Thesis Component - II

ABIOTIC COMPARTMENT
Analytical Results

Basic Conceptual Comprehension

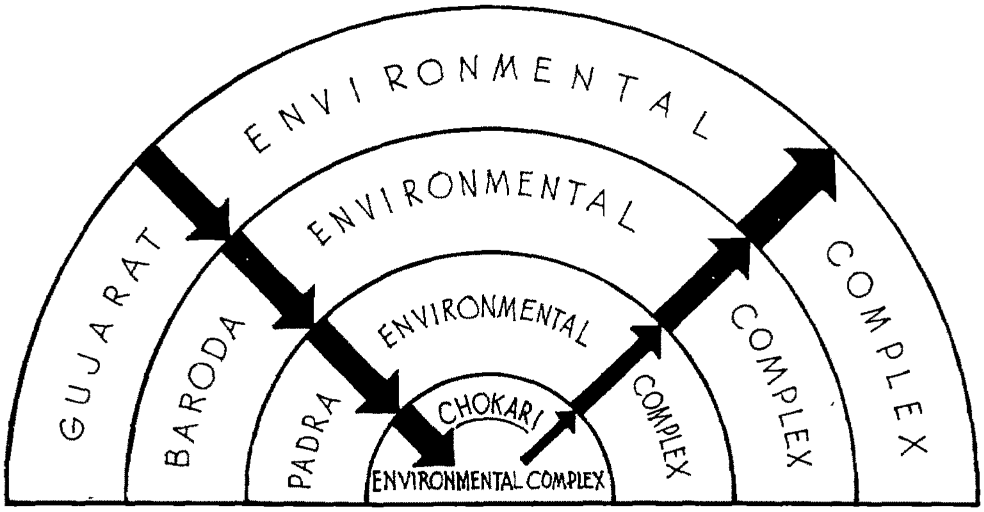
The environment as a whole is divided into three parts - the physical environment, the edaphic environment and the socio-cultural economic environment (Medford, 1973).

The goal of rural ecology is a comprehensive view of the diverse and numerous interactions of the organisms and their environments in the rural ecosystems.

According to Larcher (1975), in interpreting the ecological systems, the ecologist must try to understand the dynamic interplay of environmental factors and the organisms. All the environmental influences act continuously and jointly upon the organisms hence the ecosystems have to be studied and analyzed along with their environmental complexes to obtain a comprehensive view of the 'entire' ecosystem (Odum, 1971). From the point of view of hierarchical analysis, the environment of the region, district and taluka has profound influence on the environment of the rural ecosystem under consideration. On the other hand, the magnitude of the contribution of the unit rural ecosystem environment to the total environment at the regional level is comparatively smaller (PLATE 12).

The three units in this compartment are dealing with the physical, the edaphic and the socio-cultural economic environment of the estuarine rural ecosystem at Chokari.

Plate - 12 : The hierarchical levels of environmental complex along with their interactions both from the level of higher hierarchical position to that of the lower one and vice-versa.



INTERACTION OF ENVIRONMENTAL COMPLEX AT VARIOUS LEVELS

PLATE - 12

Thesis Component II

Abiotic Compartment.

Unit - I

The Physical Environment

I. Physical macro-environment of Gujarat region :

I. 1. Geo-physiographic aspects :

Gujarat State lies between 20.1° and 24.7° north latitude and 68.4° and 74.4° east longitudes. The entire region is situated on the western coast of Indian subcontinent covering an area of 195,984 sq. km.

The entire Gujarat region is divided into two natural parts viz. the mainland of Gujarat forming the eastern half and the peninsular Gujarat. The rivers Sabarmati, Mahi, Narmada and Tapi flow from eastern parts to the Gulf of Khambhat. Gujarat mainland can be further categorized into areas of north, central and southern plains. In the eastern part Arvalli Hill systems which rise to 319 meters, are prominent. Eastern part is dominated by the Satpura hilly complexes with heights ranging from 150 to 243 meters. These complexes partition the waters of Narmada and Tapi. The plains of mainland of Gujarat are partitioned by scattered hillocks and small rivers as well as streams. The coastal plains are sandy and saline.

The peninsular part is distinct in physiographic aspects due to small systems of scattered hillocks and small plains that traverse in between such hillock areas. This peninsular part is further classified in three sections consisting of hilly areas, tablelands and coastal areas.

Saurashtra is mainly composed of coastal plains and hilly systems while the Kutch comprises of the desert tracts as well as saline land masses with stray hilly subsystems.

I. 2. Climatological aspects :

Gujarat belongs to the dry zone of the country. The drier regions are divided into semiarid and arid zones based upon the severity of aridity. The physical environment of this region is composed of arid and semiarid zones. The variation in the pattern of rainfall is distinct in the different districts of the State. Dangs region receives maximum rainfall while the Kutch region records minimum rainfall values in the State (Table 1).

Koteswaram (1974) reports the range of the influx of solar radiation of 80-82 KCal/cm^2/yr for Gujarat. The reports of the meteorological Department record the wind pressure of 1000 millibars during July - October and 1008 millibars during January - April period.

The temperature ranges recorded are 25°-29°C during

Table 1. Rainfall distribution in the State.*

District	Rainfall (in cm)
Dang	199.8
Surat	152.1
Panchmahal	98.8
Baroda	96.8
Bharuch	94.9
Kheda	81.5
Sabarkantha	81.0
Banaskantha	62.6
Ahmedabad	62.5
Junagadh	62.3
Mehsana	60.9
Bhavnagar	59.3
Rajkot	58.9
Surendranagar	50.6
Amreli	50.0
Jamnagar	47.1
Kutch	32.2

* Based on 'Gujarat' - University Book Production Board, Gujarat State, Ahmedabad.

July - October period while 30°-31°C during January - April period. There are variations in the temperature regimes and humidity values throughout entire State.

II. Physical micro-environment of Baroda district and Chokari rural ecosystem area :

II. 1. Geo-physiographic aspects :

Baroda (Vadodara) occupies 3.9% of geographical area of the Gujarat State, with an area of 7788 sq. km. The district is one of the eastern most parts of the state. It is located between latitude 21°-0' north and longitude 73°-00' and 74°-1'.

Geomorphic partitions of the district consist of the eastern hilly, medium to high relief terrain and the western plainland area. The hilly systems can be further categorized into two parts. The northern part consists of irregular hilly ridges with intervening small valleys while the southern part is flat topped hilly region. The district is traversed by Narmada, Mahi, Orsang, Heran and Vishwamitri river systems.

The ecosystem area of Chokari rural complex is situated on the plain terrain with the river Mahi on its northern border.

II. 2. Climatological aspects :

Baroda district as a whole has hot and dry climate which is representative of tropical monsoon continental type of climate. Such a climate naturally involves the division of the year into three seasons primarily on the basis of a reversal of the prevailing wind direction between winter and summer and concentration of the rainfall during the four months. The observations made at Chokari ecosystem area did not differ from those of Meteorological records at Baroda.

II. 3. The Pattern of Seasons :

Winter :

The winter season lasts from November to February. However, the later part of the October is transitional period and marks the beginning of the winter season in November. It is characterized by low temperatures especially during the nights. The wind is light and north-westerly in direction. Occasionally, it remains foggy. The visits of cold air masses bring the temperature very low. The season is dry with clear sky.

Summer :

The summer lasts from March to May. There is rise in temperature during this period. The sky is clear but hot winds are experienced with variable directions northwest to west or south to west. Winds and dust storms of very small magnitude occur occasionally. The landscape is dreary and pale and the fields are empty and barren (Kulkarni, 1973).

Wet Summer :

By the middle of June the monsoon begins. Although the temperature is comparable to that of summer season. There are a few showers and the monsoon gradually sets in.

Rainy season :

July to September are real months of shower. The rains come generally from the second or last week of June and last till the second or third week of September. Occasionally showers are received during the months of October also. The monsoon in this district sets in along with the winds.

Transitional Autumn :

There is no well-defined autumn season. However, the October end and early November period may be described as Transitional Autumn which is for a very short period.

The season-periods are also fluctuating depending upon the various environmental influences. The preceding paragraphs however represent broad categories of the seasonal patterns.

