CHAPTER VI

SUMMARY AND CONCLUSION
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The evolution of landforms is a combined product of many interacting processes of which climatic parameters assume greater significance. Drainage lines are considered to be the most sensitive parameters to climatic events over the past and present and truly represent the changing evolution of landforms in terms of dissection intensity. In the present analysis drainage density and drainage texture are chosen as indices of denudation and impact of climatic along with other various environmental parameters on these two denudational indices has been analysed. These various environmental characters are physiographic, climatic, lithologic, pedologic and vegetative characters of the river basin.

The Som river is the main tributary of Mahi river basin flowing in the Udaipur and Dungarpur districts of southern Rajasthan covering an area of 6152.69 sq.km. Godaveri, Ghorel and Gangeri are right bank tributaries and Gomati, Gamiri, Nal, Koel are a few left bank tributaries of Som river. The study of drainage pattern highlights the nature, behaviour and importance of drainage pattern in denudation. This river basin has the highest height of 1011 mt. and lowest of 180 mt. The detailed physiographic study
is carried out by intensive analysis of distribution pattern of relative relief, average slope, average height, hill frequency, slope, dissection index and erosion intensity indicators. Total high hill frequency region forms 5.37 per cent of the basin area. The area without hill frequency constitutes 38.7 per cent of the total basin area. Very steep slope constitutes only 2.9 per cent of the area in the basin whereas very gentle slope constitutes 30.54 per cent of the area. High degree of dissection is found in north part of the basin over 4.6 per cent of the basin.

The landforms are constituted by hills rolling foot hills, pediments, undulating uplands, valleys and lakes. The valley system is not clearly marked in this basin as only 54 per cent of its area is classified as valleys. The big valley is that formed by Gomati river.

The rock formations of the basin are classified into three geological formations. The Bhilwara geological formation occurred in Archaean period and consist of Mangalwar complex, Mafic and Ultramafic and Rajpura-Debari rock groups. The Aravalli geological formation of proterozoic period contains Debari, Udaipur, Bari lake and Jhadol rock groups. The Gogunda rock group of Delhi geological formation also occurred in proterozoic period. The lithologic characters of each rock formation is carried out by sediment yield index, porosity and permeability of rock formation. More than 30 per cent of the basin area depicts moderate sediment yield
index mean of 1000. Only a meagre 0.34 per cent of the area shows high sediment yield indices of more than 1200. The Bari lake group has the highest porosity value of 14.30 whereas Jhadol group has the highest permeability value.

The climatic characteristics of river basin are understood with the help of nature and distribution pattern of rainfall, temperature and potential evapotranspiration. These climatic factors are sub-divided into six component factors of climate. The mean annual rainfall of the basin is 633 mm. Temperature varies between 23°C to 27°C. High value of mean annual potential evapotranspiration more than 130 mm is found in south and south-eastern part of the river basin. The mean annual rainfall intensity of the basin is 24.33 mm per day, which divides the basin into two parts of low and high to either side. Bavalwara has the highest seasonal rainfall 205.6 while Sarara shows the least 146.12 mm.

The pedologic analysis of the basin reveals that the characters of soil range between clay loam to heavy clay. Five types of soil association have emerged in the basin which are EN, NB Ktd, ENP, BN and BM. The nature of these five soil types are analysed in terms of their depth, colour, texture, mineral composition and intensity of erosion activity on it. The distribution of forest cover shows that near about 32 per cent of the basin area contains forest.
The river is the most important denudational agent of the region. The concentration of streams measures the intensity of denudation which can be calculated in terms of drainage density and drainage texture. The importance of both the parameters in denudation analysis can be understood by their sensitiveness towards climate, expression ability of eroded landforms, variability with scale, and gives better result than other measurements.

The spatial distribution of drainage density of basin shows that its value ranges between 0.72 to 4.68 km/km² with an average value of 2.79 km/km². The spatial distribution of drainage texture values of the basin represent between 0.2 to 10.76 with an average value of 3.87.

