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Scaling Issues and Discriminant Function Analysis of Landsliding for the Haida Gwaii, British Columbia, Canada

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Gimbarzevsky (1988) collected an exceptional landsliding inventory for the Haida Gwaii, British Columbia (formerly called the Queen Charlotte Islands). This data base includes more than 8 000 landsliding vectors, with an areal coverage of about 10 000 km2. Unfortunately, this landsliding inventory was never published in the referred literature, despite its regional significance. The data collection occurred prior to widespread use of GIS technologies in landsliding analysis, thus restricting the types of analyses that were undertaken at the time relative to what is possible today. Gimbarzevsky identified the landsliding events from 1:50 000 aerial photographs, and then transferred the landslide vectors to NTS map sheets. In this study, we digitized the landslide vectors from these original map sheets and connected each vector to a digital elevation model. Rood (1984, 1990) and Martin et al. (2001) developed and analyzed a landsliding data base for the Haida Gwaii based on larger-scale aerial photographs ($\sim$ 1:13 000) than those used by Gimbarzevsky (1988). The spatial coverage of Rood's landslide inventory is much more restricted (350 km2), thus limiting adequate statistical representation of larger, more infrequent landslides. Whereas the landsliding inventory of Gimbarzevsky best represents medium to large landslides, the landsliding inventory of Rood provides better information about landsliding at small to medium scales. Analyses are undertaken to evaluate the relative strengths of these two landsliding inventories of contrasting scale, and consideration is given as to how these landsliding inventories can be combined to obtain an improved representation of landslides covering a full range of sizes. We then apply discriminant analysis to the Gimbarzevsky data base to assess which ten predictor variables, selected on the basis of mechanical theory, best predict failed vs. unfailed locations in the landscape. Some predictor variables may be cross-correlated, and any one particular variable may be related to several aspects of mechanical theory; it is important to recognize that the significance of particular groupings may reflect this information. Eight of the original variables were statistically significant in discriminating between failed and unfailed locations. Results showed that about 82% of original grouped cases were classified correctly. Finally, discriminant analysis coefficients and variable coverage information were used to create a landslide susceptibility map for the Haida Gwaii, British Columbia.