II. 4. Temperature Patterns :

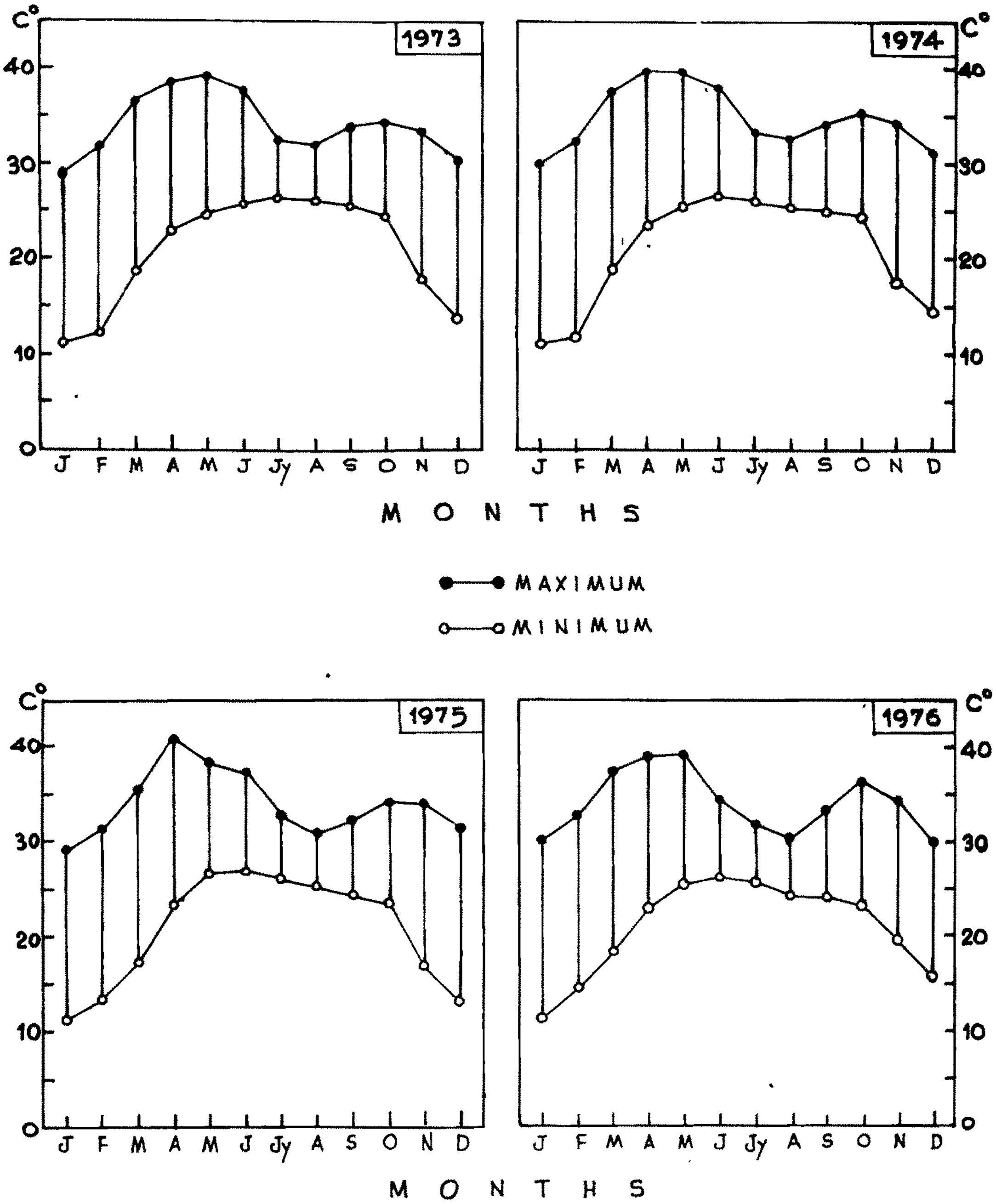
The lowest temperatures for the year are recorded during the winter season. The average yearly temperature which is 35° to 40°C gradually decreases to the minimum level of 25° or 20°C in July - August. December or January forms the coldest period of the year. The average minimum temperature goes upto 10° or 11°C. The temperature gradually increases and reaches the peak value in April or May. The temperature in the March to May period is highest and comes down by the middle of June with the advent of monsoon. (PLATE 13).

The Range of Temperature :

Average monthly range of temperatures during the study period has been highest in month of April or May when it is 39° to 41°C. Though the average maximum reaches to 38° or 39°C, the average minimum temperature remains 24° to 26°C. The monthly range then decreases. April-May is, however, the hottest period.

With the arrival of monsoon, the maximum temperatures become lowered while the lowering of the minimum range is not very appreciable. This has been attributed to the cooling effect of rainfall (Naik and Razak, 1967) (Tables 2 and 3).

Plate - 13 : Climatograph of Temperature (maximum and minimum) showing the monthly mean values for the study period (1973 - 1976).



TEMPERATURE (MONTHLY MEAN)

PLATE-13

Table 2. Temperature (Monthly mean)

Month	1973		1974	
	Maximum	Minimum	Maximum	Minimum
January	29.1	11.1	30.1	11.3
February	31.8	12.2	32.4	11.9
March	36.6	18.6	37.5	19.1
April	38.4	22.8	39.9	23.8
May	39.1	24.6	39.6	25.6
June	37.9	25.6	38.1	26.8
July	32.3	26.3	33.3	26.1
August	31.9	26.0	32.8	25.4
September	33.9	25.5	34.2	25.1
October	34.3	24.3	35.3	24.5
November	33.4	17.9	34.3	17.6
December	30.3	13.8	31.3	14.5

Table 3. Temperature (Monthly mean)

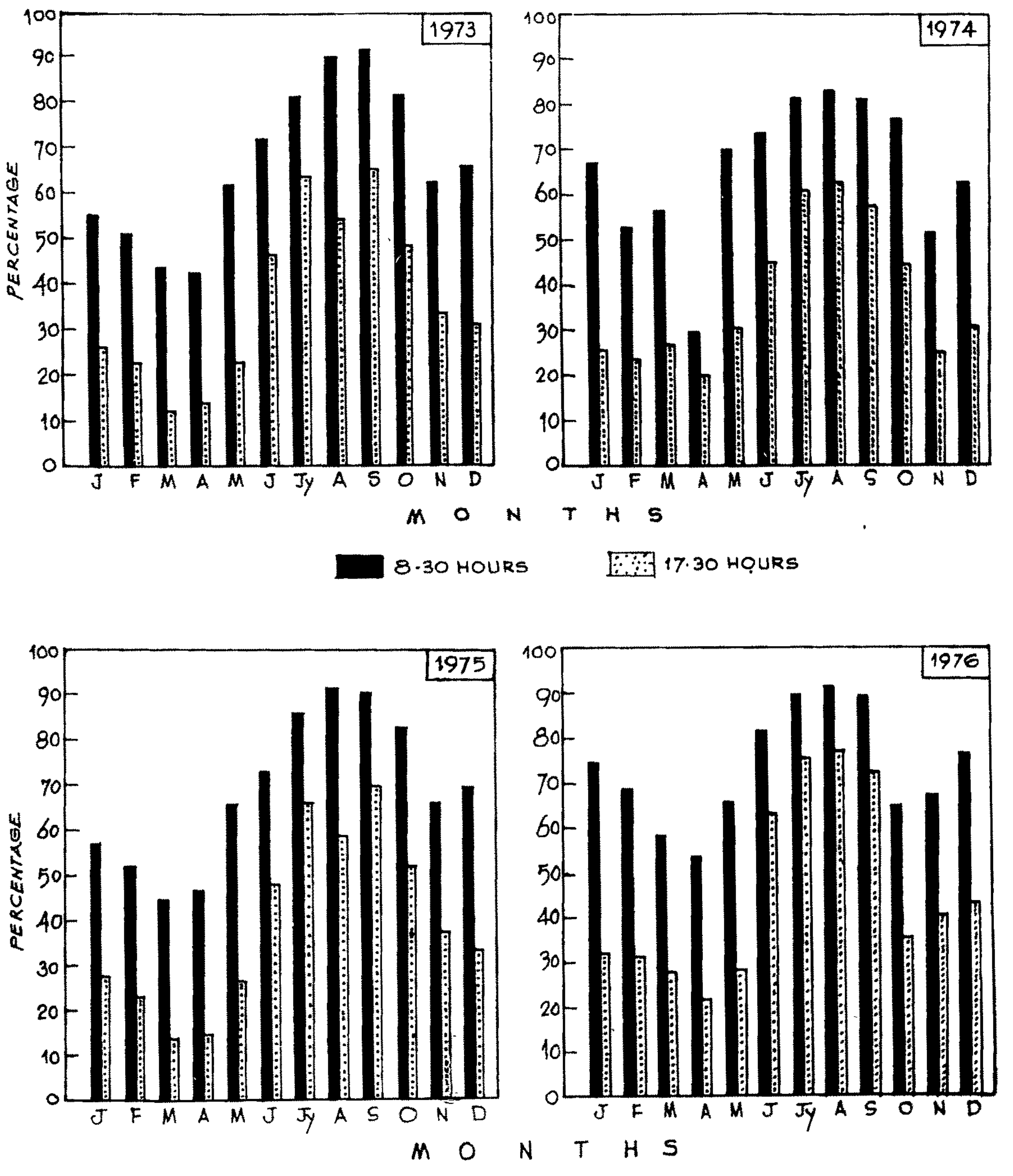
Month	1975		1976	
	Maximum	Minimum	Maximum	Minimum
January	29.2	11.4	30.2	11.5
February	31.3	13.3	32.9	14.6
March	35.6	17.4	37.6	18.5
April	40.9	23.6	39.1	23.2
May	38.1	26.8	39.2	25.6
June	37.4	27.2	34.5	26.1
July	32.9	26.1	31.9	25.7
August	31.1	25.3	30.5	24.4
September	32.4	24.5	33.4	24.1
October	34.3	23.6	36.5	23.3
November	34.2	16.9	34.4	19.9
December	31.6	13.3	29.9	15.9

II. 5. Humidity Pattern :

Relative humidity for the study period suggests that the highest values in the month of August or September are achieved due to low rate of evaporation and highest precipitation (Pandeya, 1977). The value decreases steadily during the month of October to November at the end of rainy season. The increase in relative humidity in December and January is not because of any increase in average temperature of these winter months. The relative humidity starts decreasing from February and reaches to its minimum in the month of April because of decrease in the rate of absolute humidity (Kulkarni, 1973) (PLATE 14) (Tables 4 and 5).