To understand the dynamic nature of denudation, drainage density and drainage texture are analysed and correlated with various physiographic, climatic, lithologic, pedologic and vegetative parameters of the basin separately. A stepwise multiple regression analysis is carried out for drainage density and drainage texture with all the five parameters to understand the relative importance of all the parameters. This analysis reveals that physiographic parameters assume more importance and the pedologic parameters the least.

The physiographic parameter is constituted by relative relief, average height, hill frequency, average slope,
slope, dissection index and erosion intensity. The analysis of all the physiographic variables demonstrate that dissection index and erosion intensity have high degree of association with drainage density due to the fact that drainage density is used as parental constituent in both the variables. The slope displays least degree of association with drainage density. All the remaining physiographic variables express low levels of association with drainage density at high level of significance. All the variables are positively correlated with 1 per cent level of significance. High relative relief, slope encourage more conversion of potential energy into kinetic form which means that more amount of work can be done. This explains that all the physiographic variables are important in denudation variation.

The climatic parameter includes six variables namely total mean annual rainfall, rainfall intensity, seasonality of rainfall, mean annual temperature, mean annual potential evapotranspiration and difference between mean annual rainfall and mean annual potential evapotranspiration. The rainfall intensity and seasonality of rainfall depict positive relationship and remaining four variables indicate negative relationship with drainage density at a high level of significance. The mean annual temperature and mean annual potential evapotranspiration depict high degree of negative association and rainfall intensity express low degree of positive association with drainage density among climatic parameter.
The lithologic characteristics of the basin are analysed through sediment yield index, porosity and permeability of rock formations. The lithologic variables do not exhibit much influence on drainage density. They account for 15.84 per cent variation in drainage density. In the stepwise regression analysis, sediment yield index and porosity of rock demonstrate negative relationship whereas permeability of rock displays positive association with drainage density. The negative relationship of sediment yield index is due to mining, deforestation, construction of road and dams in the basin. The sediment yield index is the most powerful explanatory variable among the lithologic variables.

The pedologic parameters is constituted by three variables, such as proportion of sand in soil, proportion of clay in soil and silt clay ratio. These variables demonstrate negative relationship with drainage density at a high levels of significance. All these three variables explain 4.53 per cent drainage density variation in river basin.

The influence of vegetation cover on denudation has been analysed by taking proportion of area under forest. The proportion of area under forest depicts contradictory positive relationship with drainage density which may be due to more attraction of rainfall by forest cover and misrepresentation of forest area.

In the multiple regression analysis only thirteen variables out of twenty variables are carried out with drainage density to avoid the problem of multicollinearity from the relationship. Out of these thirteen variables only eight variables are significantly explain 34.2 per cent of variation in drainage density. Among these significant variables, proportion of area under forest, relative relief, porosity of rock and total mean annual rainfall are the
important variables for drainage density variation in the basin. These four variables explain 33.8 per cent variation on drainage density of the basin. The relationship of drainage density with all independent variables at simple and multiple regression analysis are not comparable due to presence of multicollinearity in multiple regression analysis.

The drainage texture is also used as an index of denudation along with drainage density in this analysis. All the physiographic variables are positively related with drainage texture at high levels of significance except slope. The dissection index becomes the most explanatory and slope the least explanatory variable among all the physiographic variables. In this denudational analysis dissection index, erosion intensity and relative relief account for large proportion of drainage texture variation.

Among the climatic variables rainfall intensity and seasonality of rainfall depict positive relationship at low level of significance and remaining four variables observe negative relationship with drainage texture at high levels of significance. In this analysis mean annual temperature and mean annual potential evapotranspiration emerge as important explanatory variables for drainage texture variation.

The lithologic variables express negative relationship with drainage texture at low levels of significance. This reveals that lithologic variables are not a good expla-
natory variables, even though porosity of rock displays comparatively more influence in drainage texture variation than remaining variables.

In the case of pedologic variables proportion of clay and silt clay ratio of soil represent negative and proportion of sand in soil positive relationship with drainage texture at low levels of significance, which prove their low importance in drainage texture variation. As in the case of drainage density, drainage texture also depicts a contradictory positive relationship with proportion of area under forest.

