

CHAPTER - 1

INTRODUCTION

1.1 INTRODUCTION : The Sali River Basin (Fig. 1.1) is a sub-basin in the lower Damodar Region of the Ganga Plain within West Bengal. Geo-environmental appraisal of the area is prerequisite for amelioration of its age old poverty stricken agrarian economy. The Sali and its tributaries drain a considerable part of Bankura district and covers 914.5 sq.km. comprising portions of Gangajalghati, Barjora, Sonamukhi, Patrasair and a little amount of Indus Police Stations of the district. The terrain is constituted of low hills, lateritic hummocks and valley-fills, pediments and flood plains with terraces etc. Apart from the diverse morphologic and drainage status, faster run-off, frequent drought and floods, poor pedological base, low ground water potential etc. have adversely affected the existing agricultural economy of the Sali Basin, poverty appears to be widespread, much of the forest wealth is now gone; and the agricultural yield rates are low. All in all, the scenerio is depressing.

The effect of the interactions of the various forces relating to the geo-environmental status of the Sali Basin are found to be well manifested in the development of diverse land use at different levels within the area. The Sali river drains four distinct physiographic divisions which are also marked by the contrasting land use patterns, being developed in response to the varied geo-ecological conditions in the Basin. The physiographic units, as established by the present researcher, are (Table 5.3 and Fig. 5.12) : (i) A Laterite Capped Dissected Upland (Gangajalghati Surface) which lies at an altitude above 120 m. from mean sea level and covers 45 sq.km. is in Gangajalghati P.S. Faster run-off adversely affects the surface water for agriculture. Groundwater potential is extremely limited and found only in the joints of the underlying hard rocks. Agriculture is characterized by mono-cropped (paddy) and its success depends on good monsoon rain; (ii) An Upper Plain (Kora Surface) is bound by contours between 80 m. and 120 m. above m.s.l. and spread over the areas of the Western part of Barjora P.S. and adjoining Gangajalghati

P.S. (310 sq.km.). In the south of the Kora hill (154 m.) a pediment has covered a considerable area near Amarkanan. V-Shaped valley through gradual erosion and valley trenching are some of the important riverine landforms here. Cultivation of paddy in the monsoon season has been extended from the plains and depressions to the pediment by making small terraces. Thin skeletal soils which do not lend themselves to well agriculture, are largely clothed by forests; (iii) A Rolling Plain (Sonamukhi Surface) having altitudinal range between 40 m. and 80 m. has covered 444 sq.km. and becomes the largest geomorphic division in the Sali Basin. The monotony of the topography in this surface is broken by the appearance of the valleys of varying dimensions and extent. Agriculture is best developed; (iv) A Low Flat Plain (Bodai Surface) having altitude below 40 m. from m.s.l. has covered an area of 115.5 sq.km. down stream off Sonamukhi town and continues upto the confluence of the Sali with Damodar river at Samsar in Indus P.S. Several marshes and back swamps have developed. Floods are also common almost every year particularly due to spilling over of the excess water of the Damodar during monsoon rains. Soil is mostly sandy and agriculture is moderately developed.

The geological background of the Sali Basin is characterized by the rocks ranging from Archaean crystalline to Recent Alluvium (Table 2.1). Quaternary Formations have been divided into four units (Fig. 2.2) : Lalgah (Laterite), Sijua (Older Alluvium), Chunchura (Silt with fine sand), and Hugli (Silt and clay). These morpho-stratigraphic units have profound impact on the ecology of the region.

The area enjoys a typical tropical humid monsoonal climate controlled by rain bearing south-west monsoon wind system. Duration of dry spell within the monsoon season is significant and it affects the successful cultivation of crops. Incidence of drought here is also not less important.

The main findings, as stated above, have been obtained primarily from field investigations carried out by the present researcher as fulfilment of modern methodology, being supplemented by evidences and information available from published materials. Laboratory work has been carried out for data and related information. Vast amount of

processed data have been made least complicated and easily understandable to moderately educated farm-operators and field-officers, who would be primarily responsible for translating the recommendations into practice. But at the same time the most sophisticated scientific analyses have been done for intricate quantitative exercise.

1.2 AREA AND LOCATION : Physiographically, the state of West Bengal in India presents herself with (i) high mountains in the north, (ii) rolling plateau in the West, (iii) deep tidal delta to the extreme south, and (iv) a vast alluvial plain in the southern (Rarh region) and the central part.

