CONSTRUCTION OF GIS AND DATABASE FOR DEBRIS FLOW
POTENTIAL STUDY OF CHEN-YOU-LAN RIVER WATERSHED

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Abstract: The problems caused by debris flows are becoming more and more serious in Taiwan. In order to perform the risk assessment for hazard mitigation, the database of debris flow rivers of Chen-You-Lan Watershed was constructed. The potential factors as well as the natural environmental data of debris flow river and basin were built into database. The client-server spatial geographic information system was built for querying, demonstration, and spatial analysis of the database. This database and GIS can be used for further analysis and classifications of potential debris flow hazard, as well as scenario simulations for hazard reduction and mitigation.

Keywords: debris flows, the potential factors, GIS, database

1. INTRODUCTION

Due to the vast development of economy and the limited available land in plane, usage and development of the land in mountain terrain has grown rapidly. However, the mountain terrain in Taiwan is usually very steep and fragile. Heavy rainfall carried by typhoon often causes severe hazard with slope failure.

Among all types of slope failure, debris flow often causes severe loss of human lives and properties because of its high flow velocity and large deposition area. To mitigate the hazard, risk assessment was needed and the GIS tool is used to do the analysis, demonstration, and information management of the database. In this research, the database for hazard potential study of the Chen-You-Lan river watershed was built, and the GIS provided a proper platform for spatial analysis as well as information management. For the GIS software, Arcview was used.

2. NATURAL ENVIRONMENT DATABASE OF CHEN-YOU-LAN RIVER WATERSHED

In order to perform analysis of debris flow hazard potential, it is necessary to construct database of the related natural environment information of the Chen-You-Lan river watershed, and to set up the structure of geographic information system. The database of the natural environment factors for the debris flow study include: the geological condition of the area, the elevation contour of the area (DEM), the river system of the area, and determination of the watershed.

The original data of the geological distribution of the area, the digital elevation model of the area, and the river system of the area were obtained from the related governmental agencies, and were integrated into the database. The watershed of the each river in the area was determined using the spatial analyzer of the GIS and the final result was modified according to the contour and sunshade maps of the local area. For the Chen-You-Lan river watershed, there are a total number of debris flow watersheds. These natural environment data provided a base for further analysis and determination of the potential factors of debris flow.

3. POTENTIAL FACTOR ANALYSIS USING GIS

For the debris flow to occur in the field, it is necessary that certain field condition be met, which includes: enough water supply, enough amount of deposit material, and proper geomorphic condition. Based on the potential factors, the hazard potential caused by debris flow in the area could be
the surface runoff than the watershed with large-basin area are easier to be moved into the main stream by flow occurrence, because the landslide debris in the small-form-factor has a higher probability of debris Chien-Yen Yi [4] indicated that the watershed with watershed divided by the square of the stream length. 3.3 The watershed factor The form factor is defined as the area of the watershed divided by the square of the stream length. Chen-Yen Yi [4] indicated that the watershed with small-form-factor has a higher probability of debris flow occurrence, because the landslide debris in the basin are easier to be moved into the main stream by the surface runoff than the watershed with large-
5 CONCLUSIONS

By using the tool provided in the GIS system, the database of the potential factors needed for the hazard potential study of the debris flow watershed could be easily analyzed and obtained. The natural environment data, the developed potential factors data, as well as the in-situ photographs and other information were all integrated well and could be demonstrated as spatial database in GIS. The database constructed under GIS proved to be a powerful and helpful tool for analysis of hazard potential, data management, query and demonstration of the database for debris flow hazard mitigation.

References


Fig1  The distribution of the area by each classification of the slope inclination

Fig2  The distribution of the area by each classification of the slope orientation
Fig3 The distribution of the geologic map of the Fun-Chou basin

Fig4 The locating result of the summit point of the debris deposition fan
Fig 5 The contour and area slices in Fun-Chou basin

Fig 6 The relationships among ArcView, Access the database, Visual Basic and ODBC
Fig 7 The Chen-You-Lan River spatial geographic database