ECONOMIC ATLAS OF MADRAS STATE

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ECONOMIC ATLAS OF MADRAS STATE

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Preface

THE MAIN OBJECTIVE of this Economic Atlas is to make it a useful tool for regional planning. It makes a region-wise appraisal of the natural resources potential, their present utilization, and the prospect for their future utilization. A detailed analytical study followed by regional synthesis has been done in a series of Chapters concerning physical conditions, climate, forests, fisheries, livestock, agriculture, minerals, power, manpower, industries, transport, trade and commerce, the State income, etc. It contains 55 maps and each map is accompanied by a note containing sources, method and contents. The map, in fact, leads the reader's eyes to some of the salient features emerging out of the aerial groupings of the statistical data.

The data used for this Atlas are largely from published and unpublished Government records and papers. Some of them are NCAER's own estimates prepared in connection with the Techno-Economic Survey of Madras State. A number of relevant papers, books and Atlases have been consulted in preparing this Atlas.

The maps of this Atlas were drawn up, and the accompanying notes were prepared by Dr. (Miss) P. Sen Gupta, Head of the Geography Section of the National Council of Applied Economic Research, ably assisted by her young co-workers.

The National Council acknowledges thankfulness to Dr. S. P. Chatterjee, Director of Atlas Organization and Dr. U.K. Bose, Meteorologist, Indian Meteorological Department for their valuable suggestions in preparing this Atlas.

NEW DELHI
August 1961

P. S. LOKANATHAN
Director-General

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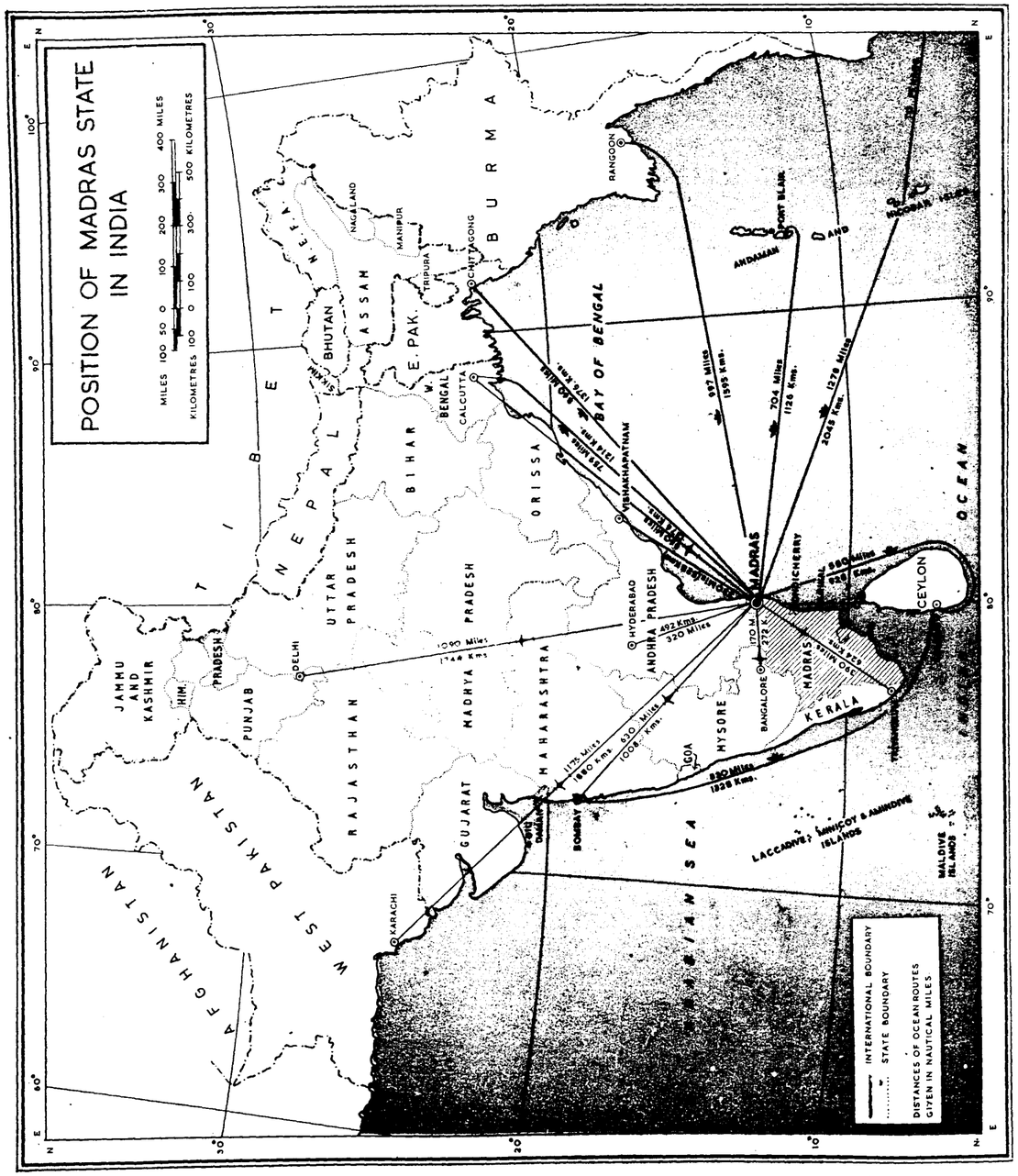
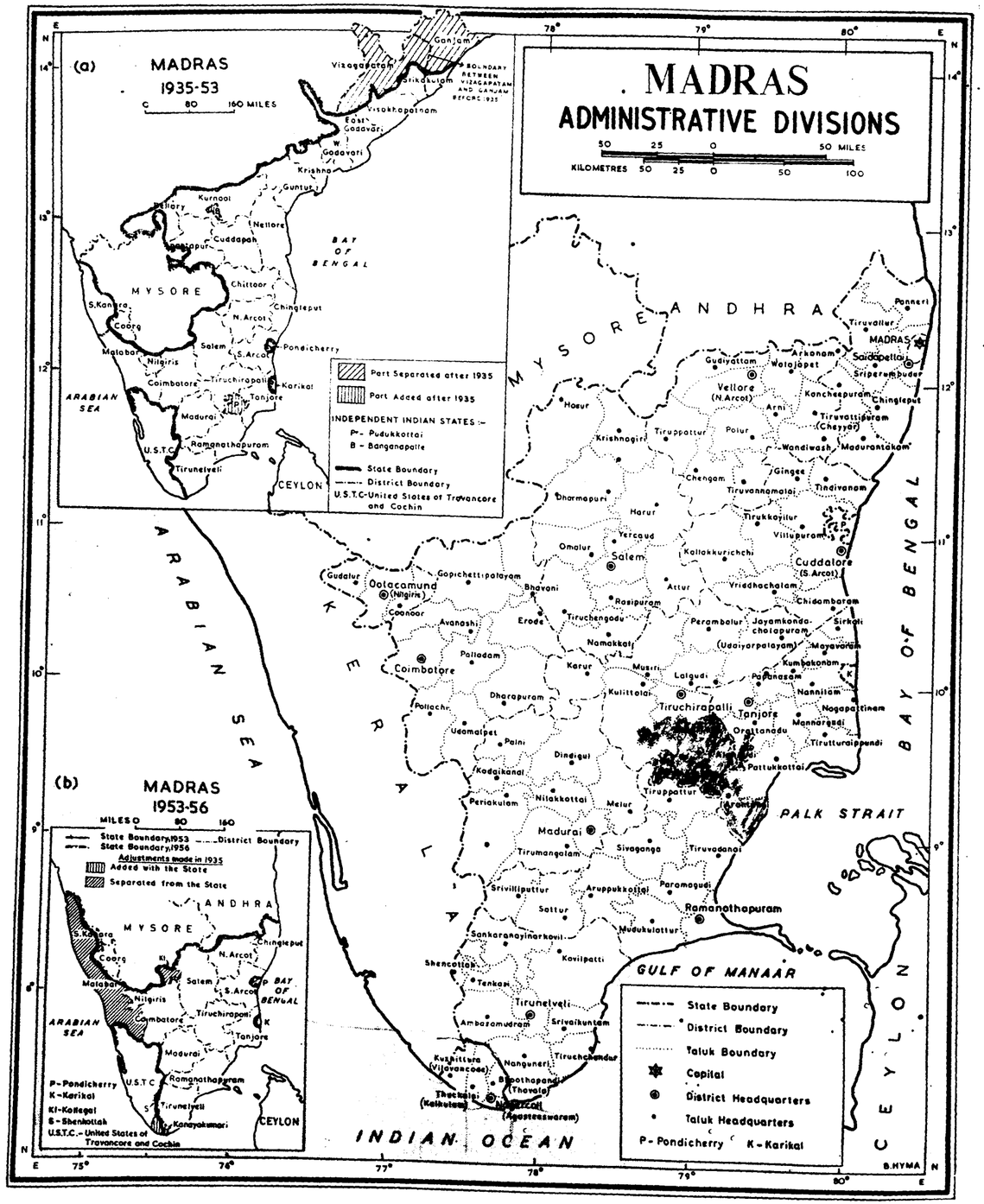
Map 1



Map 1

Position of Madras State in India

THIS MAP SHOWS the geographical position of Madras State in India. It occupies the southeastern part of the Deccan peninsula, approximately 50,113 square miles or 128,289 square kms. The present boundary was carved out under the State Reorganization Act of 1956. It is bounded on the north by Mysore and Andhra States, on the west by Kerala State, on the east by the Bay of Bengal, and on the south by the Indian Ocean. Its physical boundary is marked by the Western Ghats in the west, the Nagari hills in the north and a continuous stretch of sea in the east and south from Pulicat lake to Cape Comorin. The coast is dotted with decayed relics of early European activity in which Madras City retains its importance as the Chief commercial and administrative centre of the State. Its link with the major ports and important cities through oceanic and air routes is shown by the lines with figures indicating the distances in miles as well as in kms.



Administrative Divisions

THE BOUNDARY OF Madras State was readjusted under the State Reorganization Act of 1956 which implemented the transfer of Malabar district (excluding the islands of Laccadive and Minicoy) and Kasargod taluk of Mysore to Kerala State, that of South Kanara (excluding Kasargod taluk and the Amindivi islands) and Kollegal taluk of Coimbatore district to Mysore State, and that of Shencottah taluk of Quilon district and four taluks of Trivandrum district—Vilavancode, Kalkulam, Thovala, and Agasteeswaram—to Madras State.

The present Madras State comprises 13 districts subdivided into 100 taluks. Pondicherry and Karikal, two French possessions in the State, have been ceded to India. They are now under the administration of the Central Government.

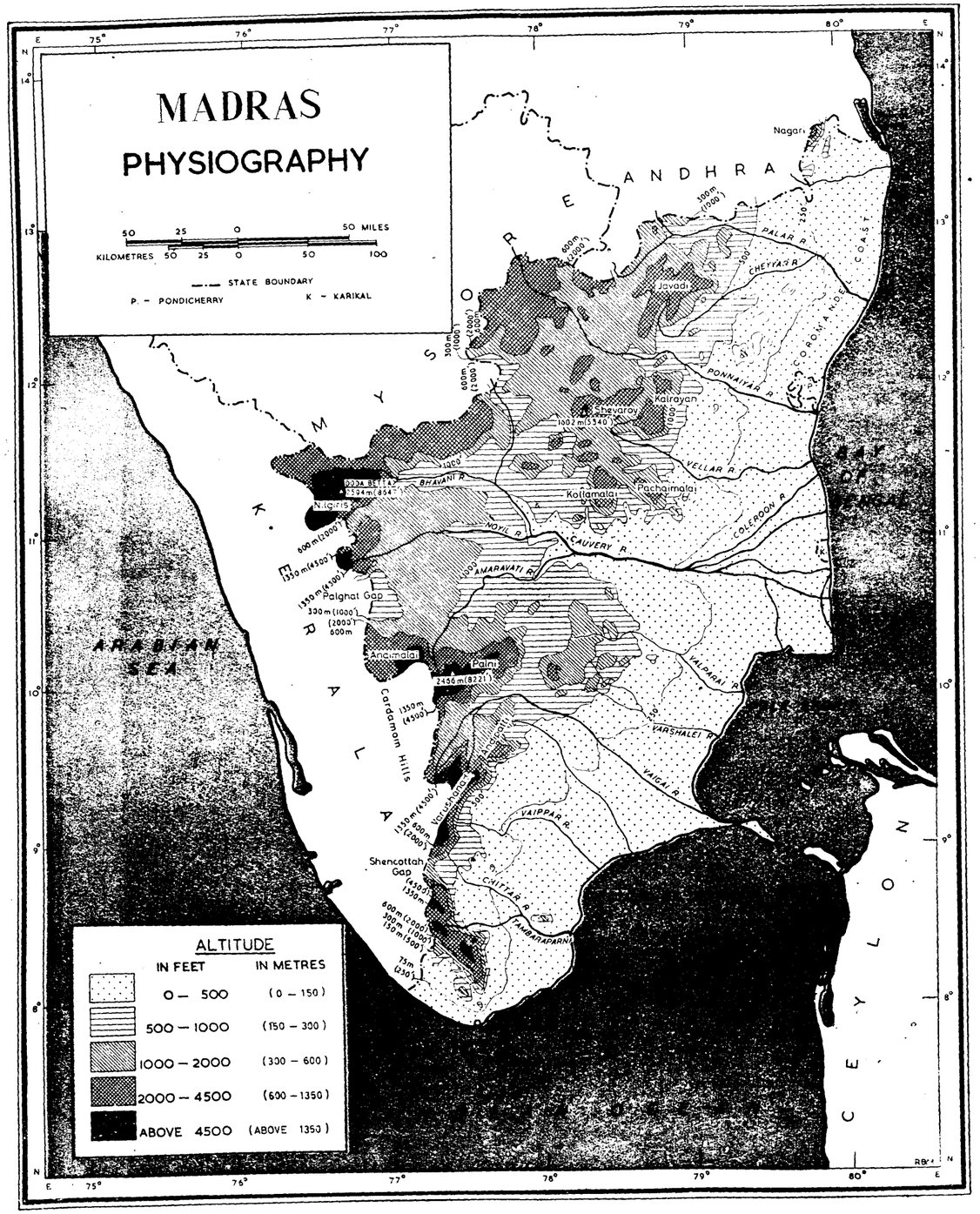
The total length of the land boundary as shown in the map is about 1200 kms (750 miles). The coastal length totals about 992 kms (620 miles).

The main legends are indicated by symbols which show the various administrative boundaries and their headquarters. The names of the district headquarters and taluks are written against the symbols. But where names of the districts or taluks and their headquarters differ, the district or taluk name is added in brackets against the headquarters, e.g., Ootacamand (Nilgiri).

Inset Map. Inset map on the left hand side at the top shows the boundary of Madras province as before 1935, and as between 1935—53. The province, in fact, came into existence in the 18th century and continued in its original form (divided into 21 districts) right up to 1935 when its northern boundary shifted to south due to the transfer of a part of Ganjam district and part of Visakhapatnam district to Orissa province under the India Act of 1935.

Inset map at the bottom shows the boundary of Madras State between 1953—56. The size of the State further dwindled on account of the emergence of Andhra State in 1953. This boundary continued till 1956 when the present Madras State was formed under the States Reorganization Act.

SOURCE : *Madras in Maps and Pictures*, Government of Madras, 1959.



Physiography

ANALYSIS

THIS MAP SHOWS the physiography of Madras State. It brings out four essential physiographic regions: (1) the Coastal Plain, (2) the Eastern Ghats, (3) the Plateau area, and (4) the Western Ghats.

1. The Coastal Plain

The Coastal Plain stretches for 620 miles (992 kms) from Pulicat lake to Cape Comorin. It can be best described under three sub-regions: the Northern Plain, the Cauvery Delta, and the Southern Plain. The Northern Plain comprises Chingleput district, a major part of South Arcot district, the eastern part of North Arcot district and northern part of Tiruchirapalli district. It is about 50--60 miles wide with an average height of 250 feet (75 meters). The Plain fringing the Eastern Ghats is relatively high, its average altitude is between 250 feet—500 feet (75 ms—150 ms). It is considered to be a marine erosion-surface. The rest of the Plain is young with a thick cover of alluvium. It is below 250 feet (75 ms), but its evenness is broken by the outcrop of old rocks. The immediate Coastal Plain is very narrow, though accretion is taking place through marine and aeolian deposition.

The Cauvery delta consists of Tanjore and part of Tiruchirapalli districts. The delta-head at Tiruchirapalli is on the 250-feet (75 ms) contour, and is about 80 miles (128 kms) away from the sea. The slope is slightly steep for the delta, having a fall of about 3 feet (4.8 kms) per mile.