II.6. Atmospheric Pressure and Winds :

In the winter months, the atmospheric pressure is high. The winds are slow, dry and cold but persistently blow from the north to north-west. From the month of March atmospheric pressure gradually decreases and becomes lowest by the middle of June. March and April are the months of variable winds, but by May, the direction is more or less fixed, westerly or south-westerly winds becoming more swift, hot and unstable by the approach of summer. As sudden pressure depressions are of common nature during these months, the wind direction becomes variable to a considerable extent. In October and November, Plate - 14 : Climatograph of Average (per cent) relative humidity at 8.30 hours and 17.30 hours during the study period (1973 - 1976).



AVERAGE PERCENT RELATIVE HUMIDITY

PLATE-14

Table 4. Average Percentage Relative Humidity.

Month	1973		1974	
	8.30 hrs	17.30 hrs	8.30 hrs	17.30 hrs
January	55.0	26.1	67.1	25.4
February	50.9	22.8	52.5	23.1
March	43.2	11.9	56.6	26.5
April	42.6	13.8	29.2	19.6
May	61.7	22.8	69.8	30.2
June	71.8	46.7	73.6	44.9
July	81.3	63.8	81.3	60.9
August	89.9	54.4	83.0	62.5
September	91.3	65.4	81.0	57.2
October	81.3	48.6	76.8	44.3
November	62.3	33.3	51.4	24.9
December	66.0	31.2	62.9	30.6

Table 5. Average Percentage Relative Humidity.

Month	1975		1976	
	8.30 hrs	17.30 hrs	8.30 hrs	17.30 hrs
January	57.0	27.7	74.7	32.0
February	51.8	23.0	68.8	31.2
March	44.3	13.3	58.3	27.6
April	46.3	14.6	53.3	21.7
May	65.4	26.4	65.9	28.5
June	72.9	47.8	81.4	63.1
July	85.9	65.9	89.7	75.5
August	91.4	58.3	89.2	72.3
September	90.3	69.9	65.0	35.2
October	82.5	51.9	67.5	40.2
November	65.6	37.3	76.2	43.1
December	69.6	33.1	68.2	37.1

once again a change takes place in temperature pressure and direction of winds which are at the same time no longer humid. The pressure continues to decrease upto December and winter winds are once again established.

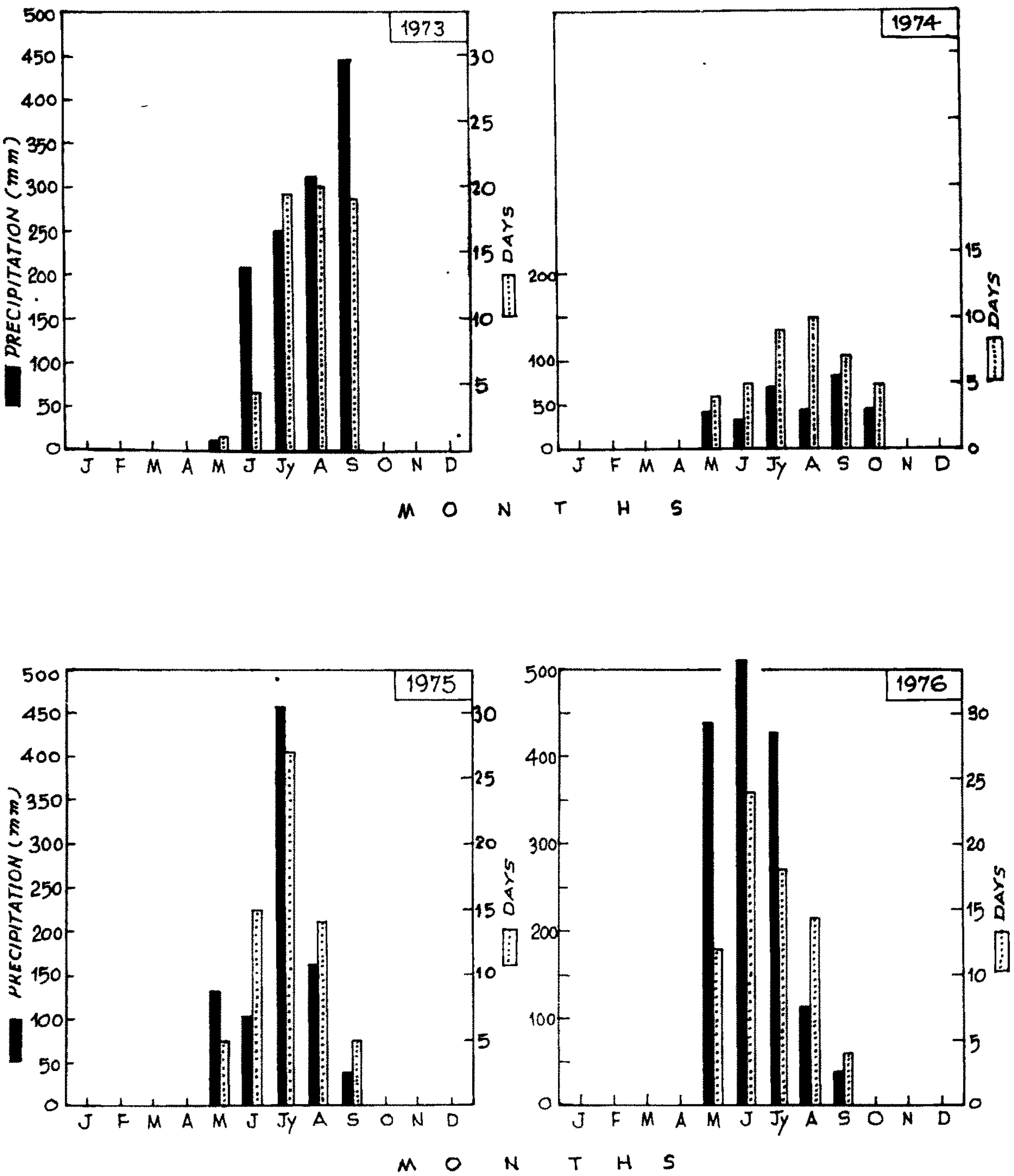
II. 7. Rainfall :

The range of average rainfall for the area is 908-1020 mm. There have been considerable fluctuations in this value. The fluctuation have had severe impact on the agro-economic status of the area. In the present study period fluctuation occurred twice. In 1974 there was less than normal precipitation which resulted in drought conditions in the area - while in 1976 the value was quite high which damaged the crop systems considerably. Not only is the amount of annual rainfall uncertain but it is also not evenly distributed during the season (Tables 6 and 7).

Uncertainty is also associated with the arrival of the monsoon in the area which normally reaches by the middle of June. Similarly the monthly departure of rainfall from average monthly rainfall varies greatly suggesting the erratic behaviour of the rainfall in the area (Naik and Razak, 1967).(PLATE 15).

Sometimes the intensity of the rainfall per rainy day is so high that it leads to flooding of the farms of the area.

Plate - 15 : Climatograph of Precipitation (Rainfall) showing the monthly patterns and the days of rain in each of the month during the study period (1973 - 1976).



P R E C I P I T A T I O N (MONTHLY PATTERNS)

PLATE- 15

Table 6. Precipitation Patterns

Months	1973		1974	
	Precipitation in mm	Days	Precipitation in mm	Days
May	10.5	1	42.4	4
June	200.8	4	30.3	5
July	247.3	19	64.9	9
August	326.3	20	42.2	10
September	444.3	19	80.7	7
October	-	-	44.4	5

Months	1975		1976	
	Precipitation in mm	Days	Precipitation in mm	Days
May	-	-	-	-
June	131.8	5	437.7	12
July	103.8	15	510.	24
August	456.0	27	427.8	19
September	159.2	14	113.2	16
October	38.3	5	36.2	4

Table 7. Precipitation Patterns

Year	Precipitation in mm
1965	638.8
1966	764.1
1967	968.0
1968	545.6
1969	1060.5
1970	1347.2
1971	917.2
1972	387.8
1973	1229.2
1974	304.9
1975	1189.1
1976	1524.9

Such flooding effect was experienced in the years 1975 and 1976 which had detrimental effect on the agricultural output of Chokari (PLATE 16).

III. Ecoclimatic aspects :(a) The concept

Meteorological parameters like solar radiation, temperature, rainfall and wind velocity etc. play the most important role being driving variables in structure and function of this ecosystem. Until recently these parameters have been treated separately and no attempts have been made in ecological investigations to synthesize them and meaningfully correlate them.

Thornwaite and Mather (1955) have suggested to classify the climate as a whole in an attempt to establish the two important parameters viz. potential evapotranspiration (PE) and Actual evapotranspiration (AE).

