



Effectiveness of landslide risk mitigation strategies in Shihmen Watershed, Taiwan

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The purpose of this study was to establish landslide risk analysis procedures that can be used to analyze landslide risk in a watershed scale and to assess the effectiveness of risk mitigation strategies. Landslide risk analysis encompassed the landslide hazard, the vulnerability of elements at risk, and community resilience capacity. First, landslide spatial probability, landslide temporal probability, and landslide area probability were joined to estimate the probability of landslides with an area exceeding a certain threshold in each slope unit. Second, the expected property and life losses were both analyzed in vulnerability analysis. Different elements at risk were assigned corresponding values, and then used in conjunction with the vulnerabilities to carry out quantitative analysis. Third, the resilience capacity of different communities was calculated based on the scores obtained through community checklists and the weights of individual items, including "the participation experience of disaster prevention drill," "real-time monitoring mechanism of community," "autonomous monitoring of residents," and "disaster prevention volunteer." Finally, the landslide probabilities, vulnerability analysis results, and resilience capacities were combined to assess landslide risk in Shihmen Watershed. In addition, the risks before and after the implementation of non-structural disaster prevention strategies were compared to determine the benefits of various strategies, and subsequently benefit-cost analysis was performed. Communities with high benefit-cost ratios included Hualing, Yisheng, Siouluan, and Gaoyi. The watershed as a whole had a benefit-cost ratio far greater than 1, indicating that the effectiveness of strategies was greater than the investment cost, and these measures were thus cost-effective. The results of factor sensitivity analysis revealed that changes in vulnerability and mortality rates would increase the uncertainty of risk, and that raise in annual interest rates or reduction in life cycle of measures would decrease the benefit-cost ratio. However, with regard to effectiveness analysis, these changes did not reverse the cost-effective inference.