The stepwise multiple regression analysis of thirteen variable out of twenty variables are carried out to understand their behaviour with drainage texture in totality. This analysis reveals that nine variables belong to physiographic, climatic lithologic and vegetative are important among them, and explain 33.9 per cent of variation in drainage texture. Among these variables relative relief, porosity of rock, permeability of rock and slope are the most important explanatory variables for drainage texture variation.

The principal component analysis for twenty independent variables is carried out to identify groups of inter-related variables. This analysis identifies five groups of different variables known as components. The detailed analysis of each component explains the association of various variables in denudation. All these five components explain 77.94 per cent of the variation of denudation in the Som River basin. The comparison of score value of each component with that of drainage density and drainage texture value
reflect the importance of different components in explaining denudation intensity.

The above detail analysis of drainage density and drainage texture with physiographic, climatic, lithologic, pedologic and vegetative parameters reveals the nature of denudation intensity as well as nature of fluvially eroded landforms of the basin. On the basis of this analysis we draw a conclusion that the physiographic variables have positive relationship with denudation. As the value of physiographic variables increases the intensity of denudation increases. The potentiality of denudation decreases with increase in total mean annual rainfall, mean annual temperature, mean annual potential evapotranspiration and difference between total mean annual rainfall, mean annual potential evapotranspiration, sediment yield index, porosity of rock, proportion of clay in soil and silt clay ratio in soil. The severity of denudation increases as values of rainfall intensity seasonality of rainfall and proportion of area under forest increases.

The dissection index and relative relief among physiographic and mean annual temperature variables among climatic parameters emerge as powerful explanatory variables for denudation variation. As the gap between mean annual rainfall and mean annual potential evapotranspiration increases the denudation intensity is reduced. The nature of denudation intensity varies with value of sediment yield index and prop-
ortion of sand is soil due to various combinations of rock on the surface of the basin.

The morphogenetic region is that area which is characterized by uniform geomorphic processes under a given climatic conditions. The morphogenetic regionalization of Som river basin has been carried out with the help of drainage density and drainage texture to identify areas of different denudation intensities.

The distribution pattern of drainage density demarcates three types of regions such as high drainage density, moderate drainage density, and low drainage density region. The high drainage density region is situated in two major areas including four small pockets of high drainage density. These regions cover 27.90 per cent of the basin area. The Bhankra-Kurabar is first high drainage density region situated in northern part of the basin. The Som-Rikhabdev is situated in western part of the basin. In addition to above two high drainage density regions, four pockets of high drainage density are also situated in the basin.

The moderate drainage density region covers large proportion of the basin in a continuous stretch and constitutes 56.50 per cent of the basin area. Due to its large size it occupies considerable area of most of tehsils underlaid by various rock types of the basin.
The low drainage density region is constituted by two major regions Aspur-Bhabrana and Jaisamand region situated in south-eastern and central part of the basin respectively. The Aspur-Bhabrana low drainage density region is situated in northern Aspur and southern Salumber tehsils. The Jaisamand low drainage density region is located in north-western Salumber and eastern Sarara tehsils. In addition to both these regions, six pockets of low drainage density are also present in the river basin. The Babarmal and Khajuri pockets of low drainage density are situated in north-western part of the basin. The remaining four pockets of Karwara-Khairwara, Bichhiwara-Dungarpur, Debela-Punali and Kundal of low drainage density are situated in south-western part of the basin.

The nature of denudation is also inferred by drainage texture values. The distribution pattern of drainage texture value identifies three regions of high moderate and low drainage texture. The high drainage texture regions are represented by two regions and one pocket. The Kherwara-Naglia region of high drainage texture is situated in northern part of the basin. The second Godavari-Parsad region of high drainage texture is situated in north-western part of the basin. The Kerpur pocket is situated in eastern part of the basin.

The moderate drainage texture region spreads all over the basin in a continuous stretch and three small pockets. The Bavalwara-Rikhabdev-Kanor moderate drainage texture region constitutes 45.90 per cent of the basin area. Apart
from above region, three pockets of moderate drainage texture are found in southern part of the basin. The Bheyana-Sanchiya-Gamzi Dewal and Mathugamra-Wasi Pockets are situated in northern Dungarpur tehsil. The last Raghunathpura-Ganeshpur pocket is situated in north-western Aspur and north-eastern Dungarpur tehsil.