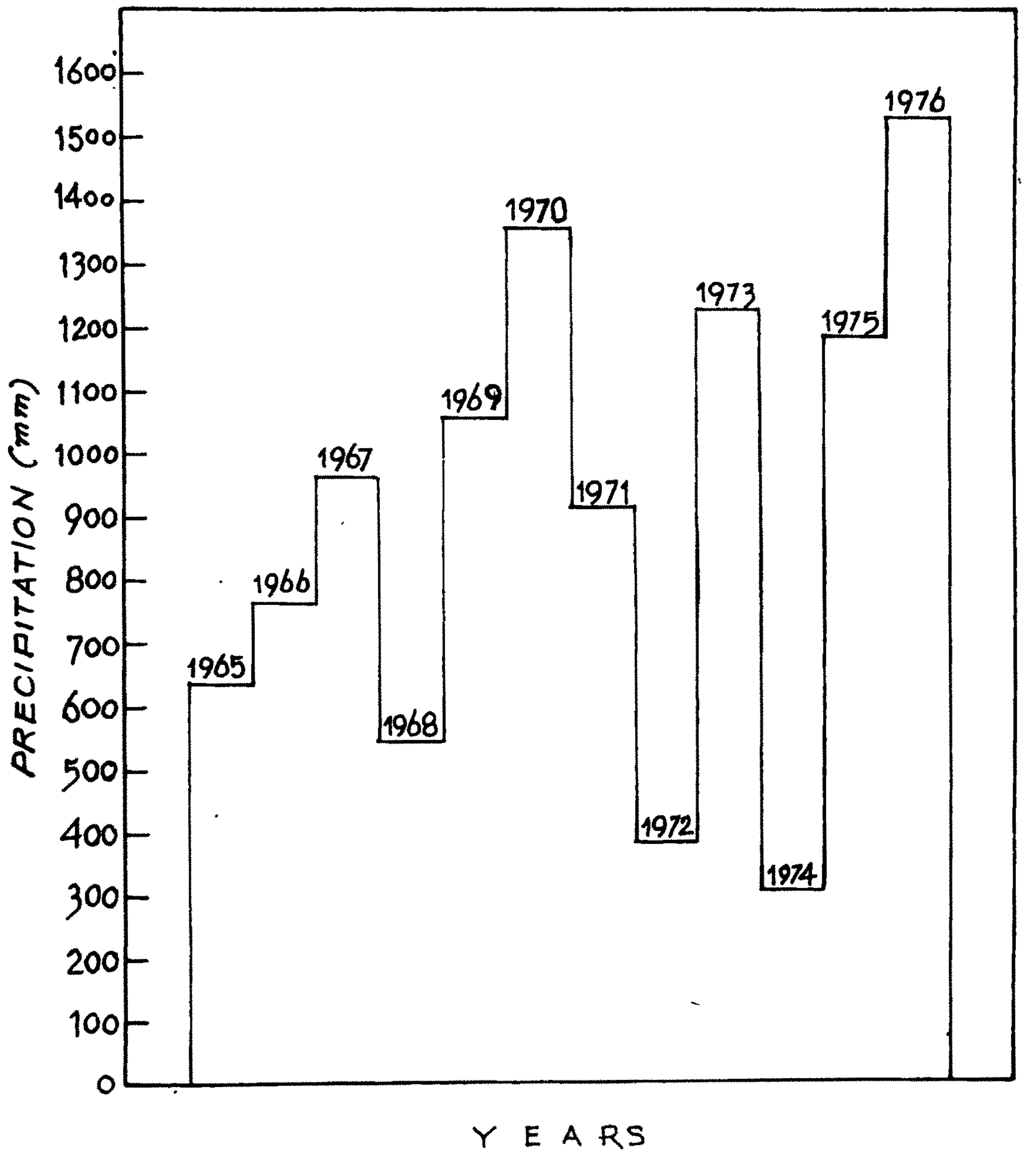
Thornwaite's climatic classification has been adapted for the first time to Indian Climates by Subrahmanyam and Subramaniam (1965) and Pandeya *et al.* (1977).

The indices used in calculation of ecoclimate of an area are given below :

T°C = Mean monthly temperature

i = Heat index

Plate - 16 : Yearly pattern of Precipitation (Rainfall) from 1965 - 1976 to indicate the erratic behaviour of the rainfall in the ecosystem area.



PRECIPITATION YEARLY PATTERN

PLATE-16

UPE = Unadjusted Potential Evapotranspiration

PE = Potential Evapotranspiration

P = Mean monthly precipitation

D = Summation Delta

St = Soil Water Storage in mm

St = Change in soil water storage in mm

AE = Actual Evapotranspiration

D = Water deficit in mm

S = Water surplus in mm

Ro = Water runoff in mm

Ih = Humidity index

Ia = Aridity index

Im = Moisture index

SCTE = Summer Concentration of Thermal efficiency

TE = Thermal efficiency.

Pandeya et al. (1977) have used the above indices and prepared a detailed description of ecoclimate of India. Pandeya et al. (1977) have prepared an ecoclimatic map of India. According to these authors, oceanic climates (with narrow range of mean monthly temperature falling within 10°C) have been distinguished from the broad range of annual mean monthly temperature (above 10°C). Each of the two groups of temperature range has been further classified into low temperature group (lowest mean temperature during winter month) and a high temperature group. Again, the two groups are further subdivided into low rainfall and high rainfall localities. In this way 8 groups of localities, 4 each in oceanic and continental climates are distinguished and finally within each group, localities can be distinguished on the basis of water status formulae proposed by Pandeya et al. (1977) as follows :

WS = P - PE - St

P = annual precipitation in mm

PE = annual potential evapotranspiration in mm

St = Soil water storage in mm

Based on this classification the following vegetational types are recognized :

A1 = Oceanic subtropical montane evergreen forests

A2 = Oceanic subtropical wet forests

B1 = Oceanic tropical dry forests to low tropical evergreen

B2 = Oceanic tropical wet evergreen forests

C1 = Continental alpine to temperate dry coniferous forests

C2 = Continental broad leaved moist temperate forests

D1 = Continental arid to dry scrub land or deciduous forest

D2 = Continental moist deciduous or semi-evergreen forest

(b) Ecoclimatic aspects - Gujarat :

The study of ecoclimate classification proposed by Pandeya *et al*. (1977) reveals the position of Gujarat from the point of view of ecoclimatic considerations.

Gujarat as a whole can be classified into four major ecoclimatic zones.

I. Coastal Saurashtra - which belongs to the Category B1 in Narrow Range of Temperature.

II. South Gujarat (lower parts except Dangs) - which belongs to the Category D1 - 2 in wide range temperature.

III. Dangs - which belongs to D2 in wide range temperature.

IV. Rest of Gujarat (including Kutch, North Gujarat, Plain of Saurashtra), which belongs to D1.1 in wide range of temperature. (PLATE 17).

III. 2. Ecoclimate of Chokari Ecosystem :

The ecoclimate of Chokari ecosystem complex has been also classified according the ecoclimatic classification.

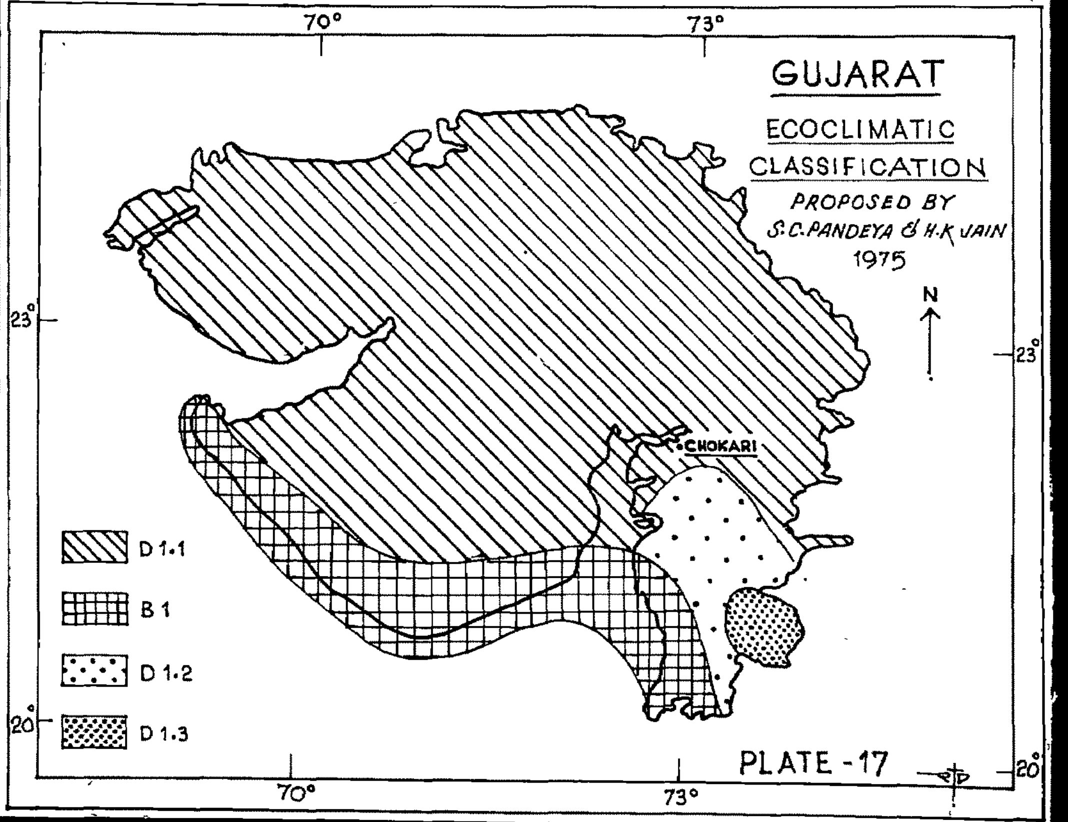
Plate - 17 : The Ecoclimatic Classification Map of Gujarat region adapted from Ecoclimatic Map of India (Pandeya and Jain, 1975).