The Southern Coastal Plain is shared by Ramanathapuram, Tirunelveli and Kanya Kumari districts. It is covered with alluvial, marine, and aeolian deposits. The coast as a whole shows strong evidence of both prograding and uplift. There are extensive outcrops of marine sandstone, in places limestone outcrops gently dip sea-ward. South of the river Tambaraparni, these outcrops are concealed by aeolian deposits. The area between the Varshalei and Vaippar is monotonously flat; the only noticeable elevations are the tank-bunds.

2. The Eastern Ghats

Between the rivers Palar and Cauvery, the Coastal Plain is backed by a discontinuous line of hills—the Javadis, Shevaroys, Kalrayans and Pachaimalais and Kollamalais. North of the Palar, smaller and even more broken hills are linked with the tail of Cuddapah in the Nagari hills. Across the Cauvery, further detached massifs lead on to the long Varushanad-Andipatti range and then to Cardamom hills. This line of discontinuous hills is known as the Eastern Ghats. It rises steeply above the plateau-level to 3600 feet—3800 feet (1080 ms—1140 ms) in the Javadis and 5000 feet—5400 feet (1500 ms—1620 ms) in the Shevaroys.

3. The Plateau Area

Between the Eastern and Western Ghats lies the plateau area with elevations between 500 feet (150 ms) and 2000 feet (600 ms). Hence the topography is undulating. In the west lies the broad Palghat gap between the Nilgiris and the Anaimalai hills. Between the Cauvery and the Palghat lies an extensive low plateau rising gradually from 400 feet (120 ms)—600 feet (180 ms) along the river to 1200 feet (360 ms) to 1500 feet (450 ms) in the west broken occassionally by granitic and gneissic monadnocks. From the

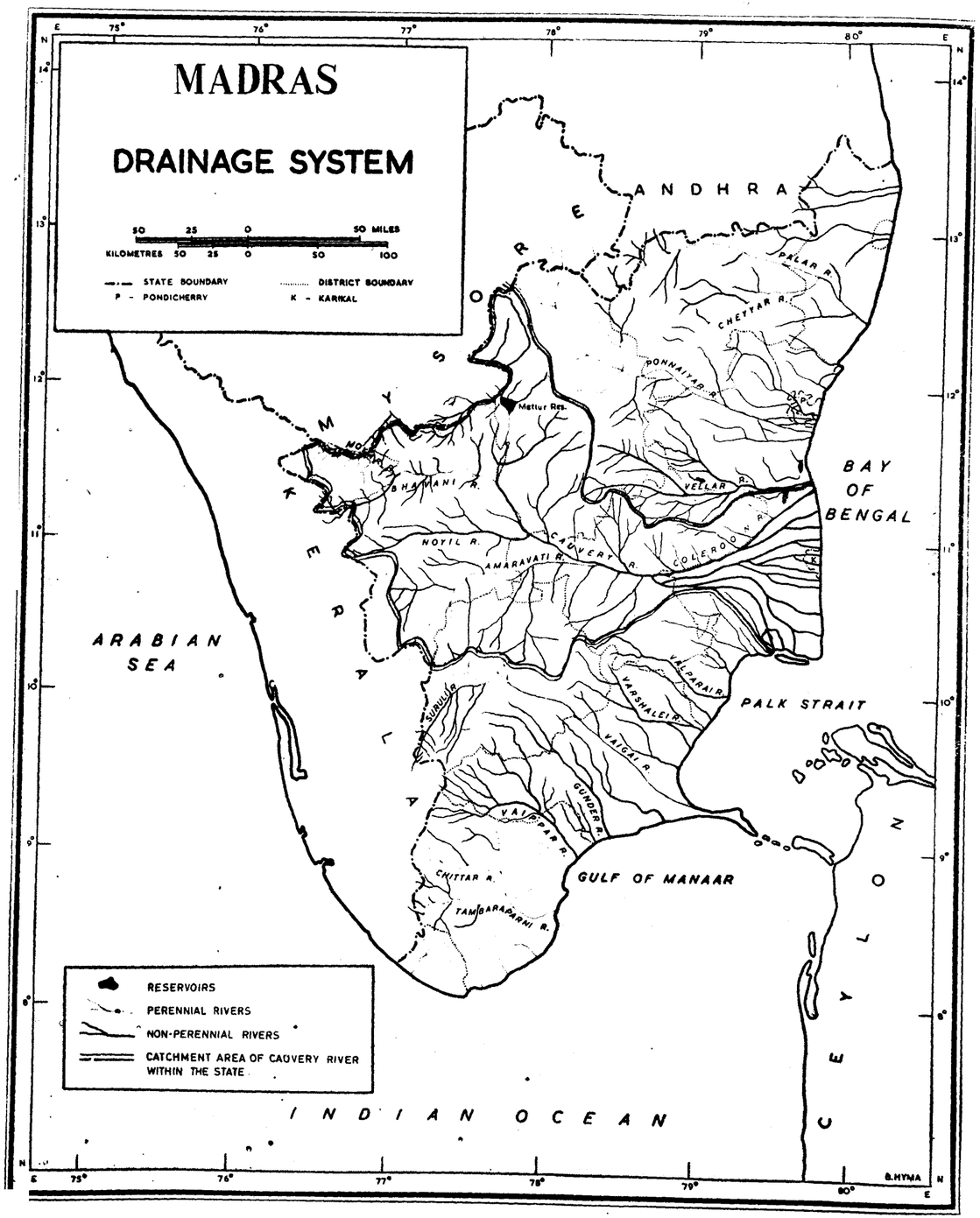
Nilgiris and Anaimalais, the Bhavani, the Noyil and Amaravati take their rise and flow through mature valleys across the plateau. The width of the plateau narrows down gradually from 72 miles (115.2 kms) near Palghat gap in the north to only 14 miles (22.4 kms) near Shencottah gap in the south.

4. The Western Ghats

The plateau is fringed on the West by a group of high hills known as the Western Ghats. On either side of the Palghat gap the highest mountains of the peninsula dominate. They are the Nilgiris in the north and the Anaimalai-Palni-Cardamom hills in the south. The Nilgiris form a compact plateau of about 1000 square miles (2560 sq. kms.) with a summit level of 6000 feet—8000 feet (1800 ms—2400 ms) rising with extreme abruptness on all sides. The other group contains Anaimalai, the highest peak of the peninsula—8841 feet (2652 ms). This peak is, however, outside the boundary of the State. Its front to the Palghat gap is remarkably steep. The southeastern flanks of the Palnis overlooking the Vaigai are remarkably abrupt as are the Cardamom and their outliers (Varushanad hills) south of Vaigai. Between 10°N and Shencottah gap lie the Cardamom hills with elevation above 6000 feet (1800 ms) where the active streams of the exposed Arabian sea-front have cut back the watershed to 4—5 miles (6.4—8.0 kms) of the eastern edge of the hills.

SOURCE : *Physical Map of India*—Survey of India.

Map 4



Map 4

Drainage System

Method

THIS MAP SHOWS the general hydrographic features of the State depicting the river systems, drainage—basins and waterfalls. The rivers are classified as perennial and non-perennial. The perennial streams are shown in blue and the non-perennial streams in black. The lakes are shown by solid blue.

Analysis

The rivers of the State flow in broad and shallow valleys maturely graded almost to their heads with only slight interruptions of profiles when they pass through the Eastern Ghats. They are entirely dependent on a rainfall concentrated in five or six months in the year and flow over a thin soil cover. They are, therefore, almost dry in the hot weather. These rivers for irrigational uses need the construction of expensive storage works and barrages.

The principal rivers are the Palar, Ponnaiyar, the Cauvery, the Vaigai and the Tambaraparni. Of these rivers, the Cauvery is the most remarkable river of the State; its delta presents some extremely distinctive physical and human features; its power and irrigational developments are outstanding. This river is not a large river by Indian standards. It is only about 475 miles (760 kms) long draining about 28,000 square miles (71,680 sq. kms). It takes its rise above the great Krishnanrajsagar, only 12 miles (19.2 kms) from Mysore City and flows through the forested hills of Mysore Plateau. Just above its confluence with the Shimsha—its main left hand tributary—the Cauvery crosses in a succession of falls, and rapids with a total drop of 320 feet (96 ms) near Sivasamudram (Mysore State) where the first hydroelectrical plant in India was established in 1902. Below Sivasamudram the river plunges through a succession of wild gorges for 32 miles; half of this course is along the northwestern boundary of the State. It then makes a right-angled bend with a drop of 70 feet (12 ms) marking the Hagenakal falls and flows in a southwest-northeast direction along the boundary of the State for about 20 miles (32 kms). It then enters another narrow straight gorge west of Salem and this provides the base for the Mettur Dam. Mettur was the first combined power and irrigation project in India. Its dam is one of the world's largest dams. Here, the river is about 1100 feet (330 ms) wide and it enters the plain area across the 500 feet (150 ms) contour receiving on its way the Bhavani and its tributary, the Moyar, and the Noyil which rises from the Nilgiris. A few miles above Tiruchirapalli, the river bifurcates; the northern branch is known as the Coleroon and the southern one is known as the Cauvery. From here onward is the deltaic country conforming to Tanjore district. The drainage pattern of the Cauvery delta is interesting with its bundle of streams packed into 8 miles—10 miles (12.8 kms—16 kms) between Tiruchirapalli and Tanjore, but forming out into a quadrant of 75 miles (120 kms) across.

The rivers Palar and Ponnaiyar have their sources very close to each other near Nandidurg on the Mysore Plateau and have forced their passage through Javadi-Kalarayan hills into the Bay of Bengal. They run rapidly in deep beds in the hills. Dams have been set up across the rivers in their lower reaches for utilizing their water for irrigation.

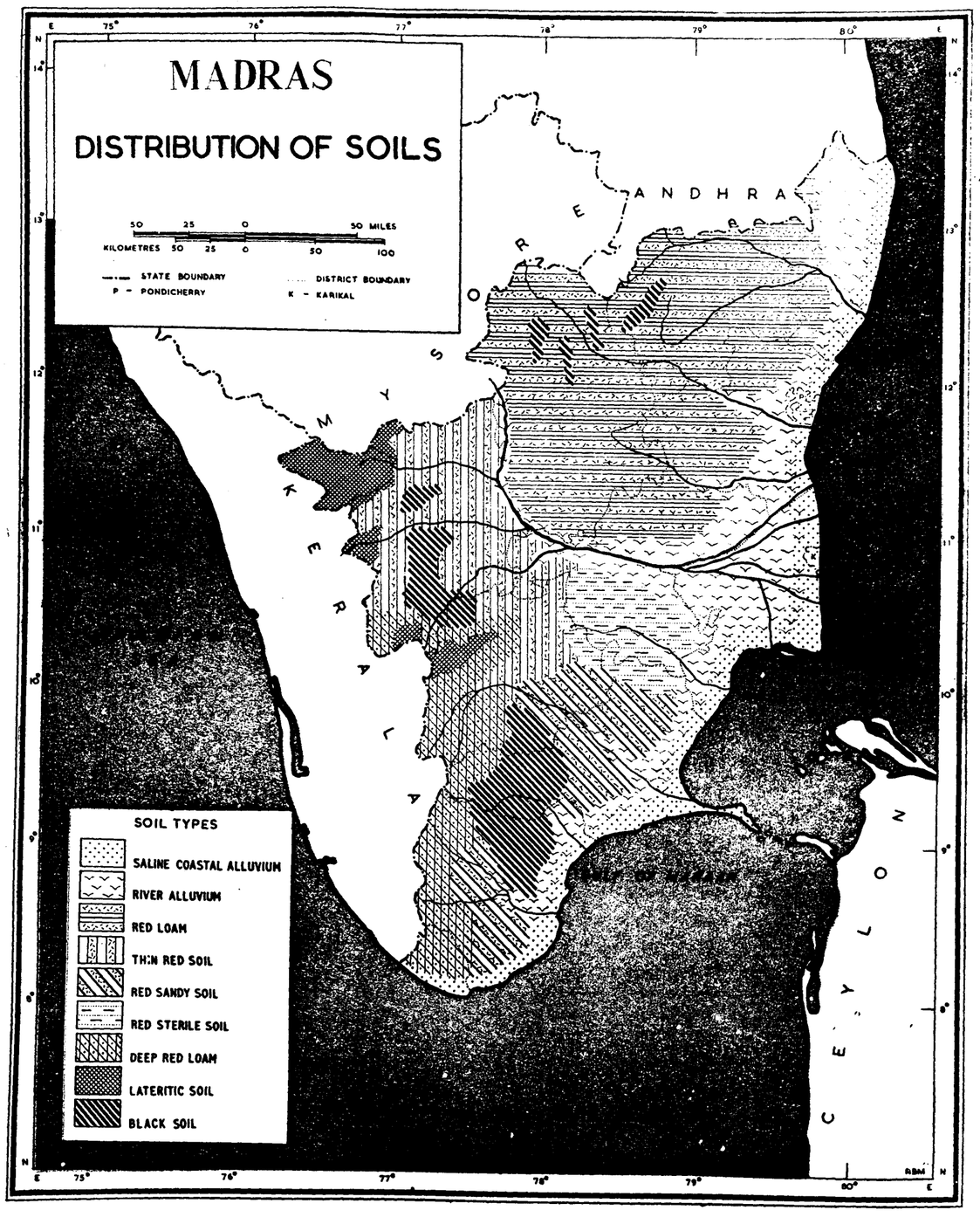
The Vaigai has two head-streams—the one is in its name rising in broad but rugged Varushanad valley about 1000 feet (300 ms) high, and the other is the Suruli taking its rise near the escarpment of Cardamom hills and flowing through the Kambam valley. These two head-streams join together about 40 miles (64 kms) down their sources and flow through the trough between the Varushanad-Andipatti hills and the Cardamom hills in a southwest-northeast direction. It breaks through the col between the Palnis and the Varushanad-Andipatti hills, and flows to the southeast in a great sweeping curve across the flat plain of Ramanathapuram district.

The Tambaraparni takes its rise in the Southern hills at 600 feet (180 ms) and enjoys the combined benefit of the advancing and retreating monsoons. This is the only river in Madras State which has from time immemorial never failed in its water-supply, and two good crops are easily raised in a year from its valley. The Tambaraparni valley with that of its tributary, the Chittar, accounts for three-quarters of the 50,000 acres of land irrigated by canals in Tirunelveli district.

Apart from these five major rivers, there are a number of minor streams falling into the Bay of Bengal. The Vellar draining the southern slopes of the Shevaroys and Kalrayans, and northern slopes of the Pachaimalai enters the sea north of the Cauvery delta. In between the Cauvery and the Vaigai, the river Varshalei takes its rise in Madurai hills at an elevation of 2000 feet (600 ms) and falls into the Bay of Bengal after a run of 60 miles (96 kms) through the plain. The river Vaippar flows in between the rivers Vaigai and Tambaraparni. It rises in Varushanad hills and falls into the Bay of Bengal after flowing for 50 miles (80 kms) across Ramanathapuram and Tirunelveli districts. None of these rivers is perennial and fit for irrigational uses.

SOURCE : *National Atlas of India*, (Preliminary Edition), Edited by S. P. Chatterji, Calcutta/Dehra Dun, 1957.

Map 5



Soils

Analysis

It is impossible to present an accurate, comprehensive, and reasonably detailed soil-pattern of Madras State from the available information. There arises a great difficulty in differentiating the zones of black and red soils, or those of the coastal alluvium and lateritic soils. The central plateau shows a very striking mosaic of black and red soils side by side, which are difficult to differentiate. Nevertheless, a formal analysis is attempted here with a view to giving some idea of the agricultural values of different soils.

The Red Soils. The red soils occupy nearly two-thirds of the cultivable area. Though they vary greatly from one region to another, yet some pattern may be described :

(*a*) The soils in the western upland region to the north of the Cauvery river (comprising the whole of North Arcot and Salem districts and the western taluks of South Arcot and northern taluks of South Arcot and northern taluks of Tiruchirapalli districts) are the red ferruginous loams and sands. In the uplands the soils are sandy and gravelly, and those in the valleys and depressions are loamy and clayey. Red soils derived from Cuddalore sandstone in South Arcot district are not fertile. They are, however, made commercially useful by planting cashewnut, casuarina and groundnut.

(*b*) The red soils in the West Central region comprising the plain portions of Coimbatore district and Karur taluk of Tiruchirapalli district, Dindigul and Palni taluks of Madurai district are extremely thin. Here the underlying rocks outcrop at the surface.

(*c*) The red soils south of the Cauvery delta excluding the black cotton soil region are a mixture of sandy clay with lateritic pallets and small debris of quartz and gneisses. Due to excessive draught soils in places are saline and unproductive.

