DECLARATION

I declare that the thesis entitled “LANDSLIDE SUSCEPTIBILITY MAPPING USING GIS BASED STATISTICAL METHODS IN COONOOR RIVER MACRO-WATERSHED IN NILGIRIS MOUNTAINS, TAMIL NADU, INDIA” submitted by me for the Degree of Doctor of Philosophy is the record of research work carried out by me during the period from February 2009 to January, 2018 under the guidance of Dr.V.RAM MOHAN, Professor, Former Faculty, Department of Geology, University of Madras, and has not formed the basis for the award of any Degree, Diploma, Associateship, Fellowship, Title at this University or any other University or other similar institution of Higher Learning.

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(S. BACKIA RAJ)
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ABSTRACT

Landslides is one of the major natural disasters that are frequently occurring in the Nilgiris mountains causing loss of lives, damaging property and affecting the community by distracting the transport communication system during every monsoon periods.

Landslides have been reported in Nilgiris from the past but the numbers are few with longer intervals. Though, anthropogenic activities such as deforestation, urbanisation and huge expansion of infrastructure cause landslide events on large scale in two years on 1978 and 1979. While, the landslide event of 1978 and 1979 had a lesser impact on the community as majority of over 350 landslides have occurred in tea estates and vegetable gardens, the subsequent events in the years 1990, 1991 and 1993 and 2009 have severely affected the settlements, destroyed the private and public properties and buried so many people. Hence, it has become timely necessary to investigate and identify the landslide susceptibility zones in the Nilgiris.

The Coonoor macro-watershed in Nilgiris Mountains with a total extent of 134.9 km² is one of the worst affected part in the above informed years. In this context, this Coonoor macro watershed was selected as a study area for the detailed investigation of the landslides and to prepare landslide susceptibility maps (LSM). The area falls in parts of Bhavani river sub-basins and it is also one of the significant zone in the view of human intervention in the form of commercial activities with tea and coffee plantations. The present study focused to identify the landslides susceptibility zonation map for the Coonor macro watershed in GIS environment using probabilistic methods.

The basic requirement of the study is the landslide inventory map which shows the areas where slope failures have taken place in the past and the causative parameters. The details of the landslides occurrences were collected from the
Two methods, viz., the Frequency ratio (FR) and Weights of Evidence (WofE) were used in the assessment of landslide susceptibility. In the first method the frequency ratio is obtained by dividing the percentage of landslide in the sub-variable by the percentage of the area occupied by the sub-variable in the total area. If the FR value is more than 1, the subvariable showing positive sign for landslide occurrence and if the FR value of a sub-variable is less than 1, it is not causing landslide. In WofE method, positive and negative weights are calculated using the landslide inventory map. Positive weight indicates that the predictable variable is present and a negative weight is a measure of absence of the predictive variable. The difference between the weights is the contrast, reflects the overall spatial association between the predictable variable and the landslides. The FR values calculated are assigned to the sub-variables and summation of the values gives the Landslide susceptibility index (LSI) which is used to prepare the LSM. The LSM shows areas with high LSI as areas of high landslide susceptibility and areas with low values have low susceptibility. Similarly LSM is also prepared assigning the contrast values calculated using WofE method. For carryout the above two models only 75 % of landslides were taken and the remaining 25 % of the landslides occurrence were utilized for validation.

The numbers of landslides in study area are 102 and validation is carried out for the watershed. The final LSM was prepared by recalculating the FR using all the 102 landslides. The landslide inventory map was overlaid on the final LSM and it was found that 79.22% of the landslides fall in high and very high landslide susceptibility zones and suggesting that the LSM can be used to predict landslide prone areas.
The predictability of the FR and WofE methods are assessed based on the overlay analysis of landslides over the LSM prepared by each method. The comparison shows that the FR and WofE method shows almost same result.

Attempt to validate the LSM using the landslides that have taken place in 2009 was also made. The overlay analysis of sixty seven landslides that have taken place during 2009 was made and it was found that thirty six landslide falls in high and very high landslide susceptibility classes. Though this can be taken as a almost successful prediction, the study of the landslides has shown that the widening of ghat road has played a major role in causing landslides.

The study is the first attempt to prepare a large scale landslide susceptibility map and the usefulness of GIS in assessment of landslide susceptibility using statistical method demonstrated. Since, the methods have high predictability.
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