D1.1 - Continental arid to dry scrab or deciduous forest
(wide range of temperature).

D1.2 - (narrow range of temperature).

D1.3 - Wide range and high rainfall.

B1 - Oceanic tropical dry forest
(Narrow range of temperature).



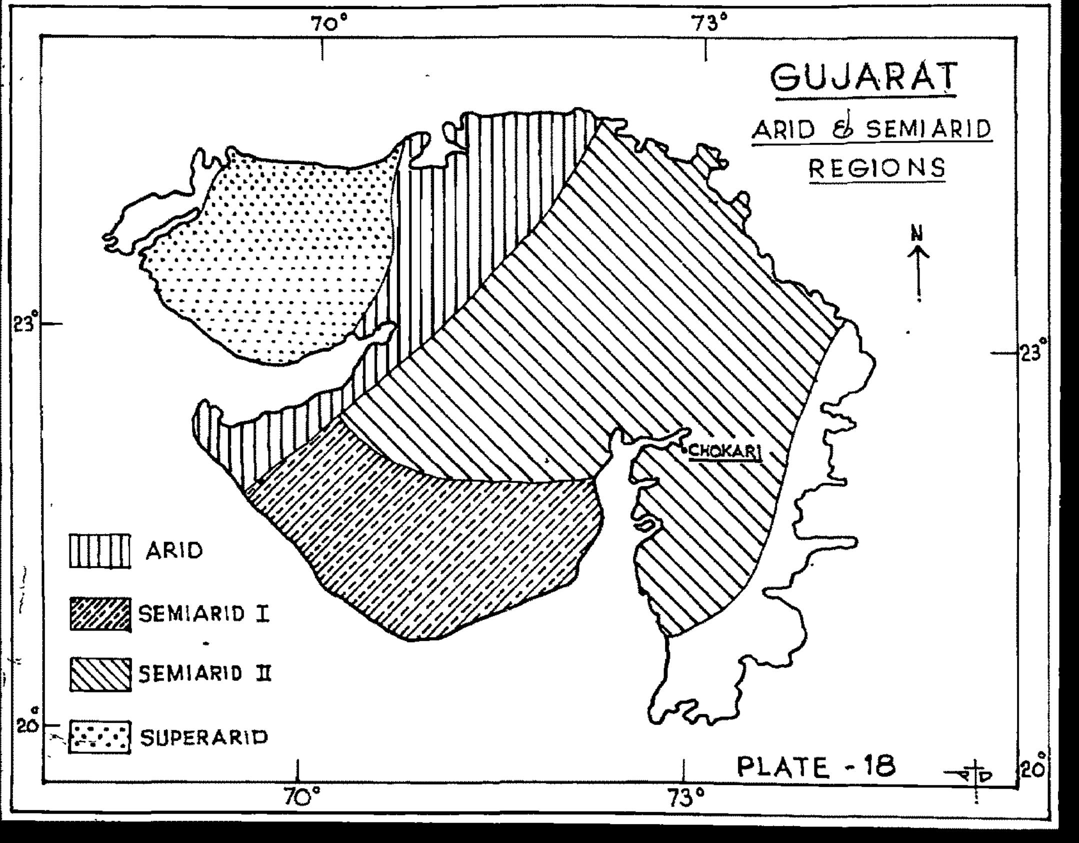
GUJARAT
ECOCLIMATIC CLASSIFICATION
PROPOSED BY
S.C. PANDEYA & H.K. JAIN
1975
N
CHOKARI
D 1.1
B 1
D 1.2
D 1.3
70°
73°
23°
20°

PLATE - 17

Chokari ecosystem complex comes under the Category D1.1 (as per the categories referred to earlier).

This ecosystem is characterized by a moderate precipitation, high temperature and with evaporation exceeding the precipitation. It therefore, under the semiarid region of the State. In this semiarid category the water surplus is available only during the growing months where AE equalises PE and with soil moisture recharge and water surplus during one of the monsoon months and with net water surplus in negative balance. (PLATE 18).

Plate - 18 : Gujarat region classified into Arid, Semi-arid and Super-arid regions.
Ecosystem area at Chokari is a part of Semi-arid region.



GUJARAT
ARID & SEMIARID
REGIONS
N
70°
73°
23°
20°
CHOKARI
ARID
SEMIARID I
SEMIARID II
SUPERARID
PLATE - 18

Thesis component II

Abiotic Compartment

Unit - II

The Edaphic Environment

I. 1. Litho-Edaphic complexes of Gujarat - a macroview :

Lithogeologically the major portion of Gujarat State has a flat topography, which is indeed the southern most extremity of the semi-circular old alluvial plains. Low hilly regions occur in the north part of the Sahyadri and portions of Aravalli systems lying in northeast to south west directions. Reports of the Geology Department, Government of India clearly indicate that the deccan trap occupies the major part of the peninsular Gujarat, parts of Dangs, Bulsar, Surat, Bharuch districts and to a little extent Kutch. In North, Central and South Gujarat mainland we get rocks of recent category. Near the coastal areas Siwalik or Oligocene are found in combination with one another. Palaeozoic, dharwarian and charnockities are found on the eastern border of north and central Gujarat (Land sat prints- 1 and 2).

I. 2. Edaphic complexes of Gujarat :

Edaphology of Gujarat has been worked out by Shah (1955). The survey of soils of this region yields the following categorization according to Shah (1955) : (PLATE 19).

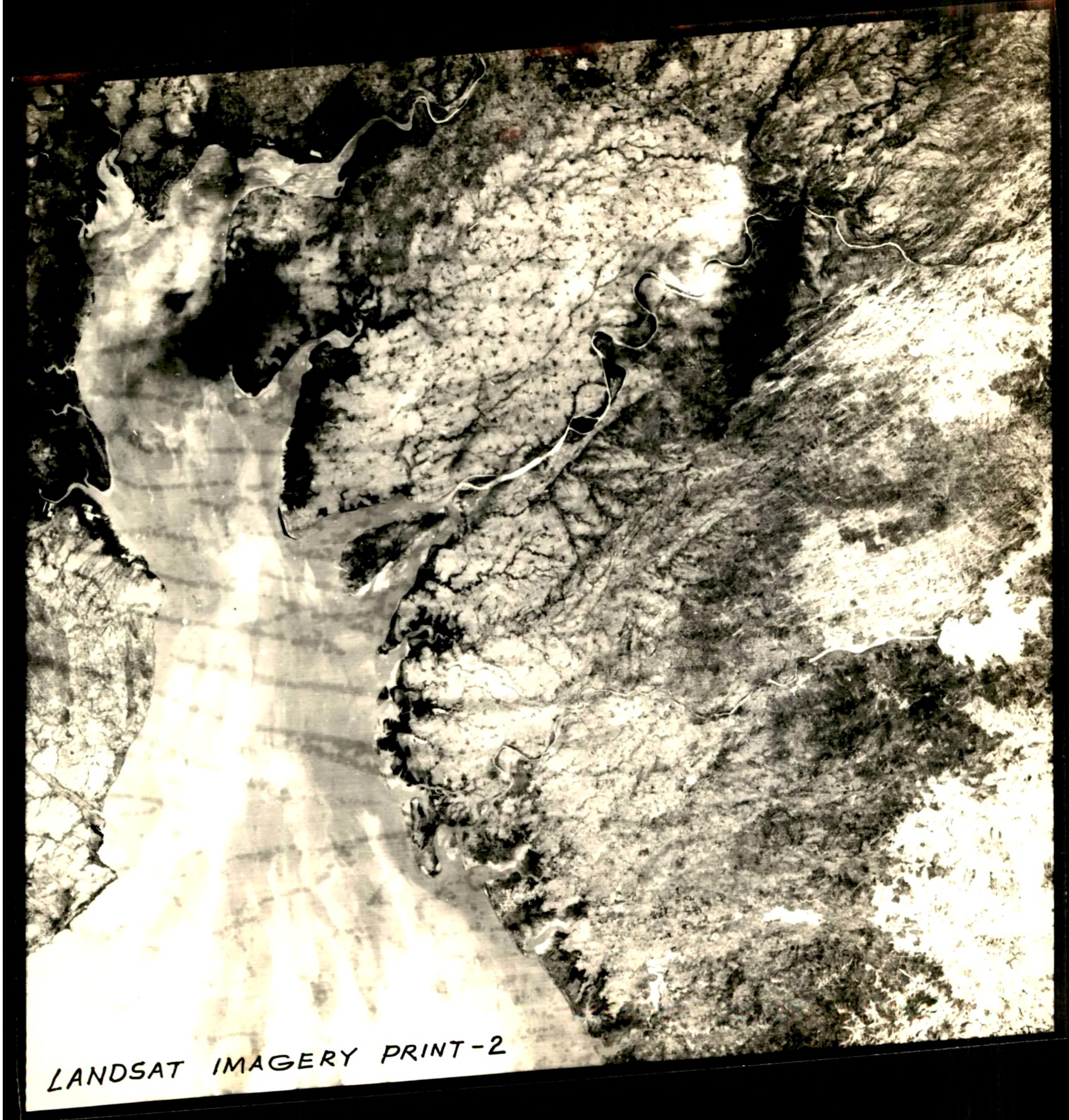
- Shallow black soils
- Medium black soils

Landsat Imagery Prints 1 and 2 :

The Litho-edaphic complexes of some parts of Gujarat and Baroda district.