(*d*) The red soils in the South Tiruchirapalli district and Tirupattur taluk of Ramanathapuram district are sterile. They turn into soda soils in the south which are entirely bare of vegetation.

(*e*) The red soils at the foot of Southern Ghats are deep loam. The origin of this soil is from pluvial deposits washed from the adjacent Ghats. Due to high rainfall oxidization proceeds rapidly and the soil turns to deeper colour. However, this soil is fertile and well irrigation is prevalent in this soil region because water is available with even the slightest boring.

Laterites. Laterites are found to form on the high hills of Madurai and Nilgiri districts where heavy rainfall leads to excessive leaching. These soils are highly acidic in nature, deficient in lime, nitrogen and magnesia. Only special crops like tea, cinchona, rubber and coffee are grown on these soils by adding heavy doses of manures.

Black Soils. Black soils are predominant in the heart of the red soil tract to the south of the Cauvery delta. They occupy the southern part of Tirumangalam taluk in Madurai district, Sattur taluk and part of Srivilliputtur taluk in Ramanathapuram district, greater part of Kovilpatti taluk, northern portion of Srivaikuntam taluk, and western part of Sankaranayinarkovil taluk in Tirunelveli district. Other than this major area, there are some patches of blacks oils in the west central region where rainfall is scanty and

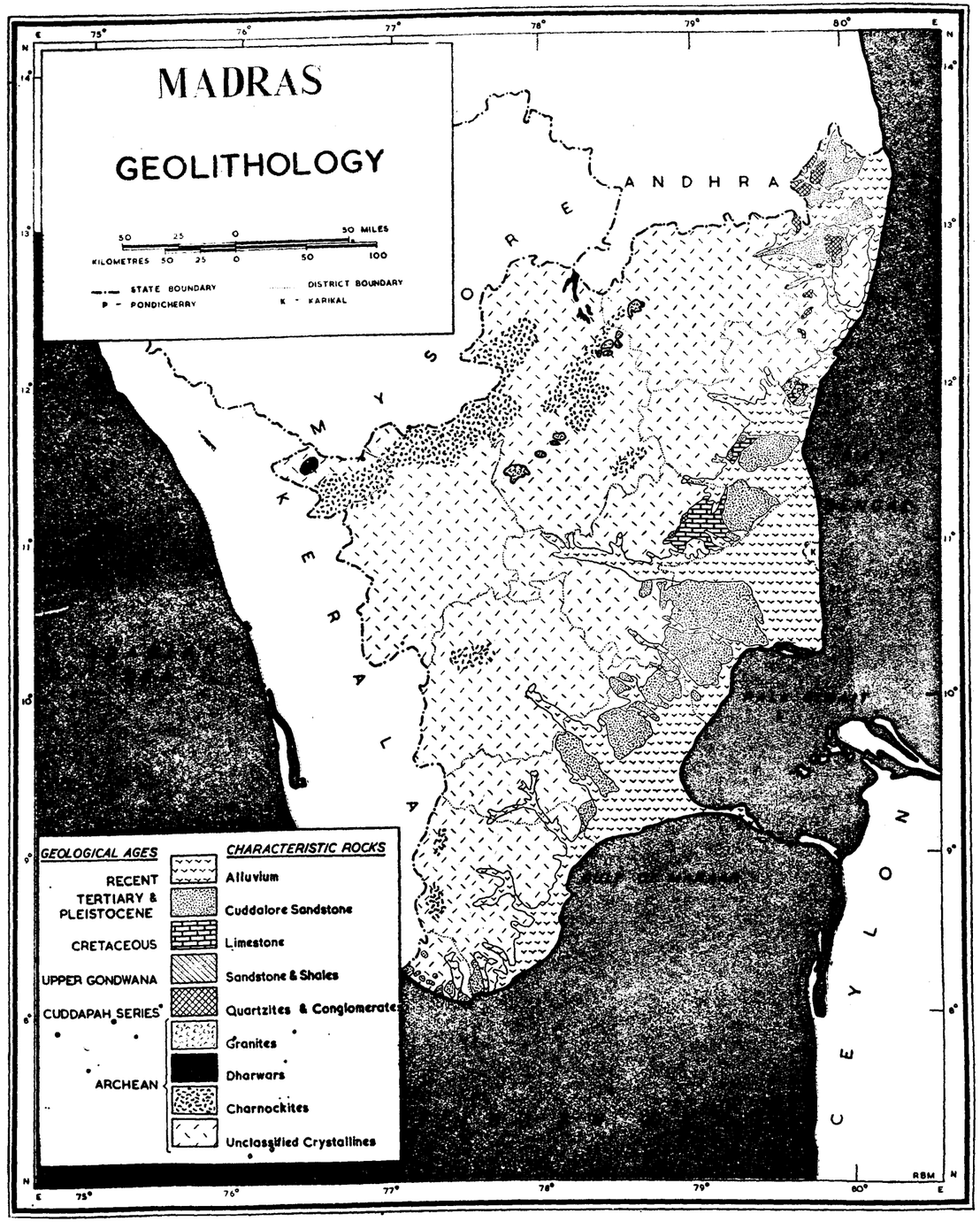
weathering of ferruginous gneisses and schists under semi-arid conditions has resulted in the black cotton soils. This black soil differs from the *regur* over the Deccan trap in that there is no transition between it and the underlying rock. The *regur* of Madras State is less black, less moisture-retaining, but more friable and more suited to irrigation. In thickness it is not as deep as the trap area. The *regur* of this area has a layer rich in *kankar* nodules formed by the segregation of calcium carbonate. Nevertheless, in physical properties it resembles the trap soil—argillaceous, tenaceous, and retentive of moisture. The fertility of black soils in Madras owes to the mixing of soils due to the formation of deep cracks. They are rich in iron, lime, magnesia and aluminium but poor in phosphorus, nitrogen and organic matter. They are suited to cotton cultivation.

Alluvial Soils. Alluvial soils are, as a rule, transported and found in the river valleys, deltaic parts, and on the coast line. Composition of the strata varies with the nature of the silts brought by the rivers. In Tiruchirapalli district, rich alluvial soil has been formed for a length of about 50 miles along the course of the Cauvery about a mile wide on either side of the river. The alluvium of Cauvery delta between Coleroon and Cauvery is exceptionally fertile and highly valued for agriculture. Its degree of fertility decreases gradually according to the distances away from the river. The alluvial soils of Tambaraparni are black loam, well suited to irrigation. The soils overlying a stiff yellow clay or marl have a greater fertility.

The coastal plain to the north of the Cauvery delta contains clayey and loamy alluvial soils which are fertile. To the south of the delta the soils are of red ferruginous type, not so productive. The alluvial soils in the littoral tracts contain grey sand which is highly saline, porous and least productive.

SOURCES : (1) *The Indian Geographical Journal*, Vol. *XXIII*, No. 28, April-June, 1948.
(2) I.C.A.R., *Final Report of All India Soil Survey Schemes.*
(3) Soils—*National Atlas of India.*
(4) Indian Soils—*Adapted from Schokalasky*; *India and Pakistan by O.H.K. Spate.*

Map 6



Map 6

Geolithology

Analysis

THE GEOLOGICAL MAP of Madras State shows its division into two broad units in conformity with the physical map of the country. The oldest, and the most stable land mass lies in the west roughly corresponding to the hills and plateaus, and the younger formation is in the coastal plain lying in the east. The 500 feet (150 ms) contour line roughly divides these two units. In each unit various symbols are used for differentiating the rocks of different ages. Archean rocks form the foundation of old and stable blocks on which later deposits have been laid down. The basement rocks are, however, classified into three groups according to ages, very old gneisses and schists, Dharwars and Charnokites. The first group forms an enormous portion of the surface of the State. Associated with these are dharwar schists which extend from Mysore State into Salem district. On crossing the southern boundary of Mysore State, it splits into two branches—an easterly one, about three-fourths of a mile (1.2 km) broad, and a westerly one slightly shorter in length. In addition to these main bands, there are a number of minor bands east of Krishnagiri in Salem district and in Nilgiri district. The constituent rocks of these series are chlorite, talc, schists together with slates, quartzites and conglomerates.

Intruded into the old gneisses are the outcrops of the members of the Charnockites series. They are found extensively developed in the interfluve area between the Bhavani and the Cauvery, in part of the Nilgiris, in the Javadis, Shevaroys and Pachaimalais, and in plains and Southern Ghats. Associated with the old gneisses there are outcrops of crystalline limestone at several places. The principal outcrops are in Tirunelveli, Tiruchirapalli and Coimbatore districts. Crystalline limestone of fine grain is found to the south and southeast of Karur. The Madukarai bed, which is being used for cement industry, crops up in a ridge seven miles southwest of Coimbatore.

The Archean gneisses and schists have been intruded into dykes and sills, the great majority of which are traps. The basic dykes are numerous in the northern part of the region. The ultra basic rocks traversed by abundant magnesite veins are found in an area of about 12 square miles (30.7 sq. kms) to the north and northwest of Salem town. This barren hilly tract is known as the 'Chalk hills'.

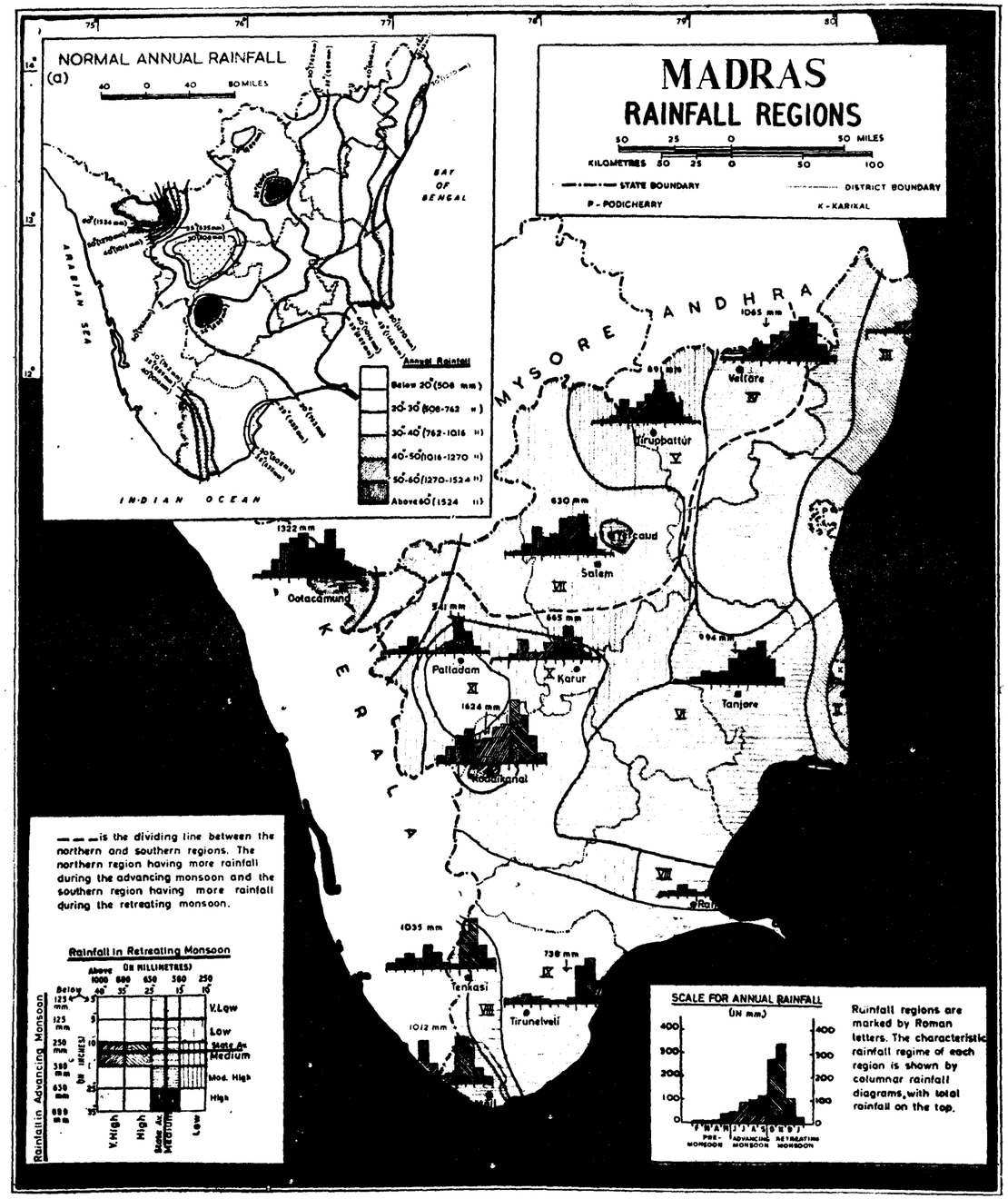
The next series of rocks, from the point of view of age, belong to the Cuddapah system. The Nagari Nose mountain and its outliers are composed of quartzites and conglomerates of this period.

There are small patches of upper Gondwana rocks at the eastern edge of the gneissic plateaus and hills. These rocks are probably the remnants of a once continuous formation now separated by denudation and overlain by the later deposits, chiefly laterites.

In the coastal region, which is of more recent formation, there are outcrops of Cretaceous limestone, Cuddalore sandstones forming low plateaus terminating in low but abrupt headlands on their northern and eastern sides. Laterite is found to occur on all the previous formations specially over Cuddalore sandstones. The lower Eocene beds which lie below the Cuddalore sandstone of the Pondicherry area contain lignite. The most recent formations are those of alluvium. The alluvial plains are much wider inland than they are at the seaboard. They are, however, being added by aeolian and marine depositions.

SOURCE : *Geological Map of India and Adjacent Countries*, 1 inch=32 miles.

Map 7



Map 7

Rainfall Regions

Method

THIS MAP IS drawn after a careful study of the rainfall regime during the advancing and retreating monsoons for 60 (sixty) stations. It is an isopleth map joining stations with a similar rainfall regime. Isopleths are drawn with the combination of two variables—rainfall during the advancing monsoon and rainfall during the retreating monsoon.

The rainfall data for the advancing monsoon are grouped into five classes : High—25"-35" (630-880 mm), Moderately High—15"-25" (380-630 mm), Medium—10"-15" (250-380 mm), Low—5"-10" (125-250 mm) and Very Low—below 5" (125 mm).

For the retreating monsoon data are classified into four groups : Very High—35"-40" (880-1000 mm), High—25"-35" (630-880 mm), Medium—15"-25" (380-630 mm) and Low—10"-15" (250-380 mm). About eleven combinations of these two variables are the critical values for drawing isopleths.

Analysis

The Madras State has three distinct seasons—advancing monsoon season (S.W. winds)—June-September, retreating monsoon season (N.E. winds)—October-January, transitional dry season—February-May.

The S. W. winds are descending winds blowing on the leeward side of the Western Ghats, and hence give little rain unless they are forced to ascend up by the intervening groups of hills. The heaviest rainfall of this season occurs in the high hills of Nilgiri district, because of its direct exposure to S. W. winds. An overwhelming area in the northern part enjoys more rainfall during the advancing monsoon season than during the retreating monsoon season. The broken line as shown in the map is the dividing line between the areas with the predominance of advancing monsoon rainfall in the north and retreating monsoon rainfall in the south. It passes through the Palghat gap through Coimbatore and Salem districts to North Arcot district.

The rainfall of the retreating monsoon is closely associated with the seasonal depressions in the Bay of Bengal round which humid currents of the retreating monsoon blow towards the east coast of this region and this current is vigorous when the depressions are powerful over the Bay. Since the direction is either easterly or northeasterly, rainfall is heaviest along the east coast and declines steadily in the interior till it ascends up the Ghats.

During the hot weather season climate is generally dry, interrupted by thunderstorms whose frequencies increase rapidly with the increase of temperature.

Following are the rainfall regions with their characteristic rainfall regimes.