The Sali river (79.5 kms. long) has its origin near a low residual hill (Lachanchandi 169 m.) in the rolling plateau in the west, a part of the Chotanagpur plateau and passes through the vast alluvial plain, known as Rarh region, before it debouches into the Damodar which has formed a big sub-basin to the Ganga plain in Bihar and West Bengal. The Sali in Bankura district, West Bengal has formed a small drainage basin and possesses an age old poverty stricken agrarian economy which draws attention for amelioration after proper appraisal of its geo-environment. The industrial activity (excepting a few cottage industries) is practically absent. Such poor economy of the Basin has only similarity with that of the neighbouring district of Puruliya in the West, where as, in the north, there lies the highly developed industrial belt of Barddhaman district. The agriculturally developed areas of Bankura district have also located in the east and in the south of the Basin.

The Sali Basin (Fig. 1.1) is spread over the administrative jurisdiction of Gangajalghati, Barjora, Sonamukhi, Patrasair and Indus Development Blocks and Police Stations of Bankura District. The Basin is extended from 23° 10' 10" N to 23° 27' 10" N and from 87° 1' 30" E to 87° 38' 20" E. It is 67.2 km. long having maximum width of 20.3 km. and minimum, 5.3 km. Its total area is 914.5 sq.km. and population 312, 829 (1991). The general alignment of the Basin is from North-West to South-East.

The area is connected with Bankura (District Headquarters) in the south west and Durgapur in the north by State Highways Nos. 5 and 9 respectively, and with Raina in Barddhaman district, West Bengal in the east by a narrow gauge railway line.

1.3 OBJECTIVES : The major objective of the thesis is geo-environmental appraisal of the Sali river basin of Bankura district, West Bengal (India) with the view to ameliorate its age old poverty stricken agrarian economy. It is necessary that resources of the Basin are utilized for building up of rural infrastructure which is an essential prerequisite for a more sustained employment and development. Among the different parameters of the geo-environment, the present researcher has given concentration on the appraisal of the general geology, climatic and pedological bases, fluvial environment and landforms, source of water and broad land use pattern of the Basin. The scheme of the present work has been explained in brief :

- (i) General appraisal of the important parameters of the geo-environment as stated above, of the Sali Basin at micro-level as far as practicable.
- (ii) Particular emphasis on the classification of the Sali Basin into distinct geomorphic divisions corresponding with its varied morphological and drainage conditions.
- (iii) Presentation of geo-environmental data through a number of thematic maps on geology, geomorphology, climate, soil, land use and others.
- (iv) Understanding the correlations among different geo-environmental parameters particularly between landform and land use by using statistical techniques through computer.
- (v) Identification of natural endowments in the Basin and delineate the development corridors without causing any disequilibrium in the ecosystem leading to the severe retrogression of the short term gains.

(vi) Preparation of a land capability map for considering the guide map for the local farmers who would themselves translate all the necessary suggestions into actions for better land use in the Basin.

An immense importance is attached with this research work to prepare detailed maps on (a) landforms and drainage conditions and (b) land use pattern of the Basin. The land use analysis in association with the terrain analysis in this research work is expected to be of great help to other researchers and planners engaged in giving a picture of the total economic status which may be used for formulating effective programmes for the development of the area. Appraisal of water resource and soils is an additional point in this context.

1.4 METHODOLOGY : The methodology adopted to achieve the above mentioned objectives involve (a) pre-field, (b) field, and (c) post-field studies with special reference to the advanced techniques of field investigation employing standard geomorphological equipments like Abney level, Clinograph, Soil Testing Kits etc. For the purpose of studying the village-wise land use pattern relating to the landscape, filling of questionnaires and personal interviews were carried on. A brief account of the methodology is as follows.

i) Demarcation of the basin boundary with the help of topographical sheets (1 : 50,000) and cadastral maps to draw the base map of the study area. (ii) Collection of data, evidences and information from various published materials and official sources. Such sources include Memoirs and Records of the Geological Survey of India, Indian Meteorological Department, Forest Department, and reports from the Central Ground Water Board, All India Soil Survey and Land use Planning, Agriculture Department, Government of West Bengal, (iii) Synthesisation of all the available published and unpublished geo-environmental information, (iv) Formulation of the field Survey and Laboratory Work Schedule on the basis of modern techniques, (v) Field Survey to collect ground truth in the form of geological and geomorphological information of the Basin and inputs for other thematic maps, (vi) Preparation of grid-mosaic on the topographical sheets (scale 1 : 50,000)

published by Survey of India for computation of tables (grid-wise) on : (I) Four Geomorphic Variables i.e., a) Relative relief (in metre), (b) Average slope (in minute), (c) Drainage density (km/km²), (d) roughness index, and (II) Four land use variables (in percentage to the total area) i.e., (e) Forests including cultured forests, (f) Area under paddy (the main crop), (g) Area under other crops, (h) Areas not available for cultivation, (vii) Generation of data from topo-graphical sheets (scale 1 : 50,000) for morphometric analysis, (viii) Statistical analysis to establish the inter-relationship between landform elements and land use factors using computer.