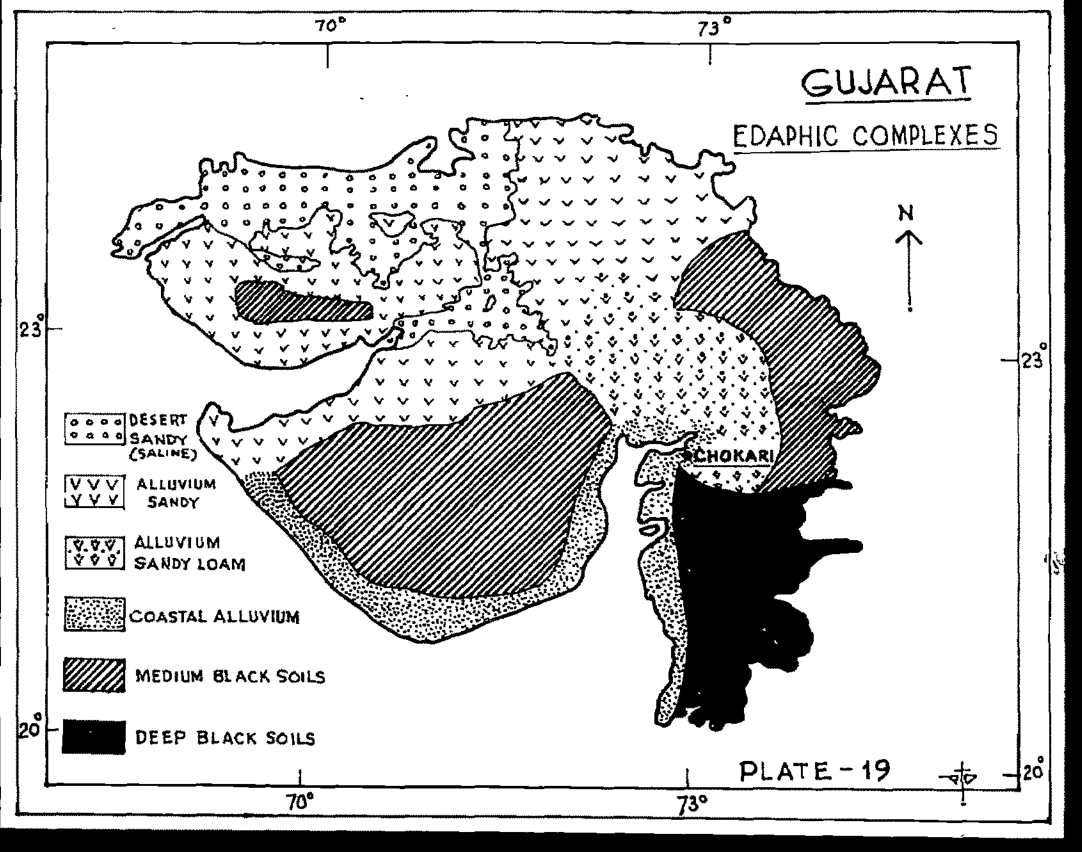
(The illustrations are kindly supplied by the Head, Aerial Surveys, Ground Truth and Photo Interpretation Division of Space Applications Centre, Ahmedabad.).


LANDSAT IMAGERY PRINT-1



LANDSAT IMAGERY PRINT - 2

Plate - 19 : Edaphic complexes of Gujarat region -
a broad categorization at the State level.


GUJARAT
EDAPHIC COMPLEXES
N
70°
73°
23°
20°
DESERT SANDY (SALINE)
ALLUVIUM SANDY
ALLUVIUM SANDY LOAM
COASTAL ALLUVIUM
MEDIUM BLACK SOILS
DEEP BLACK SOILS
CHOKARI
PLATE - 19

- Deep black soils
- Sandyloam (old alluvial) soils
- Coastal alluvial soils.

Recent surveys made by Pandeya et al. (1977) lead to the different categorization as shown below :

- Medium and deep black soils
- Old alluvial soils
- Patches of red and yellow soils of hilly regions.

I. 3. Black Soil Complexes :

These include deep and medium black soils of Surat and Bharuch and medium black soils in the eastern parts of some places like Sabarkantha, Godhra, Naroda and can even be found in parts of districts like Jamnagar, N Junagadh, Rajkot, Amreli and Bhavnagar. According to Pandeya et al. (1977) it is the clay-humus complex that imparts the characteristic colour to the soil. Joshi (1950) (as quoted by Pandeya et al., 1977) observed that the colour assumed by black soil depends upon colour of mechanical components of the soil. These soils are base rich clayey soils of high fertility - commonly called as black - cotton - soils (Table 8).

Table 8 : Range of variation of several constituents of black soils.

Constituents	Range of variation
Finer fraction (Clay and Silt)	70 - 90%
Coarse sand	4 - 8%
pH	7.2 - 8
Total Solids	0.05- 1.5%
Salts concentration depth	1.5 - 2.5 m
Acid solubles	1 - 10%
Exchange Capacity	40 - 60 m. e./100 g soil
Exchangeable Ca	15 - 42 " "
Exchangeable Mg	6 - 12 " "
Exchangeable K	0.1 - 0.6 "
Exchangeable Na	3 - 13
Fe_2O_3	0 - 13%
Al_2O_3	16 - 23%
R_2O_3	25 - 35%
CaO	2.5 - 7%
MgO	3 - 4%
SiO_2	50 - 55%

I. 4. Old alluvial soils :

Old alluviums are composed of sandy layers of considerable thickness. Such soils may be neutral or slightly alkaline or saline (PLATE 20). Pandeya (1977) reports such soils to be base saturated. Physicochemical properties indicate that such soils have higher moisture retention capacity (Table 9).

II. Edaphic complexes of Baroda district and Padra Taluka :

II.1. Litho-Geo-edaphological aspects :

It has been mentioned earlier that the district has flat as well as flat topped hilly topography belonging to the deccan trap complexes. The western plains have flat appearance and low lying pile of thick alluvium. These alluvium zones are dissected by river systems as indicated in the geo-physiography of the area. According to the geological reports the recent and older alluviual soils belong to the Quarternary Complex. The older alluvium which constitutes sand, silt, clay and kankar has been deposited and weathered during the whole length of Quaternary period. This is covered by younger alluvium and different types of soils (Land sat prints 1 and 2).

Plate - 20 : Fluctuations in the coastal alluvial soils in the level of salinity due to sea water ingress. The zones are not cultivable on the whole due to high value of electrical conductivity. The 'temporary' farming is done in some areas (slightly away from the coast) during the low salinity level.

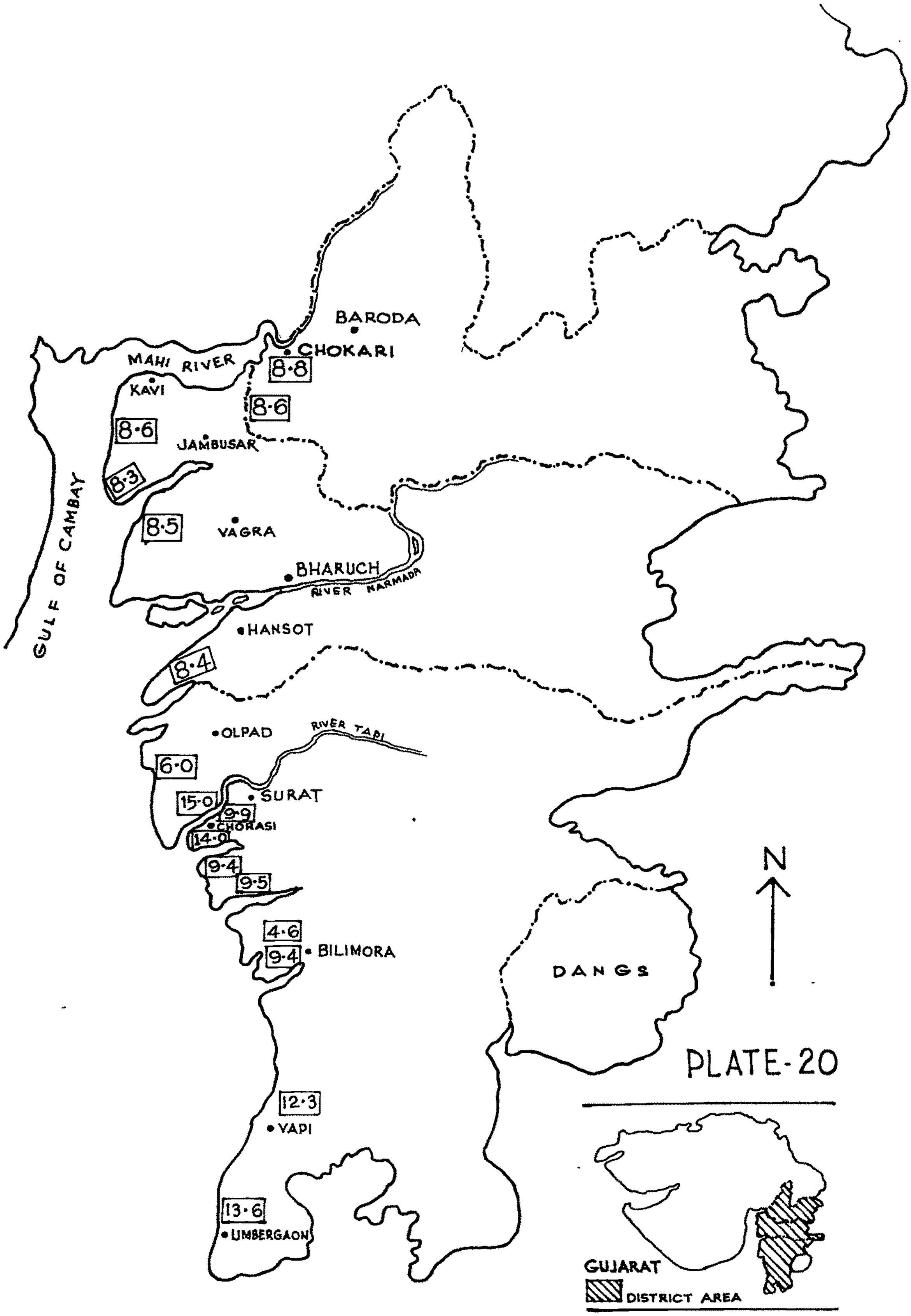


PLATE-20

ELECTRICAL CONDUCTIVITY (Ec) IN millimhos/cm OF BARODA, BHARUCH AND SURAT. (COASTAL REGIONS)

Table 9 : Physico-Chemical Characters of Old alluvial Soils.