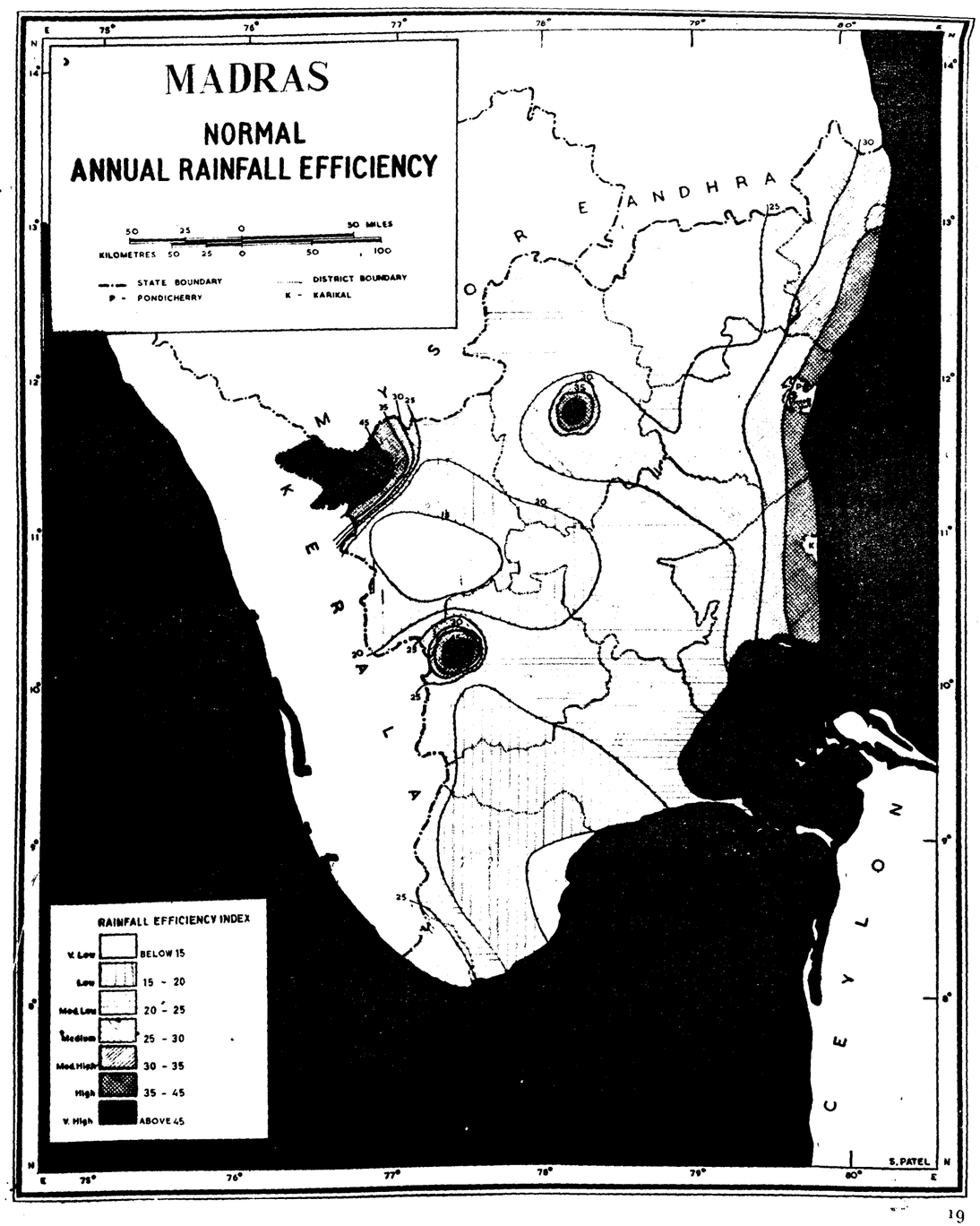
Classification	*Regions*	*Characteristics*
High Rainfall Region	I. Nilgiri district	(a) June-September rainfall is high (600-900 mms) (b) October-January rainfall is medium (400-600 mms) (c) October is the peak rainfall month
High Rainfall Region	II. Coastal region of South Arcot and Tanjore districts, and Palni hills of Madurai district	(a) October-January rainfall is very high. It exceeds 900 mms (b) November peak under the influence of depressions (c) June-September rainfall is medium (250-400 mms)
High Rainfall Region	III. Sub-coastal and coastal regions of Chingleput, South Arcot and Tanjore districts	(a) October-January rainfall is high (600-900 mm) (b) November peak under the retreating monsoon (c) June-September rainfall is moderately high (400-600 mm)
Medium Rainfall Region	IV. Western part of Chingleput and South Arcot district and eastern part of North Arcot district	(a) Rainfall in advancing monsoon is moderately high (400-600 mm) and that of retreating monsoon is medium (b) November peak under the influence of retreating monsoon
Medium Rainfall Region	V. Eastern part of Salem district and western part of North Arcot district	(a) June-September rainfall is moderately high (400-600 mm) (b) September is the peak rainfall month (c) October-January rainfall is low (250-400 mm)
Medium Rainfall Region	VI. Western part of Tanjore district, eastern part of Tiruchirapalli and Madurai and northern part of Ramanathapuram district	(a) October-January rainfall is medium (400-600 mm) (b) November is the peak rainfall month (c) June-September rainfall is medium (250-400 mm)
Medium Rainfall Region	VII. Northern part of Coimbatore district, Salem and part of Tiruchirapalli district	(a) Rainfall for the advancing monsoon is medium (250-400 mm) and for the retreating monsoon rainfall is low (250-400 mm) (b) October is the peak rainfall month
Low Rainfall Region	VIII. Central part of Ramanathapuram and western part of Tirunelveli district	(a) October-January rainfall is medium (400-600 mm) (b) November is the peak rainfall month (c) June-September rainfall is low (125-250 mm)
Low Rainfall Region	IX. Southern part of Ramanathapuram and eastern part of Tirunelveli districts	(a) October-January rainfall is medium (400-600 mm) (b) November is the peak rainfall month (c) June-September rainfall is very low (below 125 mm)
Low Rainfall Region	X. Part of Coimbatore, Madurai and Tiruchirapalli districts	Rainfall for both the monsoons is low
Very Low Rainfall Region	XI. Central part of Coimbatore district	(a) October-January rainfall is low (b) June-September rainfall is very low

Inset Map

The inset map shows the distribution of normal annual rainfall of Madras State. Rainfall data based on an average of 51 years for 60 stations have been used in the preparation of this map. Isohyets are drawn at intervals of 5 inches (125 mm). The map is coloured in six shades of blue from deep to light. Nilgiri district and Palni taluk of Madurai district receive the highest amount of rainfall as indicated by the deepest blue shade. The east coast is the second high rainfall area. The third area of medium rainfall is Kanyakumari district in the southwest. The whole of interior Plateau is a low rainfall area. There are two areas of very low rainfall—one in Coimbatore district, the other one in Ramanathapuram district.

SOURCE : Meteorological Department, Government of India.
Data—Normal Monthly and Annual Rainfall (average 51 years).

Map 8



Map 8

Normal Annual Rainfall Efficiency

Method

THIS MAP GIVES an indication of the rainfall efficiency in different parts of the State. It is an isopleth map joining stations with a similar index of efficiency. The index used here is De Martonne's index which is as follows : $I=\frac{P}{T+10}$ where I is the index of moisture, P is the mean annual rainfall in millimeters, and T is the Temperature in °C. The moisture indices for 39 stations are calculated. The ascending order of indices indicates the descending order of the magnitude of aridity. The index 25 is the critical point below which moisture is in deficit supply for agriculture. The isopleths for each of the indices—15, 20, 25, 30, 35 and 45 are drawn to delineate the areas with different magnitudes of wetness and aridity.

Analysis

The highly efficient rainfall areas in the State are the Nilgiri hills, Palni hills (Madurai district) and Shevroy hills (Salem district) where the moisture index ascends upto 55.

The second area with a high moisture index (35-45) corresponds to the coastal part of Chingleput, South Arcot and Tanjore districts, stretching from Madras to Point Calimere.

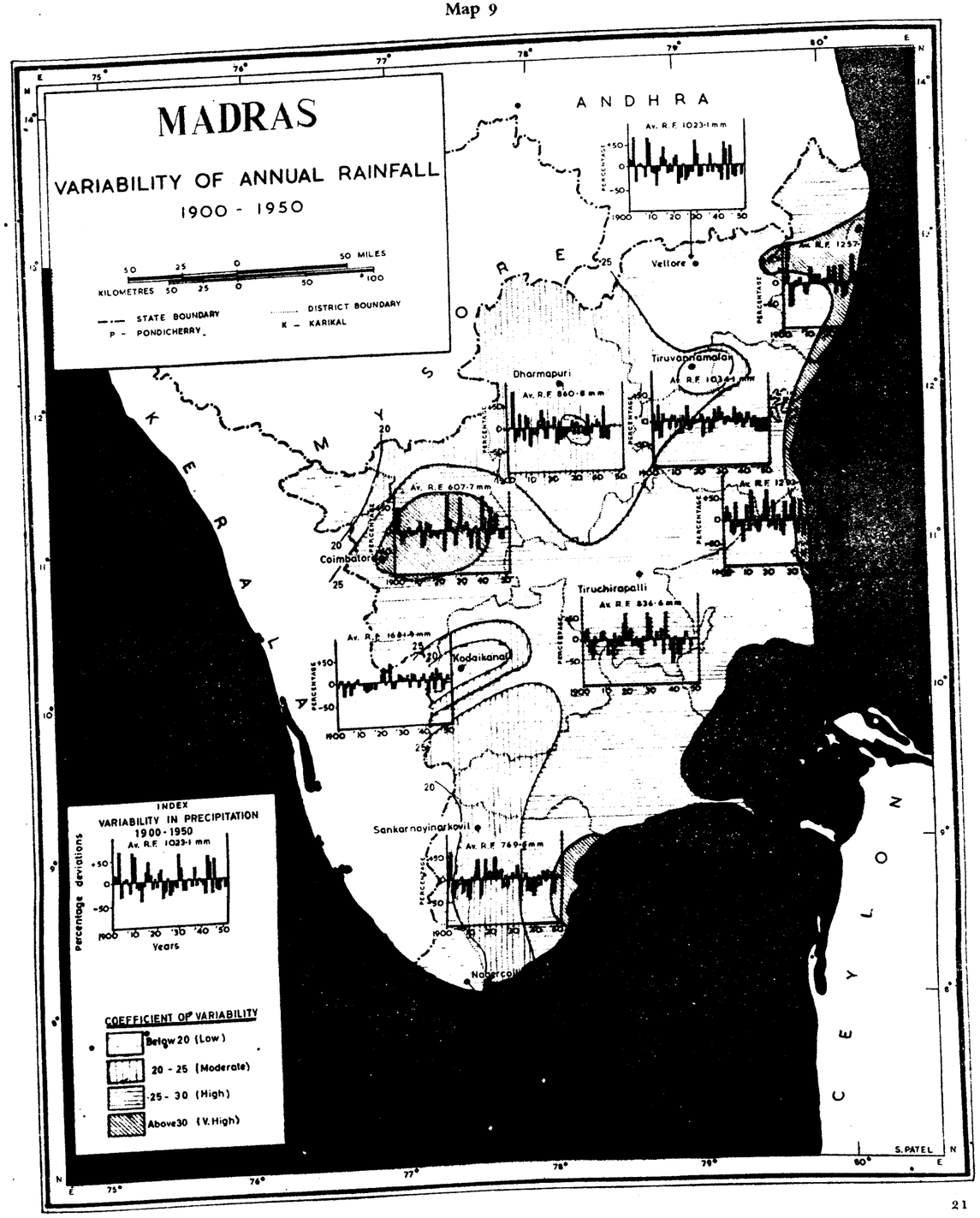
The third area with a moderately high moisture index (30-35) is mainly the sub-coastal part of Chingleput, South Arcot and Tanjore districts. Rainfall efficiency is marginal for agriculture in the northeastern part comprising the eastern margin of North Arcot district, the southeastern part of Salem, the western part of Chingleput, the whole of South Arcot and part of Tiruchirapalli and Tanjore districts. Moisture indices of this area range between 25 and 30. Another area with a similar moisture index corresponds to Kanyakumari district at the southwest extremity of the State.

The isopleth for index 25 is the critical dividing line between arid and humid parts of the State. To the west of this line rainfall is hardly sufficient for agriculture. Aridity is conspicuously significant in the northwestern and southeastern parts of the State. A major part of Coimbatore district, western part of Tiruchirapalli district, and northern part of Madurai district, form the driest part in the State with moisture index below 20. Another strikingly dry area lies in Tirunelveli and Ramanathapuram districts.

From the above analysis it is clear that the efficiency of annual rainfall is strikingly low in western and southeastern parts of the State. Here, irrigation is absolutely essential for agricultural success.

SOURCE : Meteorological Department, Government of India.
Data—Normal annual rainfall in millimeters, and normal temperature in °C.

Map 9



Map 9

Variability of Annual Rainfall, 1900—1950

Method

THIS MAP INTENDS to show the regional variation in the reliability of annual rainfall in Madras State. Reliability is, in fact, the inverse of variability. Hence the coefficient of variability is taken as the index for measuring reliability. The coefficient of variability is calculated as $CV = \frac{\sigma}{M} \times 100$, where CV is the coefficient of variability, σ is the standard deviation and M is the mean annual rainfall for 51 years. Coefficients are determined for 29 stations, and then isopleths are drawn for delimiting the areas with low, moderate, high, and very high variability. In each region one or two graphs are drawn to show the variability by the yearly percentage departures from the mean annual rainfall.

Analysis

With the exception of a few areas the variability of annual rainfall is everywhere on the high side. It is significantly high in the east coast region and in the arid part of Coimbatore and Tirunelveli districts. It is interesting to note that the east coast in spite of its high rainfall records a high coefficient of variability. This abnormality perhaps follows from the frequent weather disturbances arising from the passage of depressions formed over the Bay of Bengal. Since the mean annual rainfall of this part is more than 1250 mm, frequent negative departures from the mean annual rainfall would not increase crop failures in close successions. Unlike the east coast, the arid interior and southeast coast are liable to crop-failures due to frequent departures below the mean annual rainfall which is extremely low (620 mm).

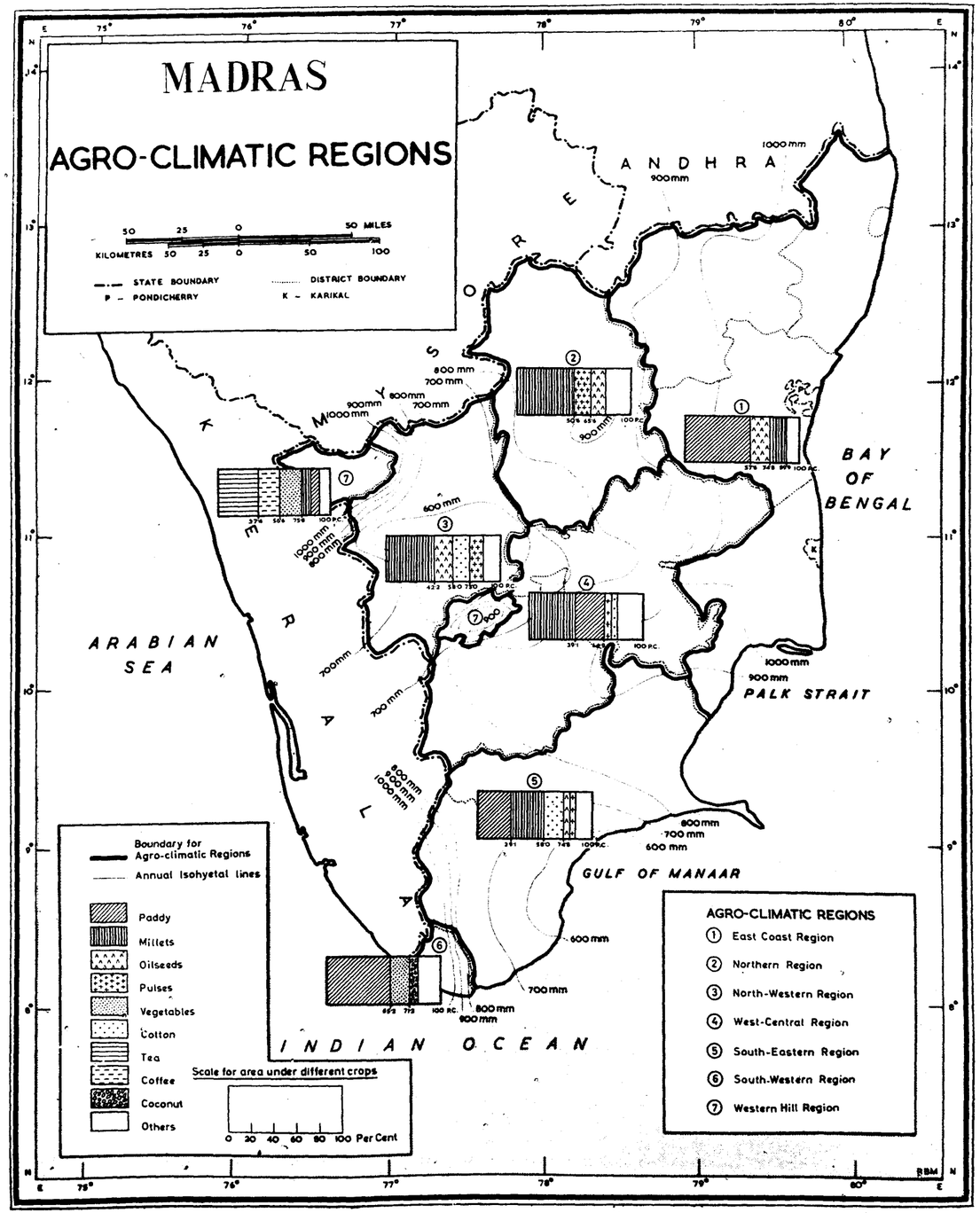
A very large area in the northeast, centre and south shows a high coefficient of variability as 25 to 30 per cent. In the eastern part, where rainfall is above 1000 mm, this high variability index is not alarming to the cultivators. But in the central and southern parts, frequent departures below the mean annual rainfall of 800 mm give frequent warnings of crop-failure to the farmers.