The low drainage texture region is situated around moderate drainage texture region. This region may be named as Salumber-Aspur-Dewal low drainage texture region. A large proportion of low drainage texture region is situated in southern and south-eastern part of the basin. This region includes area of southern Ghirwa, south-eastern Jhadol, western and southern Khairwara, Dungarpur, Aspur, Salumber, north-western Dhariawad and north-west and eastern Sarara tehsils of the basin. It covers 41.22 per cent of the basin area.

The morphogenetic regionalization of Som river basin is carried out by analysing spatial distribution and combination of different values of drainage density and drainage texture. The Som river basin has been divided into five morphogenetic regions such as very high denudation, high denudation, moderate denudation, low denudation and very low denudation region.

The very high denudation region is identified by the combination of area of high drainage density and drainage
texture. In this way two regions and one pocket of very high denudation emerge on the surface of the basin. It is the smallest region among all the five regions. It covers 431.79 sq. km. area which comes to be 7.08 per cent of the basin area. The Kharwa-Naglia region of very high denudation is situated in northern part of the basin and includes 303.59 sq. km. of the basin area. The second Godavari-Parsad region of very high denudation is found in western part of the basin and covers 111.5 sq. km. area of the basin. The Kerpura pocket is placed in eastern part of the basin and covers an area of 16.67 sq. km. This region has moderate to high dissection index and erosion intensity with moderate intensities of remaining variables.

The high denudation region is found around very high denudation region and constitutes 1275.29 sq. km. of the basin area. It has been demarcated by combination of high drainage density and moderate drainage texture in the river basin. In this manner, three regions and one pocket of high denudation emerge in the basin. The Som-Rikhabdev-Samari region is the largest high denudation region situated in western part of the basin and covers 992.25 sq. km. area of the basin. The Umra-Shishvi and Jagat-Kurabar region of high denudation is situated in northern part of the basin and covers 81.29 and 161.02 sq. km. area of the basin respectively. The Malpur pocket is situated in south-eastern part of the basin and incorporates 40.64 sq. km. area of the basin. The high
intensity denudation is characterised by moderate to high dissection index, erosion intensity, relative relief and average slope in the region.

The moderate denudation region is characterized by moderate drainage density and moderate drainage texture. The moderate denudation region is found all over the basin area in a fragmented parts. It covers 2050.92 sq. km. of the basin area. This region is distinguished by low physiographic, lithologic and pedologic variables with moderate influence of climatic variables.

The low denudation region incorporates those areas which observe moderate drainage density and low drainage texture values. The low denudation region is situated in three parts of the basin namely in north-western, southern and eastern part of the basin. All these regions stretch over 1605.91 sq. km. area of the basin. The north-eastern Canbara-Peduna low denudation region is spread over 410.18 sq. km. area. The southern Dewal low denudation region has an area of 601.46 sq. km. The eastern low denudation region is comprised by Kherar-Jhalara region, Paduna-Balicha region, Sarara and Jhadol pockets. These regions constitute 343.14, 195.93, 36.56 and 27.50 sq. km. of the basin respectively.

This region is marked by moderate rainfall with low intensity and seasonality with high mean annual temperature and potential evapotranspiration.
The very low denudation region is localized by the combination of the area of low drainage density and drainage texture. The very low denudation area is spread over 737.87 sq. km. area and is situated in three parts of the basin. The central Jaisamand region is situated around Jaisamand lake and covers 200.10 sq. km. area. The south-western region includes four pockets of very low denudation - Karwara-Khairwara, Bichhiwara, Kanba-Dungarpur, and Debala-Punali pockets and they occupy 56.28, 36.47, 90.67 and 40.12 sq. km. area respectively. The south-eastern Aspur-Bhabara very low denudation region incorporates 314.23 sq. km. area of the basin. This region is represented by low physiographic characteristics, moderate mean annual rainfall and rainfall intensity supported by high mean annual temperature and potential evapotranspiration.

From the above study it is clear that the drainage density and drainage texture as indices of denudation are influenced by a number of environmental parameters and the intensity of denudation is reflected in the concentration of stream network that develops in the region.