A brief summary of the results and conclusions arrived at in the present study is given below.

This study is concerned with quantification of landuse effect on the hydrologic and sediment yield characteristics of the Bhavani basin, which is undergoing significant landuse changes due to the fast socio-economic development of the region causing perceptible alteration in the ecosystem of the basin.

Based on the toposheets of the basin, aerial photos and landsat imageries and the field data collected by the various state and central agencies, the drainage characteristics, physiography, climate, geology, geomorphology, soils, vegetation and landuses of the basin have been studied in detail and documented (30). The basin has 400 rain-gauges over an area of 6730 sq.km., the density of which is considered to be good. The average annual rainfall ranging from 700 to 4600 mm occurs in two hydrologically distinct periods, one in non-monsoon (January to May) and another in monsoon (June to December). The basin is underlain by rocks of Archean age consisting of charnockites, mixed gneisses and granites with a small patch of mylonite. The soils of the basin are composed of Mollisols, Entisols, Alfisols and Inceptisols. A consolidated map of soil classification along with hydrological soil group and soil fertility classification was prepared (30).
Vegetation of the basin consists mainly of forest, grassland and cultivated crops comprising mostly potatoes, tea, coffee and orchards. Geomorphology of the basin consists of western uplands and piedmont plains. The western part of the basin, has dendritic and the northern part has trellis drainage pattern while the valley portion has sub-dendritic pattern. The drainage density of the basin is low. River piracy has been noticed at two places within the last four decades. There is a conspicuous change in the land use practices and vegetation raised over the basin.

A generalised reconnaissance level land use map depicting ten classes of land use and vegetation features such as urban, intensely cultivated cropping, barren lands, water bodies etc. was prepared on a scale of 1:500,000 (Figs. 2.20, 2.21). The land use changes over the years were also studied using the black and white aerial photographs of 1:63,000 scale. The study reveals that the natural forests/grasslands are under constant transition to man-made forest of blue gum, black wattle, pine etc. and the forests are slowly getting converted into agricultural lands. In many locations, forests and agricultural lands are being converted and used as urban settlements, industrial sites etc.

The time series analysis of rainfall, runoff and peak floods for two typical watersheds - Kateri (rural and Coonoor (urban) indicated that there has been no material variation in the variation of rainfall of the watersheds.
over the years studied (only 3 to 9 percent). The dry weatherflow has decreased to as low as 10 to 30 percent of what it was about 25 years ago. Also some streams have become completely dry during summer months. Destruction of the forest and their conversion to agricultural and urban lands have pushed up the peak flows for comparable rainfall to as much as 400 percent, of what it was about 25 years ago. Frequent land slips and land slides in the hills are observed to occur due to high surface runoff of watersheds, undergoing rapid land use changes.

Hydrologic data from two experimental watersheds - one of them undergoing land use change (watershed B) and the other kept under static conditions (watershed A) was analysed by 3-coefficient model proposed by Chow and Kulandaiswamy. The model was applied to 230 storm data selected from both the watersheds. The coefficient of correlation between the computed and observed hydrographs was found to be as high as 0.99. The results indicated that while the model parameters for a given watershed are mainly dependent on the rainfall characteristics, the landuse effect is mainly reflected in the rainfall excess which is represented by a transition factor. For basins undergoing landuse changes, the rainfall excess was related to the antecedent precipitation index (API) and the transition factor. Knowing the API and transition factor, the rainfall excess was computed and the runoff hydrograph predicted. The 3-coefficient model reproduced
the surface runoff hydrograph of a watershed in transition fairly well. The parameters of the model were sensitive only to the delay time.

Assuming that the 3-coefficient model results of the experimental watersheds, are equally applicable to larger watersheds, three typical watersheds - Mukurthy, a forest watershed, Coonoor, an urban watershed and Kateri, an agricultural watershed were selected for runoff prediction with different landuses. Daily rainfall and flow data for 5 years were subjected to analysis by the 3-coefficient model and a method for continuous runoff prediction for the monsoon and non-monsoon periods was presented. When a rural (agricultural) watershed is urbanised, the rainfall excess increases by 49 percent, while afforestation decreases it by 29 percent. A peak flow of 1.0 cm/day in a rural watershed increases by 107 percent, if urbanised and decreases by 80 percent if afforested. Further, a time to peak ($t_p$) of 2.5 days in rural watershed decreases by 18 percent if urbanised and increases by 28 percent if afforested. The 3-coefficient model lends itself for runoff prediction of a mixed watershed, having forest, rural and urban landuses and can be used to quantify the effect of landuse changes on the surface runoff characteristics.