The northwestern part and submontane tracts in the south and west show a moderate of variability (CV as 20% to 25%), though their rainfall is on the low side (below 1000 mm). Variability is moderate in the north due to regular arrival of S.W. winds through the Palghat gap. The submontane tracts show a moderate coefficient because of their location at the foot of the Ghats which act as the medium of precipitation. Nevertheless, this moderate coefficient is desirable in these areas because of their sub-humid conditions. Since their mean annual rainfall is below 1000 mm, negative departures from the normal rainfall threaten the farmers with crop-disaster.

Variability is significantly low (below 20%) in the hill areas, and in the southwestern extremity of the State. In the former areas rainfall is heavy (1500 mms) and obviously reliable. In the latter area, rainfall though not very high (about 1000 mms) is reliable mainly because of its location. Since it is exposed to both the advancing and retreating monsoons, the arrival of both the winds is rather regular.

SOURCE : Meteorological Department, Government of India.
Data—Annual rainfall for 51 years, 1900—1950.

Map 10



Map 10

Agro-climatic Regions

Method

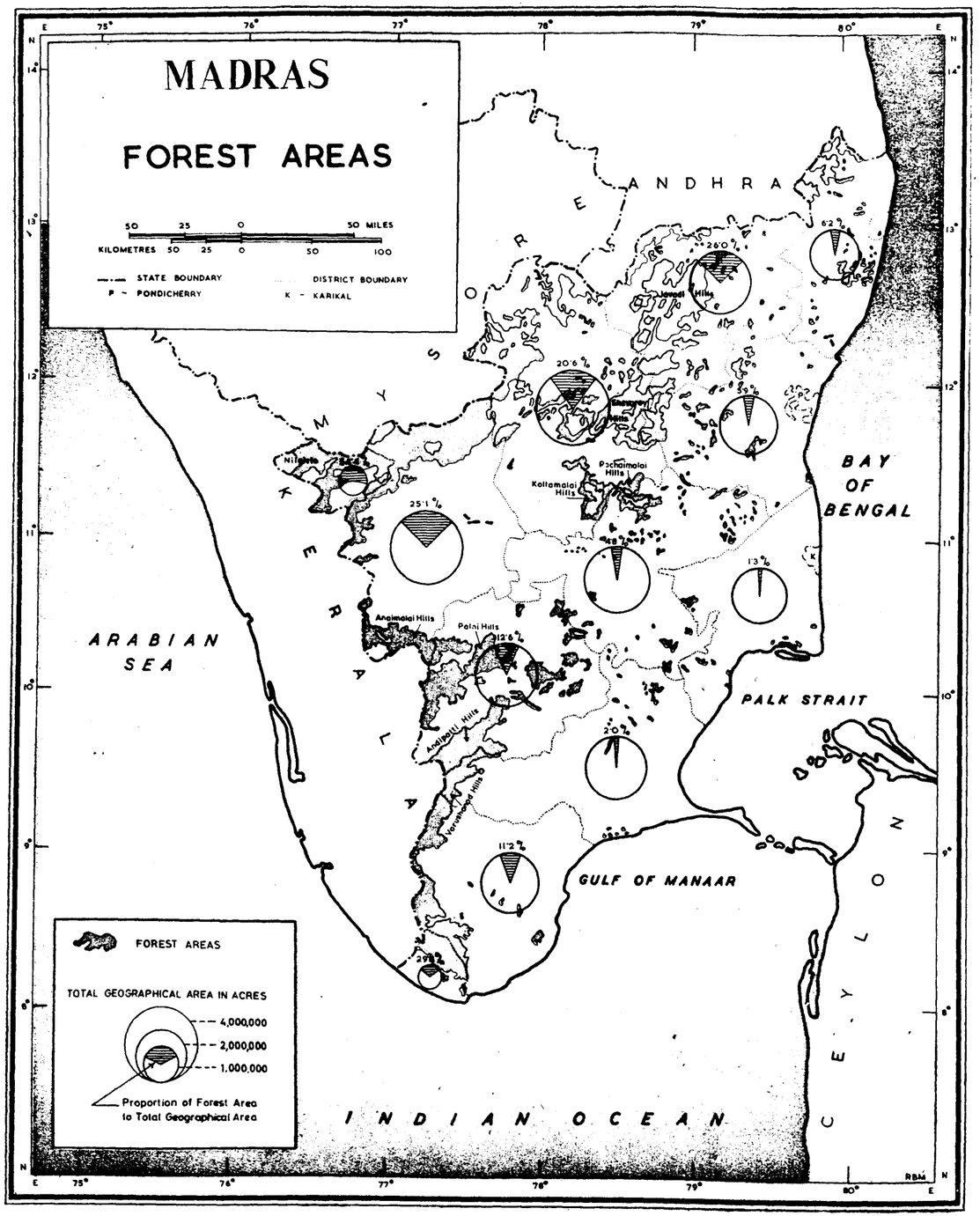
THIS MAP IS drawn by superimposing the map of rainfall regions upon the crop-distribution map. In this way seven agro-climatic regions are delineated. Each region shows agricultural inviduality because of its distinctive rainfall conditions coupled with irrigational facilities.

Analysis

Following are the Agro-climatic regions with their characteristic cropping patterns :

Agro-climatic Regions	*District Names*	*Rainfall Conditions*	*Irrigational Facilities*	*Cropping Pattern*
1. East Coast Region	Chingleput, North Arcot, South Arcot, and Tanjore	Here normal annual rainfall is above 1000 mm. Retreating monsoon (Oct.-Jan.) rainfall is high (above 900 mm). Advancing monsoon (June-Sept.) rain is low (below 400 mm).	About 58% of net sown area is irrigated. Canal irrigation assumes exceptional importance in agriculture of Tanjore district (94% of the net area irrigated by canals). Tank irrigation is predominant in other districts.	Paddy is the predominant crop. Oilseeds and millets are subsidiary crops.
2. Northern Region	Salem district	Annual rainfall is between 800-900 mm. June-September rainfall is medium (400-600 mm), Oct.-Jan. rainfall is low (200-400 mm).	About 20% of the net sown area is irrigated. Well irrigation accounts for more than 50% of the total irrigated areas.	Millet is the predominant crop. Pulses and oilseeds are subsidiary crops.
3. Northwestern Region	Coimbatore district	Annual rainfall is between 600-800 mm. Rainfall for both retreating and advancing monsoons is below 400 mm.	About 29% of the net sown area is irrigated. Well irrigation is more predominant.	Millet is the major crop. Oilseeds, cotton, and pulses are subsidiary crops.
4. West Central Region	Tiruchirapalli and Madurai districts	Annual rainfall is between 700-900 mm. Rainfall for both the retreating and advancing monsoons is moderately low (400-600 mm).	About 30% of the net sown area is irrigated by tanks, canals, and wells.	Millet is the staple crop. Rice, pulses, and cotton are subsidiary crops.
5. Southeastern Region	Tirunelveli and Ramanathapuram districts	Annual rainfall is below 900 mm. October-January rainfall is medium (400-600 mm), June-September rainfall is very low (below 125 mm).	About 37% of the net sown area is irrigated. Tank irrigation is overwhelmingly important, accounting for 95% of the net irrigated area.	Rice and millet are important. Rice is grown along the river by canal irrigation. Millet is, on the other hand, non-irrigated crop. Cotton oilseeds and pulses are subsidiary crops.
6. Southwestern Region	Kanyakumari district	Annual rainfall is about 1000 mm.	About 50% of the net sown area is irrigated. Tank irrigation is practised.	Paddy is the predominant crop. Fruits, vegetables and cocoanuts are subsidiary crops.
7. Western Hill Region	Nilgiri district, Palni taluk of Madurai district	Annual rainfall is above 1000 mm.	Only 1% of the net sown area is irrigated.	Tea and coffee are the predominant crops. Vegetables, millets, and paddy are subsidiary crops.

SOURCES : (1) *Season and Crop Report Madras State*, 1957-58.
(2) NCAER : *Techno-Economic Survey of Madras*, Government of Madras, 1961.
(3) Meteorological Department, Government of India.



Distribution of Forests

Method

THE ACTUAL AREA under forest is shown by green shades. The proportion of forest area to the total geographical area for each district is shown by Pie diagram.

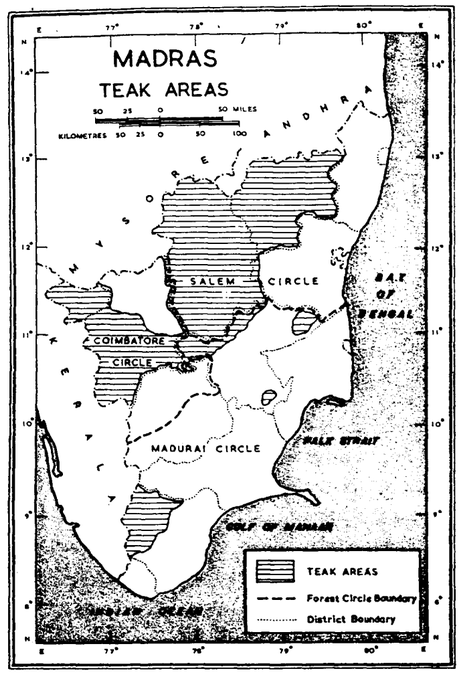
Analysis

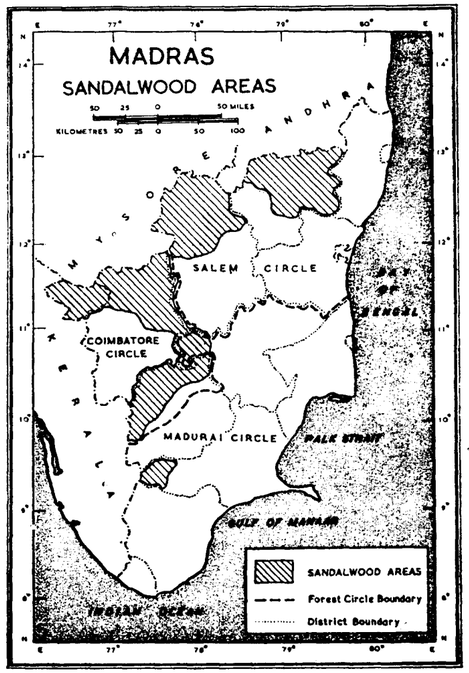
About 14 per cent of the total geographical area of Madras State in 1957-58 was covered by forests. Most of the forests are of mixed type and the output of timber in value term is low.

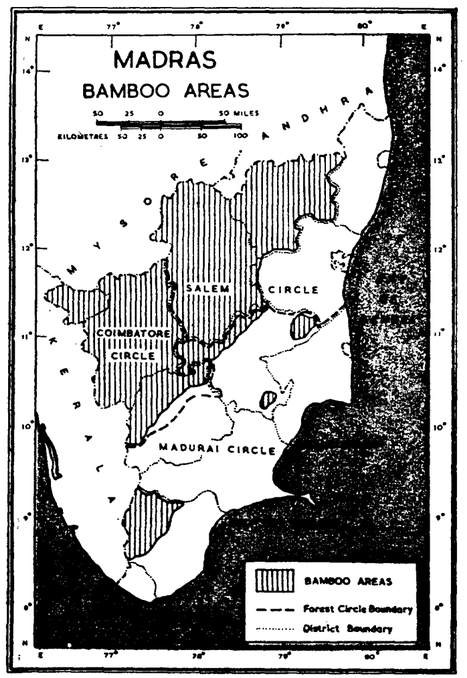
The original forest cover of the plain area has been largely modified. The clearing for agriculture has stripped the forests from nearly all of the plains and from much of the lower hills. The long stretch of plain in the east from Chingleput to Ramanathapuram district had only 6 per cent of the area under forest. The hill areas in the north and west had, on the other hand, a relatively high percentage of area under forest. The hill district of Nilgiri had more than 54 per cent of its area under forests. The other hill areas with predominance of forests are the Javadi hills in North Arcot district, the Shevaroy and Kollamalai hills in Salem district, Anaimalai hills in Coimbatore district, Palni and Andipatti hills in Madurai district, and Varushanad hills in Ramanathapuram district and Western Ghats foothills in Kanyakumari and Tirunelveli districts. Next to Nilgiri district, Kanyakumari had the highest proportion of area (29.8%) under forests followed by North Arcot district (26.0%), Coimbatore (25.1%) and Salem district (20.6%).

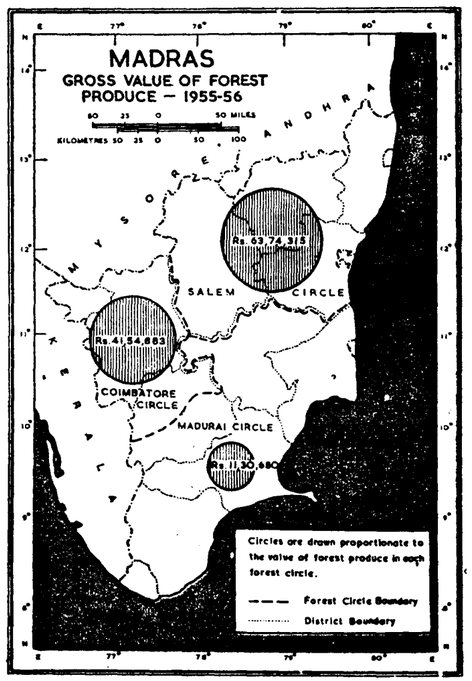
SOURCES: (1) *Season and Crop Report of the Madras State for the Agricultural year* 1957-58 (July-June).
(2) *Madras in Maps and Pictures*, Government of Madras, 1959.

DISTRIBUTION OF FOREST PRODUCE & THEIR GROSS VALUE, 1955-56









Distribution of Forest Produce and their Gross Value, 1955-56

Method

THIS MAP COMPRISES four sections. The first three sections show the distribution of teak, sandalwood and bamboos. The fourth section shows the gross value of output from these three major forest products.