Geological frame work of the Sali Basin has been unveiled through frequent field investigations with the help of topographical sheets, areal photographs, and some common equipments like spade, hammer, clinometer, abneylevel, measuring tape etc.

Terrain analysis has been done mainly through the measurement and computation of surface morphologic features and drainage patterns employing various quantitative methods with the help of topographical sheets (scale 1 : 50,000) of Survey of India bearing Nos. 73 M/3, 73 M/4, 73 M/7, 73 M/8, 73 M/11, 73 M/12.

Geo-environment of the Sali Basin also includes its climatic and pedological bases. Detailed climatic data of month wise temperature and rainfall have been collected from the Regional Meteorological Centre, Alipore and Principal Agricultural Office, Bankura. Other climatic data and related information were gathered from different published materials. The data regarding N.P.K. (Nitrogen, Phosphorus, Potash) and pH have been recorded during the field work with the help of standard soil kits. Analysis of soil samples collected from the selected sites within the study area has been done in the laboratory. Further information about the soil condition of the Basin have been obtained from the reports of the National Bureau of Soil Survey & Land use Planning, Eastern Region, Calcutta. Due weightage has also been given on studying the soil erosion status of the area during field investigations.

As water is the main factor for agricultural development, an emphasis has been given on the appraisal of the ground water potential apart from the sources of surface water. Data and related information

on ground water have been obtained from Central Ground water Board and processed cartographically.

Like the geomorphological map containing the major drainage and land form features, a detailed land use map of the Basin has been prepared on the basis of data obtained from areal photographs, toposheets etc. and information gathered from published materials and empirical observations by the researcher. This map (Fig. 7.1) exhibits some modifications particularly on the mode of presentation as compared to the generalised land use map of Eastern India issued by NATMO (National Atlas & Thematic Mapping Organisation), Calcutta. Micro land use patterns in terms of some selected mouza maps have been prepared on the line of block level land use map (Scale 1 : 50,000) of the NATMO with some modifications.

In brief, the field investigations were designated in such a way that data could be employed from the double point of view : one was to consider the major physical parameters of the geo-environment including the detailed terrain pattern by recording the micro landforms and the other was to record the existing land use patterns within the varying topographic expressions of the Sali Basin.

1.5 PREVIOUS LITERATURE : Uptill now very little attention has been paid by the geographers to the geo-environmental appraisal of river basins, particularly small river basins in India. Detailed geographical study on the Sali river Basin, Bankura district in West Bengal and its surrounding areas has not yet been done. Dunn and Dey (1942), Sengupta (1966), Hundey and Banerjee (1967) Pascoe (1977) and Chatterjee (1969) have presented a general geological and physiographical account of this part of India in their publications but very little is known regarding that of the Sali Basin. Recently, Geological Survey of India, Eastern Region, Calcutta, has taken up a project for preparation of Quaternary Geological map on scale 1 : 50,000 of the Damodar-Rupnarayan interfluvium, West Bengal within which the Sali Basin is located. Chowdhury (1973) has studied on laterites of West Bengal in a very comprehensive way.

In a joint work, Bagchi and Mukherjee (1980) have carried out a

Pioneer study on regional geographical problems of the *Rarh* region of West Bengal within which the Sali Basin is located. The main findings of their studies are presented in such a systematic manner that it is highly helpful to a researcher working on the environmental aspects of geographical studies in this part of West Bengal. West Bengal District Gazetteer (1968), Bankura district, is obviously another published literature in which an overall geographical account of the area is available. Chatterjee (1969) in his Report on the Lower Damodar Valley Region and Damodar Valley Planning Atlas has given some idea about the physical set up and the land use pattern. Physical Map (Calcutta Plate, Scale 1 : 1000,000) of National Atlas Organisation (1959) and recent topographical sheets Nos. 73 M/3, 7, 8, 11, 12 (Scale 1 : 50,000) of Survey of India, throw some light.

Pedological base and ground water conditions of the entire Bankura district, West Bengal, have been discussed in the separate official reports of the National Bureau of Soil Survey and Land use Planning (1986), and Central Ground Water Board, Calcutta (1991) respectively. Central Water Commission, Allahabad in their report on Identification of Drought prone Area, Bankura District (1982) has highlighted the climatic peculiarities of the district in details.

Systematic study on the land use of the area has not yet been done. Agriculture Department, Government of West Bengal Published Annual Plans on Agriculture for the district of Bankura and police Station-wise data including related information were made available in a very general way. Ghosh, A. (1989) has incorporated a descriptive account of the physical and cultural geography of Bankura district in his book, West Bengal Landscapes. Choudhury, D. (1989) in his article industrial prospect of Bankura District (in Bengali) in 'Economy of Bankura District, West Bengal (in Bengali)', has briefly stated the condition of land under forests in the area. Similar work has been done by Das Gupta, S.P. (1989) in Jhargram Block, Medinipur District, West Bengal.