Baseflow of Mukurthy (forest), Kateri (rural) and Coonoor (urban), were analysed for monsoon and non-monsoon
periods. Using the method suggested by Burmash et al. (11), the seasonal dry weather flow of different watersheds were plotted on semilog paper, to determine primary base flow, supplementary base flow and interflow coefficients. The variation of these coefficients was analysed to study the landuse effect on the base flow characteristics. Interflow constants are practically zero during non-monsoon. During monsoon, it is 0.54 for urban, 0.73 for rural and 0.69 for forest. The above figures indicate that percolation is least for urban, followed by forest and rural watersheds. The primary base flow constant obtained for the three landuses, was the same indicating that all the three watersheds have identical type of geological formations.

The concept of curve number technique, evolved by the Soil Conservation Service, United States Department of Agriculture, USA, to predict runoff from catchments under different landuses was adopted to construct curve numbers for Mukurthy (forest), Kateri (rural) and Coonoor (urban) watersheds from the existing daily flow hydrographs. The conventional methods of constructing curve numbers, did not reproduce the runoff volume satisfactorily. Hence a correction factor, $f$ to take into account the wetness of the surface was introduced and related to the antecedent precipitation index. The runoff computed with this correction factor reproduced the observed volume satisfactorily.
The curve numbers developed for individual landuses, when applied to a mixed watershed (Sigur upper) reproduced the runoff volume, fairly satisfactorily. The runoff curve number technique, is a simple yet useful tool for runoff prediction of a watershed, having mixed landuses.

Prediction of soil erosion, using the Universal Soil Loss Equation, (USLE) as proposed by Wishmeir et al, is attempted for the Bhavani basin. Soil loss in the 16 test watersheds were computed for the present as well as for the proposed landuse changes and were then extended to the remaining watersheds of the Bhavani basin. The study shows, that the highly protective natural forest, fall under extremely low soil loss (0.0002 to 1.00 tons/ha, followed by mixed (10 to 20), rural (30 to 60) and urban (50 to 102) landuses. Predominantly rural and urban watersheds with a very low percentage of forest (0.5 to 2.5 percent) are the main areas of erosion (50 to 133 tons/ha/annum) and require immediate attention. The study has revealed that improper rural and urban management is the root cause of erosion. The present soil loss in the Bhavani basin is 27.4 tons/ha/annum which can be reduced to a permissible limit of 1.5 tons/ha/annum, if rigid scientific conservation and management practices are adopted. If, due to population pressure and socio-economic factors, the present forest area is reduced by 50 percent at a future date, the present soil loss will increase to 62.615 tons/ha/annum. If scientific management
is adopted, it will drop to 1.79 tons/ha/annum. Soil loss data, obtained from plot studies closely correlates with calculated soil loss of certain landuses.

The sediment delivery ratio, obtained for six watersheds in Bhavani, are similar to those obtained for humid and semi-arid watersheds in other countries. As regards sediment yield, these are nil in forest land, 3.19 tons/ha in mixed landuse, 13.95 tons/ha in rural landuse and 19.0 tons/ha in urban landuse. The entire Nilgiri hills, consisting of forest, agriculture, plantation and urban landuse, has a sediment yield of 5.85 tons/ha and sediment delivery ratio of 0.047. Suitable erosion control measures for different landuses of the Bhavani basin are suggested.

From this study, it is concluded that

i. scientific land management of watersheds with mixed landuses, (forest, rural and urban) is the final answer for erosion control in the Bhavani basin.

ii. the universal soil loss equation, can be profitably applied to the mountainous region and plains of tropics for erosion prediction.

iii. the 3-coefficient model suggested by Chow and Kulandaiswamy can be used to quantify the landuse effect on the surface runoff characteristics of a mixed watershed undergoing landuse changes.
iv. the curve number technique with a slight modification can be used to predict the runoff volume of a mixed watershed undergoing landuse changes.

v. the landsat imageries, and aerial photographs along with geological and geomorphological maps, can be used for easy and quick landuse classification of a basin.