# Application of GIS in landslide risk assessment (LRA): A case study of the Kota Kinabalu area, Sabah, Malaysia

## Abstract

This paper introduces a landslide risk assessment (LRA) concept to develop a comprehensive model, which can significantly benefit stakeholders and is best suited for local conditions. The first step was to develop a semi-quantitative database through extensive desk, field and laboratory studies, including compilation of secondary data. In addition, information from remote sensing studies, engineering geological mapping, characterisation of observed hazard parameters and soil and rock testings was also included. The next step was to establish criteria for landslide hazard identification. Seven main related parameters are taken into account; i.e. 1) geology, 2) geodynamic features, 3) slope conditions, 4) hydrology/hydrogeology, 5) types of landuse, 6) engineering characteristics of soils, and 7) engineering characteristics of rocks. All the parameters were compiled and analysed with the landslide distribution map (LDM) to generate a landslide hazard map (LHM). The LDM is based on landslide locations in the study area obtained from field studies and satellite image interpretation. The third step is a vulnerability survey (physical, social and environmental) and compilation of secondary data for elements at risk (population and properties value) to produce the population map (PM) and property value map (PVM). Finally, the landslide risk map (LRiM) was produced by superimposing the LHM, PM and PVM. In terms of landslide hazards, the LHM of Kota Kinabalu area suggests that 2.78% of the area can be categorised as having very low hazard, 14.1% as low hazard, 19.7% as medium hazard, 51.6% as high hazard, 11.3% as very high hazard and 0.4% as extremely high hazard. In terms of landslide risks, the LRiM indicates that 13.1% of the area is in very low risk zone, 20.3% in low risk zone, 16.1% in medium risk zone, 17.5% in high risk zone, 23.1% in very high risk zone and 1.0% in extremely high risk zone. Areas with low degree of landslide hazards may not necessary will have low risk to landslides and vice-versa. This study shows the ability of the Geographic Information System approach

as a powerful intergrative tool in handling semi-quantitative data in spatial LRA research.