Multi-disaster Risk Assessment and Spatial Management of Coastal Areas

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ABSTRACT

This study addresses the statutory disasters defined in the Coastal Zone Management Act, land subsidence, flooding, and coastal erosion, in the context of the coastal areas of Yunlin. Using these three disaster factors, the multiple hazard factor was established for coastal areas of Yunlin. The multiple coastal hazards and vulnerability factors were combined with a risk matrix for risk assessment in coastal areas. The risk map is displayed with a geographic information system and could be used to provide the basis for land management and utilization in coastal areas.

KEY WORDS: Multi-disaster, Vulnerability and risk analysis, Pareto ranking, Land use in coastal areas, Geographic information systems (GIS).

INTRODUCTION

Because all countries experience various types of natural disasters such as drought, flooding, typhoons (hurricanes), earthquakes, volcanic eruptions, and catastrophic land subsidence, the "Natural Disaster Hot Zone-Global Risk Analysis" report by the World Bank in 2005 states that 19% of the land and more than half of the population globally are exposed to at least one natural disaster threat. Taiwan is a high-exposure country.

Climate change causes extreme weather hazards to scale-up and centralize, and the risks posed by multiple hazards are also increasing. Developed countries employ the most disaster reduction and adaptation strategies in coastal areas. To promote the use and management of land in Taiwanese coastal areas, this study considers the disasters defined in the Coastal Zone Management Act and explores the three hazards of land subsidence, flooding, and coastal erosion in the coastal areas of Yunlin. These three hazards are used to establish multi-hazard indicators in coastal areas, and four vulnerability factors are selected: entity indicators, environmental indicators, socioeconomic indicators, and resilience indicators. Furthermore, this study adopts Pareto analysis, which is an assessment methodology that values multiple factors without considering factor weights. With this method, this study separately defines and assesses the grade of each factor and then combines the multi-hazard and vulnerability indicators of coastal land use into a risk matrix to conduct disaster risk assessment for coastal areas. Finally, the geographic information system (henceforth referred to as GIS) is used to establish the risk map. By stacking and displaying the GIS map layers, this study creates a multiple hazard risk map for coastal land area and is expected to provide a reference for long-term coastal area development strategies and the land use management policy.

RESEARCH METHODOLOGY

General introduction of study area

The study focused on the coastal areas already defined in the Coastal Zone Management Act. This area is defined as the “average high tide line to the first provincial road, the coastal main road or the ridgeline land.” The study considered a village in the Yunlin County coastal areas as the statistical unit, and these coastal areas comprised four townships and 38 villages (Figure 1).