Analysis

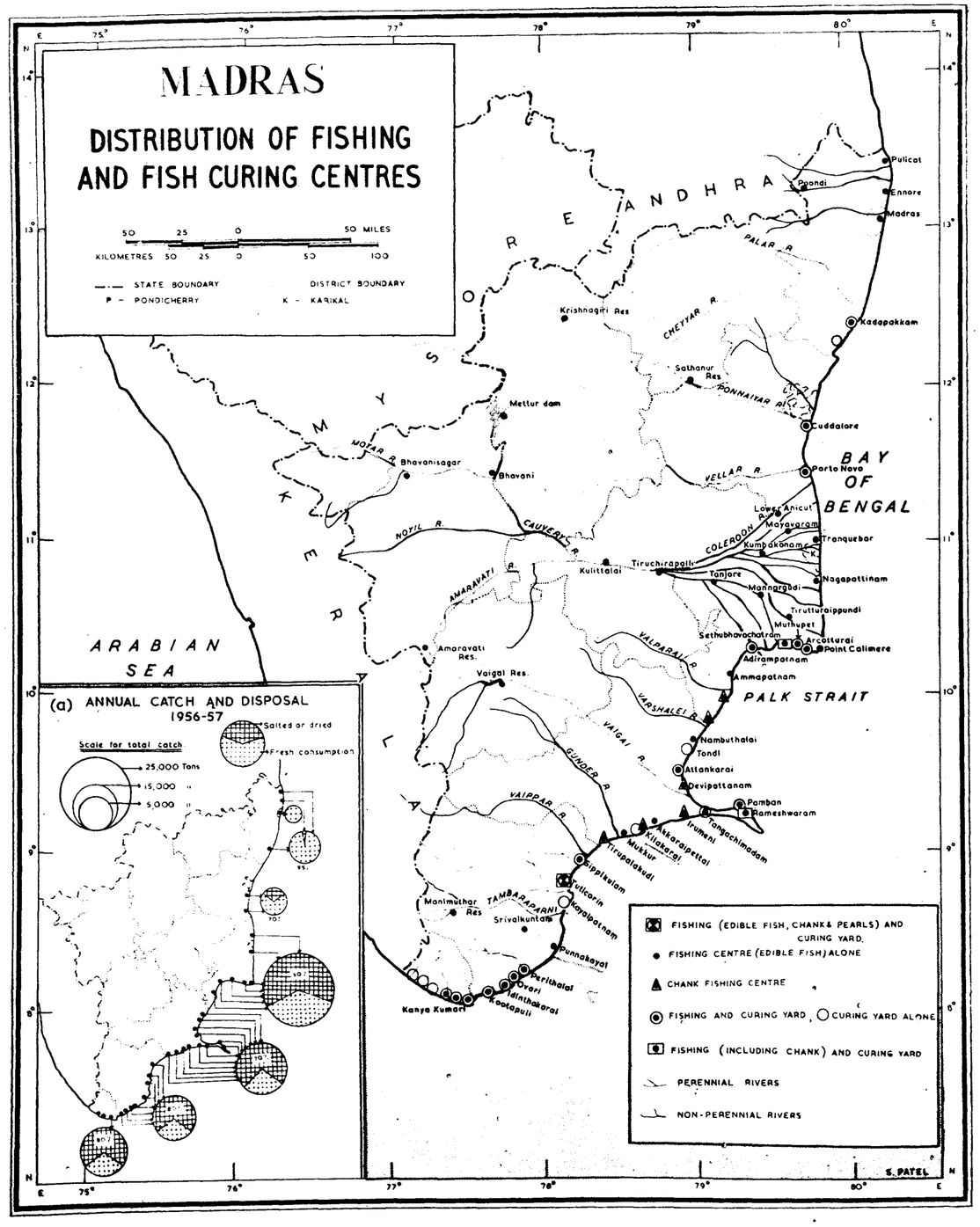
The forests of Madras produce about 2,000 tons of teak, about 800 tons of sandalwood and bamboos annually.

Sandalwood occurs mainly in the hilly tracts of Coimbatore, Salem, and North Arcot districts. Sandalwood, though a timber, is mostly used for the extraction of oil. The major portion of the sandalwood output is from Salem district. There are two sandal-oil extraction factories-one at Mettur, the other at Salem—in this district. A large portion of the sandal-oil is exported to U.S.A. and Europe. To a smaller extent, sandalwood trees are grown in Tiruchirapalli, Madurai, Nilgiri and Ramanathapuram districts.

The main species of high quality timber are the teak, van teak and rosewood. These three species of trees yield approximately 500,000 cu.ft. of timber annually. Teak alone accounts for 80 per cent of this timber output. It is grown largely in North Arcot, Salem, Coimbatore and parts of Tirunelveli and Tiruchirapalli districts. Bamboo is the third major forest product of the State. It is much more widespread than either of teak and rosewood in distribution. Except in North Arcot, Salem, Coimbatore and Nilgiri districts, the bamboo reserves serve the local demand in rural areas.

Teak and sandalwood are the main contributors to the State's gross value of forest produce. Salem circle is the leading producer of sandalwood, teak and bamboos accounting for more than half of the gross value of forest output in the State. The next valuable forest area is the Coimbatore circle. More than one-third of the value of forest produce is derived from this circle. The forest output of Madurai circle is significantly smaller than that of Coimbatore and Salem circles. It accounts for about 11 per cent of the total value of the State's forest output.

SOURCES: (1) *Madras in Maps and Pictures*, Government of Madras, 1959, pp. 52-53.
(2) Forest Department, Government of Madras.



Distribution of Fishing and Fish-curing Centres

Method

THIS MAP SHOWS the distribution of coastal and inland fishing centres, and coastal fish curing yards. Various symbols are used to differentiate these centres.

Analysis

In 1957-58, Madras produced over one lakh tons of fish, of which sea-fish accounted for 62.6 per cent and inland fish for 37.4 per cent. Practically all fresh water fish was consumed within the State.

1. Marine Fisheries

Only 36 per cent of the total marine catch (67,000 tons) in 1957-58 was consumed in fresh form and the remaining 64 per cent of the catch was available for processing. Curing is the most important fish-processing industry in the State. The entire coast is dotted with 32 fishing centres and 30 fish-curing yards. Fishing and fish-curing centres are concentrated more in the south than in the north. For every 14 miles (22.4 kms) of coastline in the south, there is one fishing centre compared to one centre for every 28 miles (44.8 kms) of coastline in the north. The four southern districts—Tanjore, Ramanathapuram, Tirunelveli and Kanyakumari—shared more than three-fourths of the total coastal fishing and fish curing centres of the State.

Other than fishing of edible varieties, Madras is famous for pearl and chank fishing. Pearl fishing has been carried on in water off Tuticorin coast from time immemorial. Oyster beds extend for about 40 miles (64 kms) along the coast and for 15 or more miles (24.0 kms or more) into the sea. Chank fishing has been a traditional craft of Madras State. Chank beds are localized off the coast of Tuticorin and Rameswaram.

Pearl fishing is a State monopoly. The Madras Government earns a fair amount of foreign exchange through the export of pearls. Chank fishery brings a revenue of the order of Rs. 3 lakhs to the Government per year. Tuticorin is by far the most important fishing centre in the State. Its fishing operation is multi-farious—the catching and curing of edible fish and the production of chanks and pearls.

2. Inland Fisheries

Tanjore, Tiruchirapalli, Salem, Madras and Coimbatore districts produce about three-fifths of the total output (40,000 tons) of inland fish in the State.

Inland fishing centres can be classified into three categories: (*a*) estuarine and backwater fisheries, (*b*) riverine fisheries, and (*c*) reservoir fisheries.

Pulicat and Ennore in Chingleput district, Muthupet in Tanjore district, Kille in South Arcot district and Manakudy Kalimere in Kanyakumari district are the important estuarine and backwater fishing centres in the State.

The Cauvery river with its tributaries and distributories is the most important source of fresh water fish in the State. Of the total 18 riverine fishing centres, 12 centres are on the Cauvery-system. The others are dispersed—one on the river Tambaraparni, one on the Vaigai, one on the Vellar, two on the Ponnaiyar and one on the Adyar. There are eight major reservoirs in the State which, though primarily meant for irrigation and power, are used for fishery also. Of these eight reservoirs, the Mettur reservoir is the most important fishing centre. It has an area of 62 square miles (158.7 sq. kms) and is being regularly stocked since its completion in 1934.

The entire fish output from inland fisheries is consumed in fresh condition. Small quantities packed in ice are transported to Madras and other distant towns, but the bulk of catch is used in the nearby towns and villages, and does not require any ice for transportation.

Inset Map

This map shows the annual catch and disposal of marine fish in 1956-57.

Method

Annual catches and disposals are shown by Pie graphs.

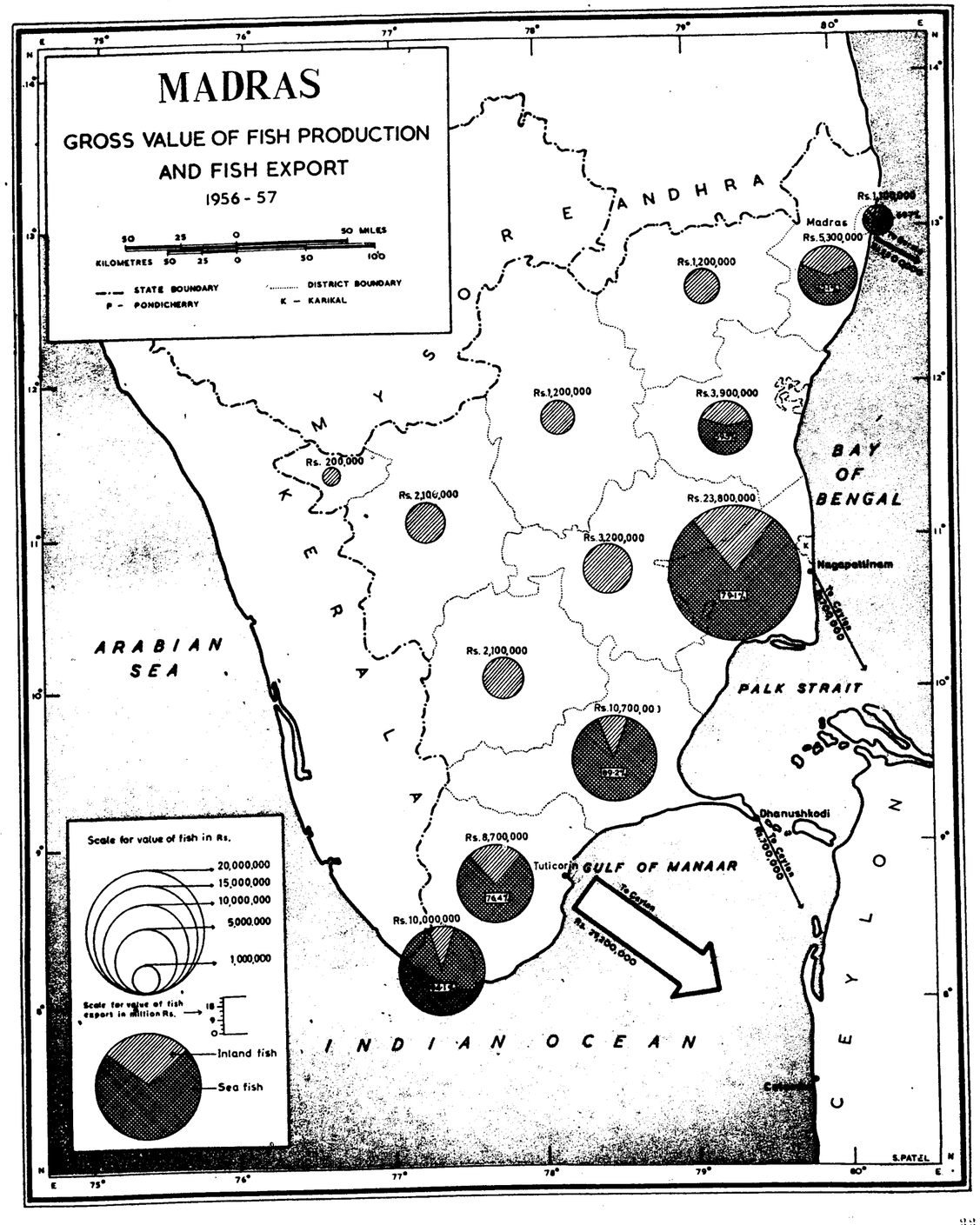
Analysis

The seven coastal districts had a total of sea fish landings of the order of 67,500 tons in 1956-57. Tanjore district had the biggest share accounting for 37.3 per cent of the total followed by Ramanathapuram (18.9%), Kanyakumari (18.7%), and Tirunelveli (13.1%) districts. In fact, the whole of the southern coast, from Tanjore to Kanyakumari district, contributed 88 per cent of the State's total landings, while the northern coast lying in Chingleput, Madras and South Arcot districts accounted for only 12 per cent of the total. There is a great deal of difference in the disposal-pattern between north and south. An overwhelming proportion of the catch was consumed fresh in the north. There was hardly any surplus left after consumption for processing in the northern coast. In Madras City the entire amount was consumed locally, while in Chingleput and South Arcot districts 70 per cent of the total catch was consumed fresh.

The southern coast, on the other hand, had more of its catch for curing than for fresh consumption. About 80 per cent of the total catch in each of Kanyakumari and Tirunelveli districts, 70 per cent in Ramanathapuram district, and 60 per cent in Tanjore district were processed.

SOURCES: (1) Fisheries Department, Government of Madras.
(2) NCAER : *Techno-Economic Survey of Madras*, Government of Madras, 1961.

Map 14



Map 14

Gross Value of Fish Production and Fish Export, 1956

Method

THIS MAP PROPOSES to show the relative position of various districts in fish production and fish export. For each district the gross value of fish production shared by the inland and marine fisheries is shown by Pie graphs. The value of fish exported abroad is shown by proportionate bars.

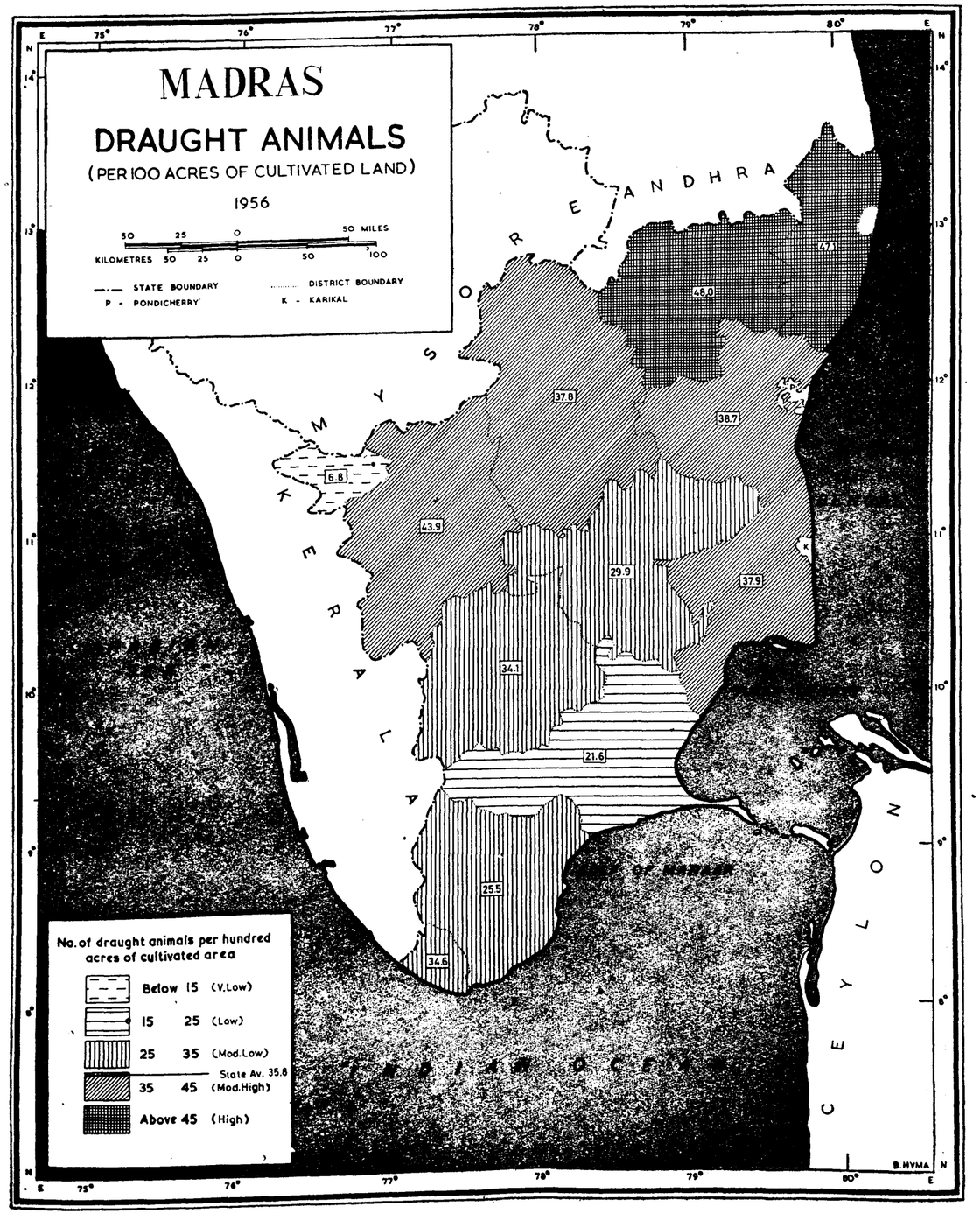
Analysis

In 1956 Madras caught fish worth Rs. 749.0 Lakhs. About 71 per cent of this gross value was confined to four coastal districts in the south—Tanjore, Ramanathapuram, Tirunelveli and Kanyakumari. Tanjore is by far the most important fish producing district in the State. In 1956 it contributed 31.9 per cent of the State's total value of fish output. The coastal districts in the north accounted for 14 per cent and inland districts—North Arcot, Salem, Coimbatore, Tiruchirapalli, Madurai and Nilgiri—for another 15 per cent of the State's total gross value of fish output. Sea-fish accounted for 80 per cent of the gross value of fish output in coastal districts. An overwhelming proportion of the sea-fish is exported abroad. There are six fishing harbours in the State such as Tuticorin in Tirunelveli district, Tondi, Dhanushkodi and Kilakarai in Ramanathapuram district; Nagapattinam in Tanjore district; Madras harbour in Madras district.