Constituent	Depth in cm		
	0 - 15	15 - 30	30 - 60
Coarse sand	0.42	0.48	0.47
Fine sand	80.07	86.00	81.61
Silt	10.75	9.75	9.50
Clay	5.50	1.00	3.75
Moisture	1.22	1.17	1.60
CO_3	Nil	Nil	Nil
Total Soluble Salts	0.016	0.011	0.096
Nitrogen	0.067	0.049	0.035
Total K (mg/100 g)	275.00	254.70	286.50
Exchangeable K (mg/100 g)	26.20	17.80	17.80
Base Exchange Capacity (mg/100 g)	9.80	9.20	10.50
Total Mn (mg/100 g)	49.10	48.30	48.80
Exchangeable Mn (mg/100 g)	0.78	0.59	0.70

II. 2. Taluka level edaphic complexes :

The edaphic complexes of Padra Taluka belong to the medium black soils and loam type of soils. The patches of deep black soils are also encountered in the taluka. The coastal areas of taluka however, show deposits of recent or old alluvial types. The Chokari ecosystem complex has the two distinct edaphic complex units. One of the units comprises of the saline soils while the other of the non-saline soils.

III. Analysis of Edaphic environment of Chokari rural ecosystem complex :

III. 1. Ecozonation of Chokari :

The rural ecosystem at Chokari occupies land area of 1380.11 hectares. The edaphic complexes at Chokari can be divided into three distinct ecological zones. The complexity of the soil systems has increased due to the Mahi river ecosystem on one hand and due to the ingress of sea water into the tidal mouth of Mahi river on the other hand. The detailed investigations for the last four years have helped the author to formulate ecological zonation (ecozones) of the Chokari Edaphic complexes. There are three distinct ecozones at Chokari (PLATE 21).

Plate - 21 : Ecozonation of Chokari rural ecosystem. The Map shows the three ecozones - viz. the non-saline, the ravine and the saline ecozones. The saline ecozone is further detailed into the three subzones.

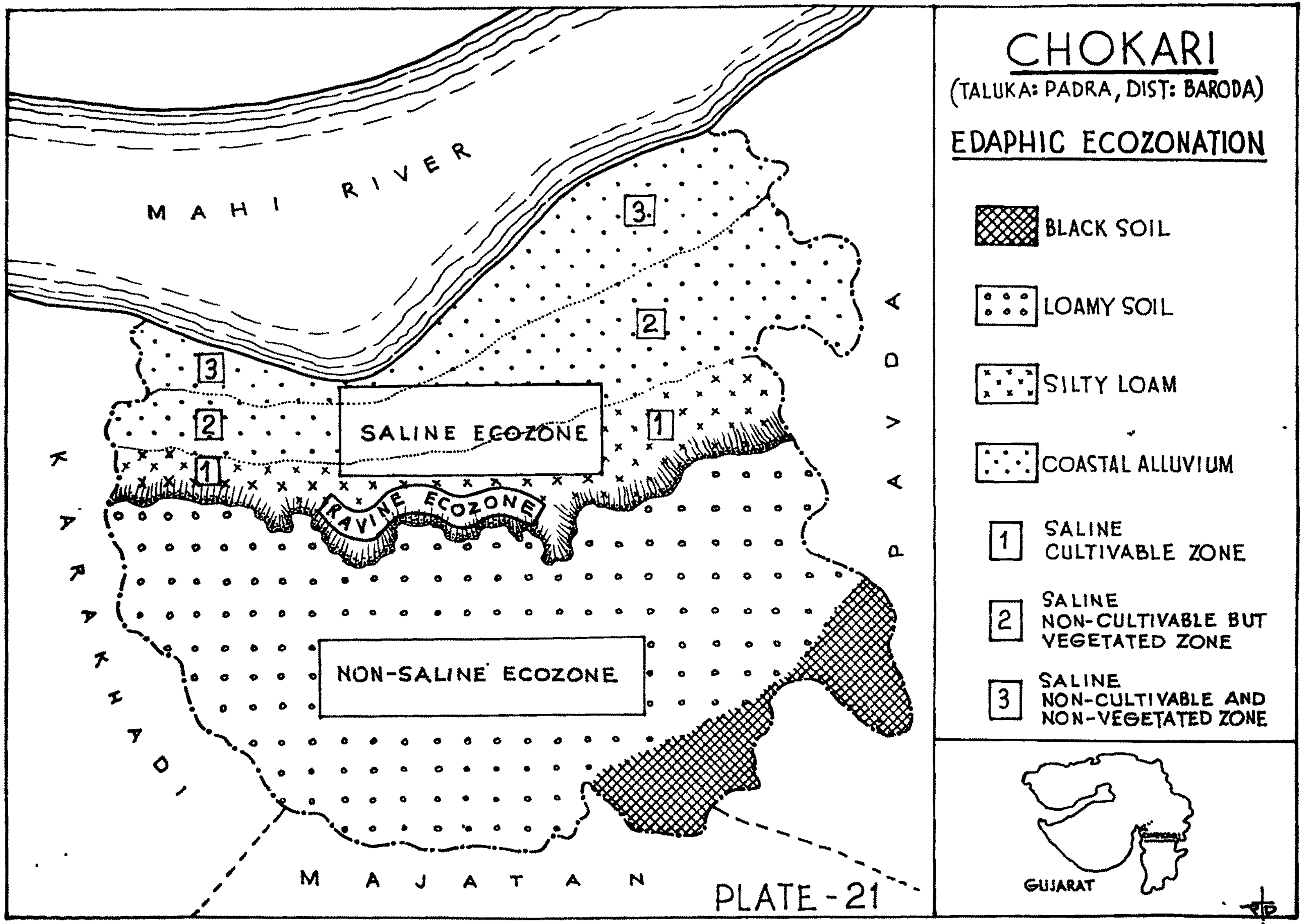

CHOKARI
(TALUKA: PADRA, DIST: BARODA)
EDAPHIC ECOZONATION
BLACK SOIL
LOAMY SOIL
SILTY LOAM
COASTAL ALLUVIUM
1 SALINE CULTIVABLE ZONE
2 SALINE NON-CULTIVABLE BUT VEGETATED ZONE
3 SALINE NON-CULTIVABLE AND NON-VEGETATED ZONE
GUJARAT
MAHI RIVER
SALINE ECOZONE
RAVINE ECOZONE
NON-SALINE ECOZONE
PAVDA
KARAKHADI
MAJATAN

PLATE - 21

(A) Non-saline ecozone

(B) Ravinous ecozone

(C) Saline ecozone.

(A) Non-saline ecozone :

The soils of this zone constitute major portion of the area. This zone is used for cultivation as well as human habitation purposes. The cultivation is done on black and loam soils and the physico-chemical characteristics of this zone are similar to the other black and loam complexes of the State.

(B) Ravinous ecozone :

This zone separates the non-saline zone from the saline as well as coastal zone ofthe area. These ravines extending to the area of 10-12 hectares are due to the interaction soil system with the Mahi river system over a long period of time. This zone is so distinct that it gives a very clear idea of the natural process of soil erosion and depletion.

(C) Saline ecozone :

The zone includes the sizeable hectare area of Chokari ecosystem. The zone consists of the coastal area of the Mahi river flowing towards the Gulf of Khambhat. The zone marks the beginning of the tidal mouth of the river hence shows salinity in edaphic complexes.

Plate - 22 : The Ravine ecozone - leading to the saline ecozone. The 'marginal' farmer is seen on the 'concerete' approach way built by the village authorities.

The saline zone is further categorized into three sub-zones as follows :

a) saline cultivable zone (PLATE 23).

b) saline non-cultivable but vegetated zone (PLATE 24).

c) saline non-cultivable and non-vegetational zone (PLATE 25).

III. 2. Physico-chemical properties of Chokari edaphic complexes :

Detailed analysis of soil samples from the saline and non-saline ecozones was carried out using the standard procedures.

