The amount is approximately 4.6 times the fire damages in the same periods.

The factors to cause sediment disasters have been widely studied (Keefer, 1984; Koukis and Ziourkas, 1991; Fernandez *et al*, 1999; Popescu, 2002). With the application of satellite images, remote sensing, global positional system and geographic information system, large scale sediment disasters evaluation can be done effectively (Guillande *et al*, 1995; Miller and Sias, 1998; Liu *et al*, 2001; Nikolakopoulos *et al*, 2005; Lin *et al*, 2006).

To recognize the land use characteristics of the landslide areas will be helpful for the watershed management. According to the genetic algorithms (Holland, 1975; Goldberg, 1989), different weighting for the artificial influencing factors of the landslide areas in the Siougulan River watershed will be obtained.

PREPARATION

In the beginning, the following maps should be collected: digital terrain map with (Fig. 1), geology distribution map, satellite images (Fig. 2), aerial maps. Furthermore, field survey finding of buildings, orchards, farm lands, roads, forest, barren land, conservation utilities of water and soil, gravel plant and mine have to be specified in map.

Before classification of satellite images, sample data for training used by maximum likelihood method are obtained by comparing with aerial maps. Sampling zones are evenly distributed in research area and each influencing factor has to appear 40 times or above in those zones. The classification results of satellite images, as shown in Table 1, are acceptable.

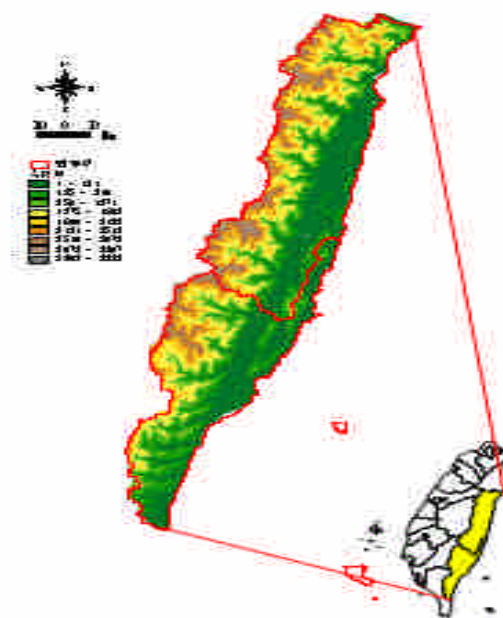


Fig. 1. Digital terrain map of eastern Taiwan