In 1956 Madras State exported fish worth about Rs. 34.0 lakhs of which 85.8 per cent was handled by Tuticorin port, 9.8 per cent by Madras port, 2.1 per cent by Dhanushkodi, 2.1 per cent by Nagapattinam, 0.2 per cent by Tondi and Kilakarai. The fish export through Tuticorin, Dhanushkodi and Nagapattinam was bound for Ceylon and that from Madras port for Burma, Malaya and Singapore.

SOURCE : *Administrative Report of the Department of Fisheries, Madras* 1956-57 : Madras Fisheries Department.

Map 15



Map 15

Draught Animals, 1956

(Per 100 acres of cultivated land)

Method

THE NUMBER OF working animals per 100 acres of cultivated land is calculated for each district and the State as a whole. These figures are then graded into classes as high, moderately high, moderately low, low, very low, above and below the State average. Now the districts are shaded according to this gradation of density. Absolute figures in each district indicate the density of draught animals per 100 acres of cultivated land.

Analysis

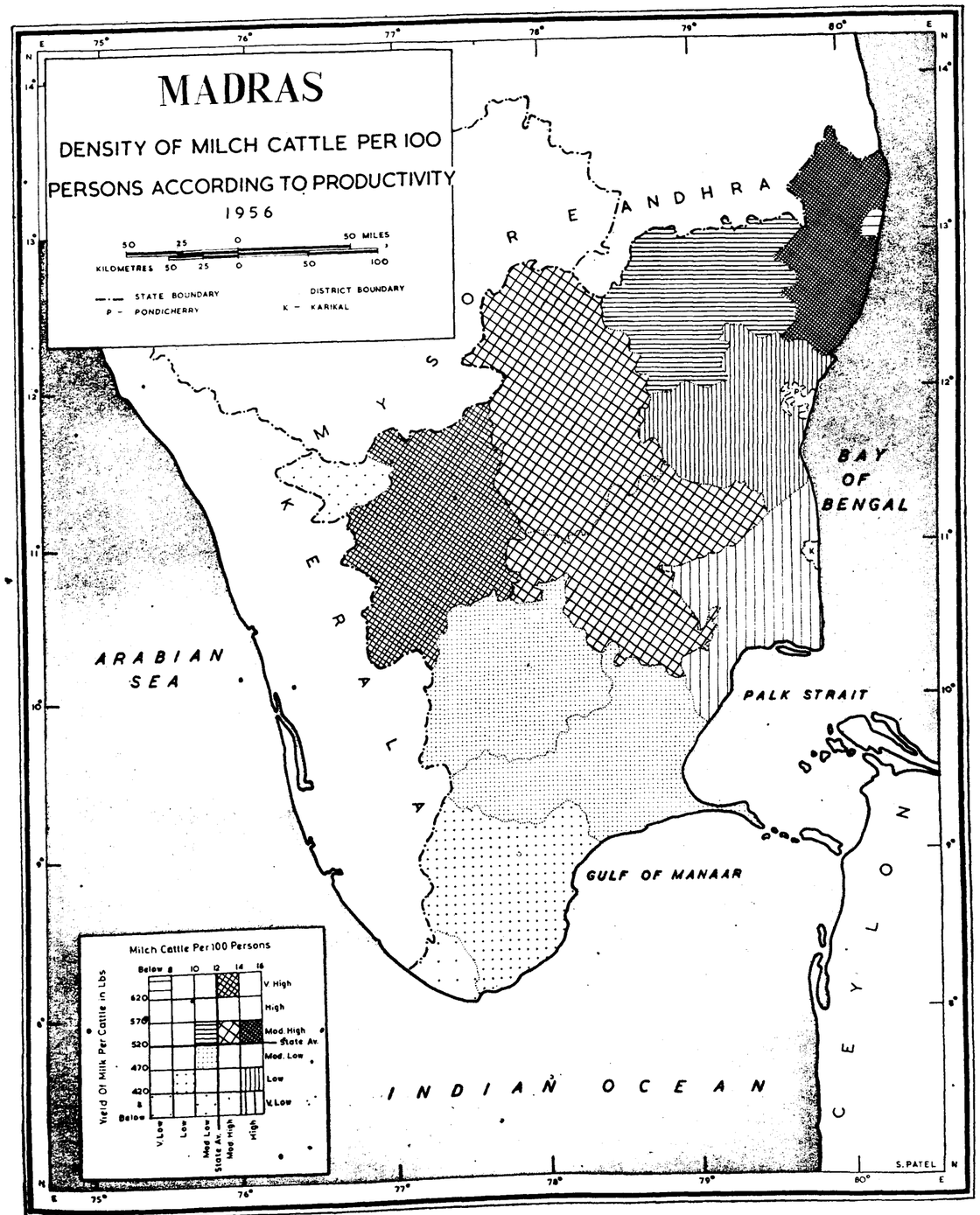
The strength of the draught force in 1956 was 5.15 million animals which gave a ratio of 35 animals per 100 acres of cultivated area against 22 animals for the country as a whole. Except in Nilgiri and Ramanathapuram districts, everywhere the ratio of working animals to the net sown area was higher than the all-India average. This map brings out that the northern and eastern districts have a density higher than the State average. The highest density of draught animals was in Chingleput and North Arcot districts. Here the average density of working animals per 100 acres of net sown area was 49 compared to 35 animals for the State as a whole.

The next high density area was in the northwest and in the east coast. Each of Salem and Coimbatore districts in the northwest supported 44 and 38 working animals per 100 acres of net sown area respectively. Tanjore and South Arcot districts in the east showed a density of 38 animals per 100 acres of cultivated land.

The rest of the area showed a low density ranging from moderately low to very low. The central districts (Tiruchirapalli and Madurai) and southern districts (Tirunelveli and Kanyakumari) had a density of draught animals moderately low ranging between 25 and 35. Ramanathapuram district showed a significantly low density of working animals, 21 animals per 100 acres of cultivated land. The lowest density of draught animals was, however, marked in the hill district of Nilgiri where for every 100 acres of cultivated land only 6 animals were used.

SOURCES: (1) *Agriculture Statistics for Madras State*, June 1957.
(2) *Agricultural Situation in India*, May 1957.
(3) The unpublished Records of the Department of Statistics, Madras.

Map 16



Map 16

Density of Milch Cattle per 100 Persons according to Productivity, 1956

Method

THIS MAP INTENDS to depict the density of milch cattle per 100 persons according to the degree of productivity. The yield of milk per cattle is taken as the criterion of productivity of cattle. The yield-figures are then arranged in ascending and descending order above and below the State average. The density of milch cattle per 100 persons is also arranged in ascending and descending order above and below the State average. Now the combinations of these two variables for each district are examined and grouped into four major classes : (*a*) high productivity and high density of milch cattle, (*b*) low productivity and high density of milch cattle, (*c*) high productivity and low density of milch cattle and (*d*) low productivity and low density of milch cattle.

Analysis

The yield of milk per cattle is lower in Madras State (520 lbs) than in India as a whole (665 lbs). The number of milch cattle per 100 persons is lower in Madras State (12) than in the country as a whole (18).

The map brings out four distinctive regions with their characteristic density and productivity of milch cattle :

(*i*) The most productive milk-area in the State lies in the north comprising Coimbatore, Salem, Tiruchirapalli, and Chingleput districts. Here both the density of milch cattle (13) and the yield of milk per cattle (600 lbs) are higher than the State average. About 50 per cent of the State's total milk-supply originates from this area.

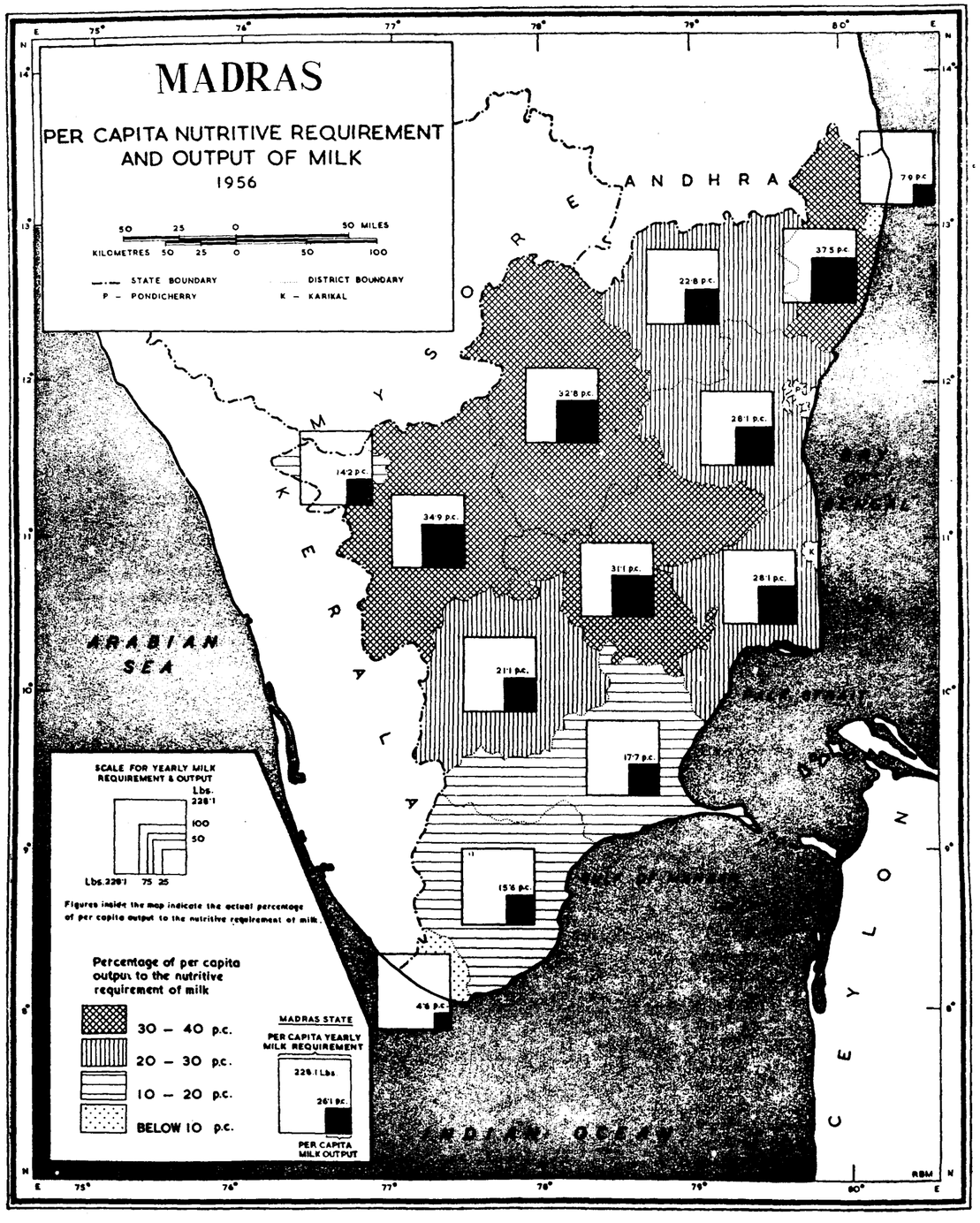
(*ii*) The second productive milk area is in the east coast—South Arcot, and Tanjore districts. It contributes 15 per cent of the State's total milk supply. The milk output is relatively high due to high density of milch cattle (15), though the average yield of milk per cattle is low (375 lbs).

(*iii*) The district of Madras is significantly poor in milk production. Its per capita milk output is 18.1 lbs compared to 59.6 lbs for the State as a whole. The low per capita output is mainly accounted for by its very low density of milch cattle (2 per 100 persons), though individual cattle is highly productive (1,250 lbs of milk per cattle).

(*iv*) North Arcot district is another poor milk area due to low density of milch cattle (11), though the per cattle milk output is higher (525 lbs) than the State average (520 lbs). Its per capita milk-output is 52.0 lbs. compared to 59.6 lbs. for the State as a whole.

(*v*) Over the rest of the State the output of milk is low due to low density and low productivity of cattle. All the southern districts—Madurai, Ramanathapuram, Tirunelveli, Kanyakumari and Nilgiri —are poor in milk supply. Here on the average the per capita milk-output is 33.4 lbs compared to the 59.6 lbs for the State as a whole. Everywhere, the density (8) and yield of milk per cattle (450 lbs) are significantly low. Kanyakumari district is the poorest milk area. Its per capita milk output is 10.6 lb against the State average of 59.6 lbs. It ranks next to Madras City in having an extraordinarily low density of milhc cattle (4 cattle per 100 persons) and stands next to Tanjore district in having an outstandingly low yield of milk per cattle (300 lbs).

SOURCES: (1) *Agricultural Situation in India*, May 1957.
(2) Data compiled from the Records with the Milk Officer of the Department of Animal Husbandry.
(3) *Estimate of Human Population in Reorganized Madras State*, 1956.



Per Capita Nutritive Requirement and Output of Milk, 1956

Method

THIS MAP INTENDS to show the relative position of various districts with regard to the output and nutritive requirement of milk per person. About 10 ozs. of milk per day has been taken as the standard nutritive requirement of milk per person. The yearly requirement thus comes to 228.1 lbs. The per capita output of milk has been calculated by dividing the annual production figure by the population figure. The difference between per capita output and per capita demand is examined for each district to find out whether its production is in deficit or in surplus.

Analysis

In every district, the output was in deficit of the nutritive requirement. The broad findings of this map are as follows :

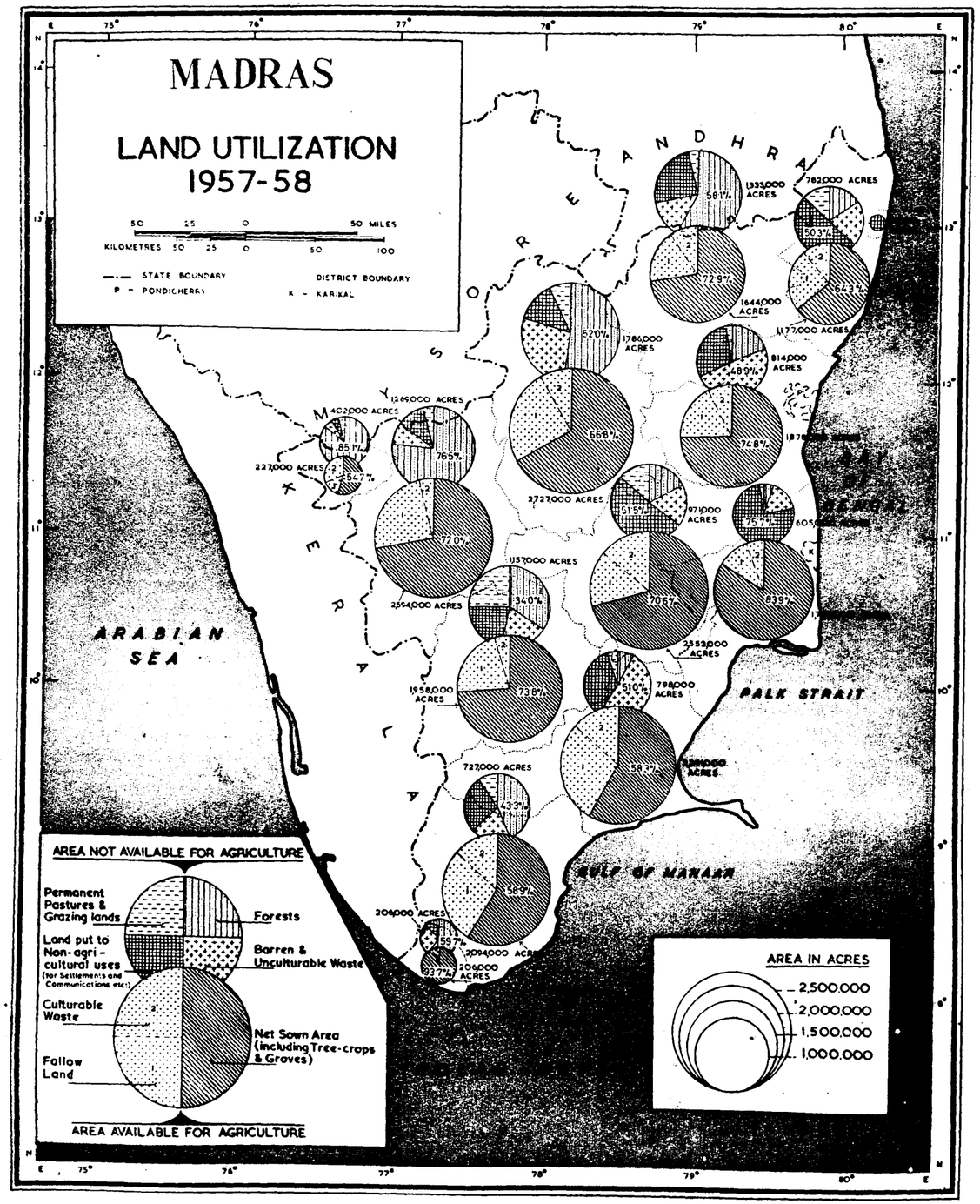
The largest deficit area comprises Madras City and Kanyakumari district. Only 5 to 8 per cent of the nutritive requirements of milk per person was supplied by the cattle population of these two districts. Very low density and a very low yield per cattle were the chief contributory factors to this very high deficit condition in the Kanyakumari district. For Madras City deficit is accounted for by the outstanding low density of milch cattle, though its yield of milk per cattle is high.