The analysis revealed clear cut distinctions and the ecozonation was firmly established by the factual data obtained as a result of the soil analysis.

a. Non-Saline Zone :

The physico-chemical properties of the soil samples of non-saline zone are as follows : (Tables 10 and 11).

It is clear from the a data that non-saline ecozone can support normal cropping patterns and crop ecosystems (Shah, 1955).

Plate - 23 : Saline cultivable zone :

- Patches of 'salt crust' on dry edaphic units are visible.
- The growth of halophytic species (*Suaeda* and *Aleuropes*) is noteworthy.
- The cultivated field is on the top part of the picture.


PLATE-23

Plate - 24 : Saline non-cultivable but vegetated zone :

The zone is highly saline and supoorts the growth of pure stands of <u>Suaeda</u> - halophytes.


PLATE-24

Plate - 25 : Saline non-cultivable and non-vegetational zone.

The salinity level being extremely high, the zone shows no plant growth. The zone interacts with the 'saline water' (due to the ingress) of the river ecosystem.


PLATE - 25

Table 10 : Samples from black patch of the non-saline zone.

Constituents	Range of variation
Clay and Silt	72 - 74%
Sand (coarse)	4.5 - 5.2%
pH	7.1 - 7.9 (variable)
Exchange capacity	45. - 47 m.e. /100 g soil
Exchangeable Ca	16 - 18 " "
Exchangeable Mg	8 - 9 " "
Exchangeable K	0.1 - 0.3 " "
SiO_2	53 - 54%
Al_2O_3	17 - 19%
Fe_2O_3	6 - 8%

Table 11 : Samples from the loam patch of non-saline zone

Constituents	Range of variation
Sand (coarse)	1.0 - 1.2%
Fine sand	80 - 81%
Silt + Clay	7.9 - 8.8%
pH	variable
Exchangeable K	15 - 16.8 m.e./100 g soil
Exchangeable Mn	0.50 - 0.56 " "
Total soluble salts	0.012- 0.011%

b. Saline zone :

Saline zone has been divided into further subzones and the samples from each of the subzone were analyzed in details as it was thought essential to understand the edaphic environment of this zone carefully due to its fluctuating nature. This zone of the ecosystem is actually the most dynamic zone due to various influences of estuarine process. The detailed analysis of the samples from each of the subzones is presented here (Tables 12 and 13).

The variations in the salinity levels were also observed from patch to patch in the saline ecozone. The electrical conductivity of the soil sample was measured from this ecozone to get an idea of the range of variation in the salinity gradient in this ecozone. The electrical conductivity measurements lead to the conclusion that salinity level (Table 14) fluctuates to a considerable extent. Seasonal variation levels of salinity in saline ecozone was also studied and it was found that the lowest values were recorded in rainy season due to leaching and flushing of salts (Richard, 1954) while the summer values were quite high. In winter although the level of salinity was quite high in some patches the cultivation could be performed by the farmers.

Table 12 : Physical Properties of Samples of Soils of saline zone

Constituents	Saline cultivable zone (Site I)	Saline cultivable zone (Site II)	Saline non-cultivable but vegetated zone	Saline non-cultivable non-vegetated zone
Sand Coarse / Sand Fine	33.3%	31.6%	28.96%	31.3%
Silt	42.4%	47.6%	48.7%	46.0%
Clay	21.2%	17.8%	22.0%	27.0%
Texture	Silty Loam	Silty Loam	Silty Loam	Silty Clay Loam
% HCO_3	0.021%	0.027%	0.038%	0.0133%
Soil colour	Brown	Brown	Brown	Brown
Organic matter	0.82	0.80%	0.21%	0.521%
Moisture Holding-capacity	43.2%	50.02%	59.79%	42.6%

Table : 13. Chemical Properties of Samples of Soils of saline zone

Constituents	Saline cultivable zone (Site I)	Saline cultivable zone (Site II)	Saline non-cultivable but vegetated zone	Saline non-cultivable non-vegetated zone
pH	8.1	8.2	8.1	7.9
Ec	1.376	2.021 milli mho/cm	12.32 milli mho/cm	15.946 milli mho/cm
$CaCO_3$	16.6%	15.0%	13.6%	17.6%
Permeability	0.592 cm/hr	0.179 cm/hr	0.378 cm/hr	0.57 cm/hr
Chloride	0.041%	0.001%	0.137%	1.8%
CO_3 content	0.002%	0.003%	0.0011%	0.0012%
Total soluble salt	0.792%	3.96%	3.4%	

Table 14 : Seasonal variation in salinity gradient in different patches of saline zone :

Season	Salinity variation EC (Electrical Conductivity) in milli mhos/cm
Rainy	1.3 - 2.8
Winter	2.9 - 3.6
Summer	4.8 - 7.8

There is considerable variation of the cropping pattern on these edaphic complexes due to salinity variation.

The edaphic complexes at Chokari in saline ecozone undergo constant change and constitute dynamic soil system. An inventory of the process of changes in saline zone of the ecosystem yielded interesting details. The floods in 1975-1976 years brought down the level of salts in the soil and crop yields were improved, but the year 1974 had brought more salinity making some soil patches unsuitable for cultivation. The edaphic environment has also effect on the socio-economic pattern of the human population of the ecosystem.

Thesis Component II

Abiotic Compartment

Unit - III

The Socio-Cultural-Economic Environment

I. 1. The Socio-Cultural Environment :

The socio-cultural environment of Chokari ecosystem complex shows symptoms of the backwardness and underdeveloped conditions. The human population of the ecosystem is socially and culturally backward primarily because of economic conditions (Otto Somoerwotto, 1974). There are various stresses that keep human component of this village ecosystem backward. The analysis revealed the different stresses that give rise to this type of socio-cultural environment.

I. 2. Analysis of Socio-Cultural Stresses :

The social environmental conditions of this rural ecosystem are severely affected by the influence of interactions of various factors. An inventory revealed the following stresses :

(a) Economic Stresses.

(b) Communication Stresses.

(c) Developmental Stresses and Interaction stresses.

(d) Edapho-physical Stresses.

(e) Agricultural Operational Stresses.

(a) Economic Stresses :

The economic environment is discussed in detail under a separate heading. However, it will not be out of place to mention here that the main cause of Socio-Cultural backward condition of the region is due to the economic stresses (Pareek,1970). The returns of the agricultural crops are meagre and hardly sufficient to allow subsistence level existence. According to the well known rural ecologist Otto Somoerwotto (1974) economically backward population remains backward even socially and culturally.

(b) Communication Stresses :

The human component of the village ecosystem is not literate. Hardly 30% of the population has done schooling. The schooling done by this population is only upto sixth grade of village school. There is only one school upto sixth grade. Seventh grade was started only two years back i.e. in 1975. The children are not encouraged to join school due to economic reasons. On the contrary, they are made 'input' members to the family resources by putting them to agricultural labour. The communication stresses are developed due to eco-educational conditions. The human population can not communicate with the taluka officials as well as other progressive villages. The human population also is not receptive to the various developmental agencies. They cannot respond to the newer approaches and methods of agriculture and cattle breeding due to these stresses.

(c) Developmental and Interaction Stresses :

The human population of the ecosystem due to its backward background experiences the developmental stresses. There are no developmental activities of the taluka administration. Even the response to the developmental activities of the village administration is not encouraging. This is due to inability of the population to interact and participate. The village population is isolated from rest of the taluka.

There are no transport facilities. During monsoon, the entire village is cut off from rest of the centres of the taluka. The economic background is responsible for this too. There is only one state transport bus that approaches the village during the whole day. The developmental and interaction stresses are one of the major causes in the backwardness of the human component of this ecosystem (Smith, 1975).

(d) Edapho-physical environmental Stresses :

The human population has to suffer the uncertain physical and edaphic conditions. The agricultural output in non-saline zone is comparatively more to that of saline zone. The saline zone cultivators are the victims of physical and edaphic stresses.

(e) Agricultural Operational Stresses :

These stresses are due to the fact that the human population is culturally not progressive. The people in the village have just subsistence and sedentary economy and hence cannot think of innovations in agricultural operations.

These stresses have had an immense influence on the entire life quality of the human population. The quality of life of human population is far from satisfactory and not comparable to the average urban dweller as revealed by the socio-economic scale.

II. The Economic environment :

The ecosystem has purely an agricultural environment and setting. There is no industry or any other developmental activity which may provide the means of livelihood to the human settlers of the ecosystem. There is no development of even cottage industries. The entire economy is dependent on the agricultural output. The population belongs to the category of marginal farmers and has no economic means of improving agricultural output. Economic status analysis reveals only two categories of income groups of the population (Table 15).

Table 15 : Income groups.

Category	Income Group
I. "Small" Farmers and Agricultural Labourers	Rs.1200/- per year
II."Big" Farmers	Rs.1900/- per year

It is clear that the degraded socio-cultural environment is due to the economic status of the population. The ecosystem is not self-sufficient and is in need of subsidies. The profession distribution of population further clarifies the findings (Table 16).

Table 16 : Percentage of profession distribution

Profession	Percentage
1. Large area cultivators (more than 0.04 hectares but less than 2 hectares)	2
2. Small area cultivators (0.04 hectares only).	51
3. Agricultural Labourers (Income less than Rs. 125/-p.m.)	47

The overall picture of the economic environment of this ecosystem is very depressing. The ecosystem production optimization measures are essential to bring the economic status of this region at par with the other village ecosystems of this taluka.