The second large deficit milk area comprises Ramanathapuram and Tirunelveli districts in the south and the Nilgiri district in the northwest. In each of these districts the milk supply was in deficit by 82—85 per cent of the nutritive requirement per person. Low density and low yield per cattle accounted for this high deficit condition (Map 16).

The third deficit milk area comprises North Arcot, South Arcot and Tanjore districts in the east and Madurai district in the centre. In each of these districts, the output was within 20—30 per cent of the nutritive requirements. The chief factor which contributed to this deficit condition is the low productivity of cattle, though the density of milch cattle is high.

Compared to other districts, Coimbatore, Tiruchirapalli, Salem and Chingleput districts had a better output. Their cattle wealth could supply 31—37 per cent of the nutritive requirements of milk per person. This is mainly because of higher productivity and higher density of milch-cattle. There is regular cattle breeding in each of these districts. The Kangayam of Coimbatore and Alambedi breed of North Salem are some of the best cattle in the State.

SOURCES: (1) *Agricultural Situation in India*, May 1957.
(2) Data compiled from the Records with the Milk Officer of the Department of Animal Husbandry.
(3) *Estimate of Human Population in Reorganized Madras State*, 1956.



Land Utilization, 1957-58

Method

THIS MAP SHOWS the pattern of land-use in the State. The land area of each district is classified into two types—agricultural and non-agricultural land.

Agricultural land is further classified as (*a*) net sown area, (*b*) current fallows and other fallows, and (*c*) culturable wastes. Net sown area represents land sown with crops. Current fallow indicates the cropped area which is kept fallow during the current year. Other fallow lands are those which are taken up for cultivation, but are temporarily out of cultivation for a period of one year or less. Culturable wastes represent all land available for cultivation whether they are taken up for cultivation or abandoned after a few years for one reason or other. Fallows and culturable wastes are shaded by the same type of hatching to bring out the areas which are still available for agricultural expansion.

Non-agricultural land has been classified as (*a*) forests, (*b*) barren and unculturable waste, (*c*) land put to non-agricultural uses such as settlements and communications, and (*d*) permanent pastures and grazing lands.

The above uses of land are shown by Pie diagrams. Two contiguous circles are drawn, one proportionate to the area available for agriculture and the other proportionate to the area not available for agriculture. Each circle is then divided into sectors proportionate to their respective uses.

Analysis

Following are the salient features of this map:

Except in Kanyakumari and Nilgiri districts, everywhere the proportion of area available for agricultural uses is higher than that of non-agricultural uses. In Kanyakumari district the agricultural and non-agricultural areas are equal, while in Nilgiri district the non-agricultural area is almost one and half times that of the agricultural area.

The proportion of net sown area to the total area available for agricultural uses is extraordinarily high in the districts of Kanyakumari (94%) and Tanjore (84%).

The proportion of fallows and culturable waste-land to the total area suited for agriculture is conspicuously high in the district of Nilgiri (45.3%), Ramanathapuram (41.7%) and Tirunelveli (41.1%).

About 40 per cent of the State's non-agricultural land is covered with forests. A very high concentration of forest area is in the western and northern hills. Nilgiri district shows the highest proportion of non-agricultural land under forests (85.1%). Next in order are Coimbatore district (59.7%), North Arcot district (58.1%), Salem district (52%).

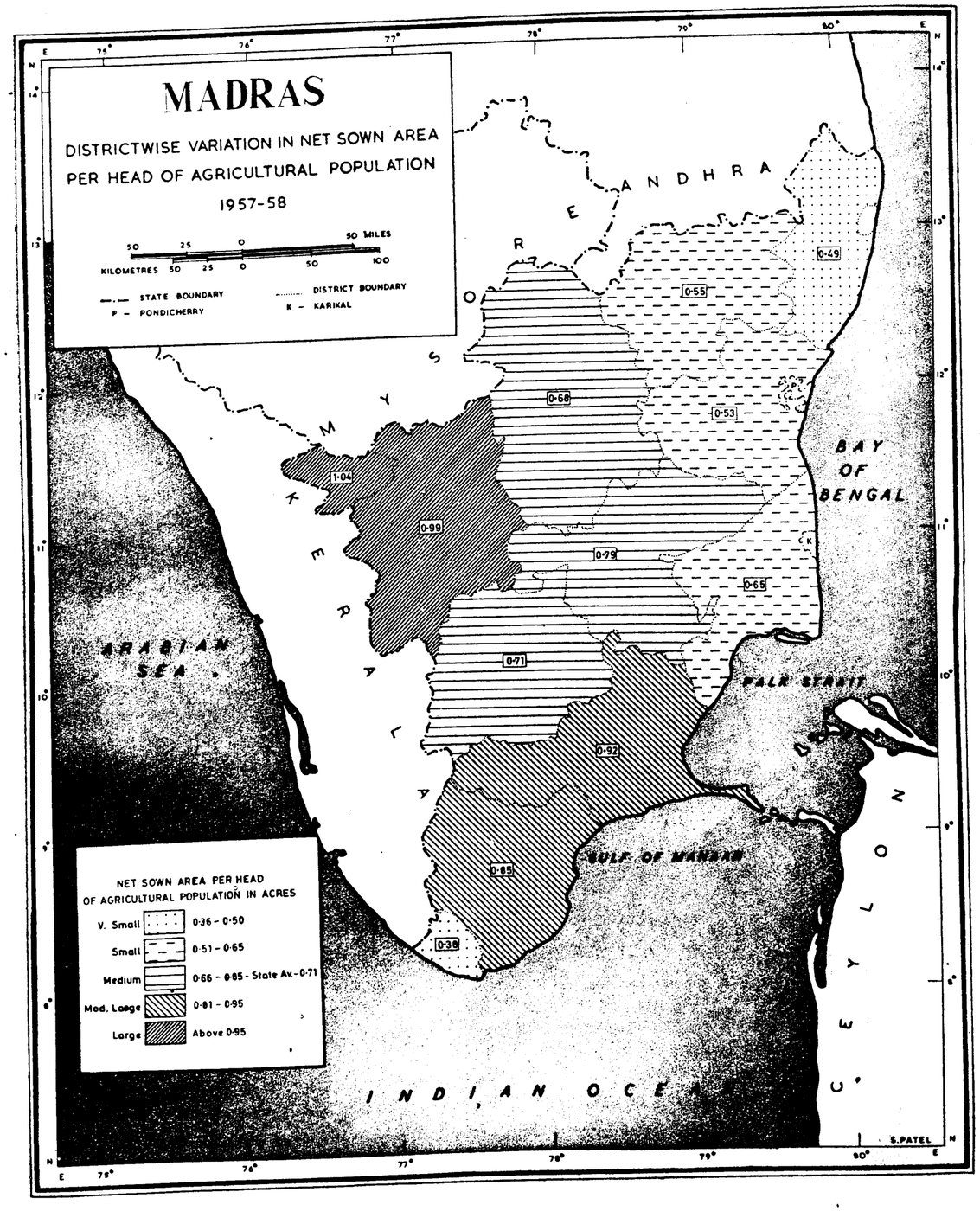
About 28 per cent of the land put to non-agricultural uses is used for settlements and communications. A very high proportion of non-agricultural land is used for communications and settlements in the districts of Tanjore (76%), Tiruchirapalli (52%) and Chingleput (50%).

Barren and unculturable wastes account for 22 per cent of the total non-agricultural area. Ramanathapuram district shows about 51 per cent of its non-agricultural land as barren and unculturable waste. The other districts with a significant proportion of barren land are South Arcot (49%), Salem (28%) and Kanyakumari (26%).

Permanent pastures and grazing grounds occupy only 9 per cent of the non-agricultural land of the State. Nevertheless, its proportion to the non-agricultural land is fairly high in Madurai (25%), Tiruchirapalli (13.4%) and Chingleput (13.1%) districts.

SOURCE : *Season and Crop Report of the Madras State for the Agricultural Year* 1957-58 (July-June).

Map 19



Map 19

Districtwise Variation in Net Sown Area per Head of Agricultural Population, 1957-58

Method

THIS MAP INTENDS to show the districtwise variation in net sown area per head of agricultural population in 1957-58. The data for net sown area are taken for 1957-58, the latest year for which data are available. The agricultural population for 1957-58 is calculated by assuming its yearly rate of growth to be the same as that of rural population as shown in the provisional counts made by the Census of India, 1961. The ratio between the net sown area and agricultural population is the index for agricultural holding per head of the agricultural population. After plotting these indices, the districts are shaded to show the range from large to very small holding, per head of the farming population.

Analysis

The net sown area per head of the agricultural population is much smaller in Madras (0.71 acre) than in India as a whole (1.1 acres). Among the districts, Kanyakumari shows the smallest size of holding per head of farming population (0.38 acre), mainly due to its very high density of population (1,550 persons per square mile). For a similar reason, Chingleput district shows a very small holding (0.49 acre) per agricultural person.

The net sown area per head of agricultural population was small in the three eastern districts—North Arcot (0.55 acre), South Arcot (0.53 acre) and Tanjore (0.65 acre)—mainly because of a very high proportion of population dependent upon agriculture (70%—80%).

The central tract comprising Salem, Tiruchirapalli, and Madurai districts had holdings of medium size. The districts of Salem and Tiruchirapalli supported less population and obviously less pressure of population on agricultural land, though a very high proportion of people (70%—71%) was dependent upon agriculture. In Madurai district the net sown area per head of agricultural population was medium (equivalent to the State average 0.71 acre) mainly because of the low density of its agricultural population.

Only four districts—Nilgiri, Coimbatore, Ramanathapuram and Tirunelveli—showed holding per agricultural person larger than the State average. Nilgiri district showed the highest figure (1.04 acres) followed by the districts of Coimbatore (0.99 acre), Ramanathapuram (0.92 acre) and Tirunelveli (0.85 acre).

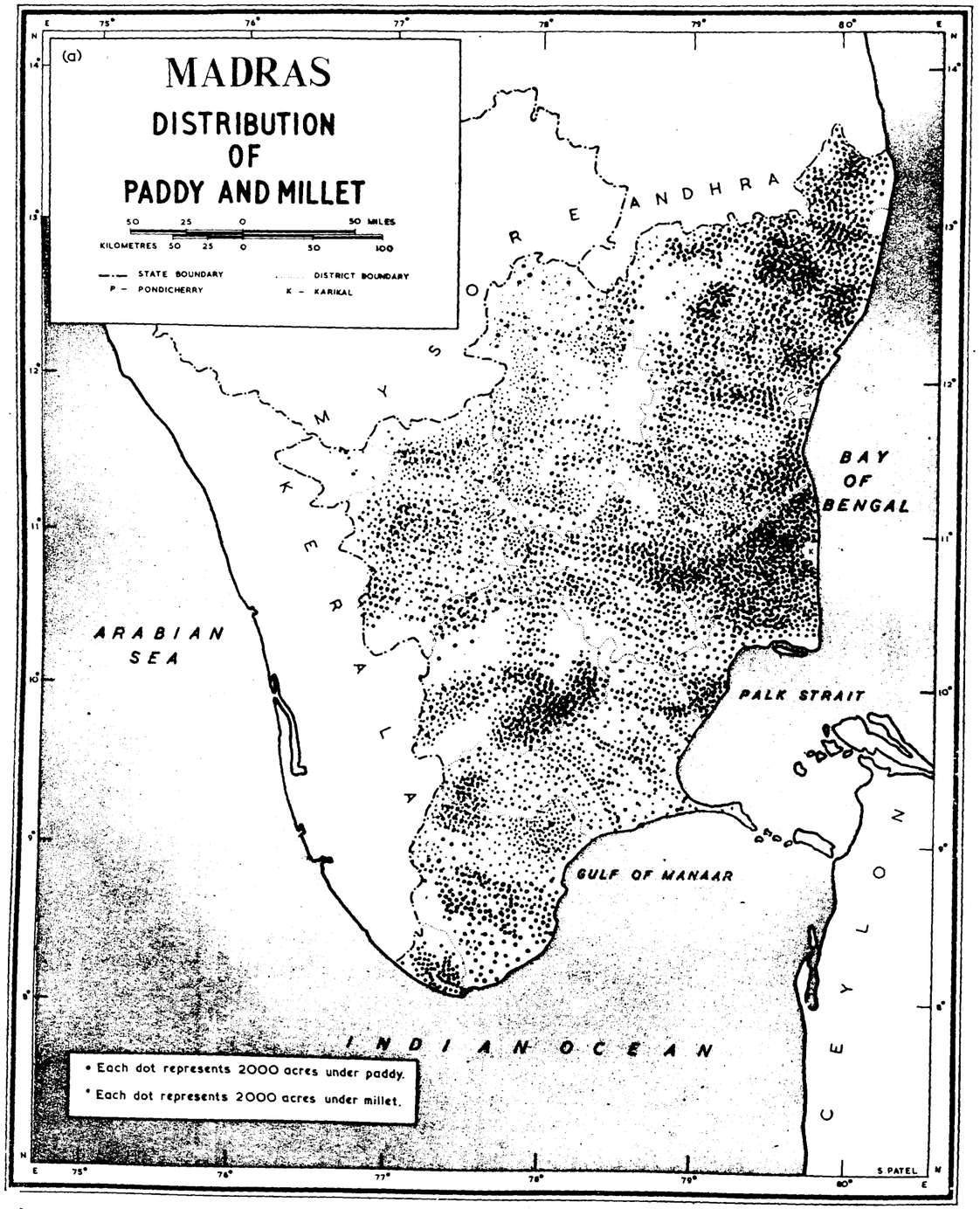
The holding per person was high in the Nilgiri district mainly because only a small proportion of its population (30%) was engaged in agricultural activities.

In Coimbatore district, a relatively high percentage of net sown area to the total geographical area (48%) and relatively low proportion of agricultural population, (56%) to the total population, accounted for its moderately large holding of agricultural land per head of the farming population (0.99 acre). In Ramanathapuram and Tirunelveli districts, the holdings were moderately large mainly due to their low density of population and low proportion of population dependent upon agriculture. In the former district 61 per cent and in the latter district 54 per cent of the total population were dependent upon agriculture.

The above analysis brings out the fact that the agricultural land of Madras was overburdened with the farming population. This condition is obviously indicative of the low proportion of earners in the rural population and the low per capita income in agricultural sector of the State economy in 1957-58.

SOURCES: (1) *Season and Crop Report of Madras State for the Agricultural Year* 1957-58 (July-June).
(2) *Provisional Population Totals, Census of India*, 1961.

Map 20 (a)



Map 20

Distribution of Major Crops

Method

THIS MAP SHOWS the distribution of major foodcrops and commercial crops. There are three sections in the map. The first section shows the distribution of staple crops—paddy and millet, the second section shows the distribution of subsidiary foodcrops—pulses and oilseeds; the third one shows the distribution of commercial crops—cotton, sugarcane, tea and coffee. They are shown by the dot method.

Analysis

Following are the salient features of crop distribution brought out by this map :

1. Food Crops

There is a heavy concentration of paddy cultivation in the east and southwest coast regions because of higher rainfall conditions and better irrigational facilities. Outside this region there are paddy growing areas, linear with the river-valleys such as the Vaigai basin, Tambaraparni valley, etc. The densest concentration of paddy cultivation is in the Cauvery delta conforming to Tanjore district.

Millet replaces paddy in the west where annual rainfall is below 1000 mm and the soil is relatively poor. Its cultivation is widespread in the western, central and southern parts of the State.

2. Subsidiary Food Crops

Pulses are grown as a second crop to millet or paddy. Among pulses horsegram, greengram, blackgram and redgram are important. Horsegram occupies the greatest area under pulses. It is exclusively grown in the districts of Salem, Coimbatore and Madurai. Blackgram and greengram are grown in all districts except in South Arcot, Tiruchirapalli and Ramanathapuram districts. On the whole pulses are most predominant in the well irrigated tracts of north and west.

Oilseeds

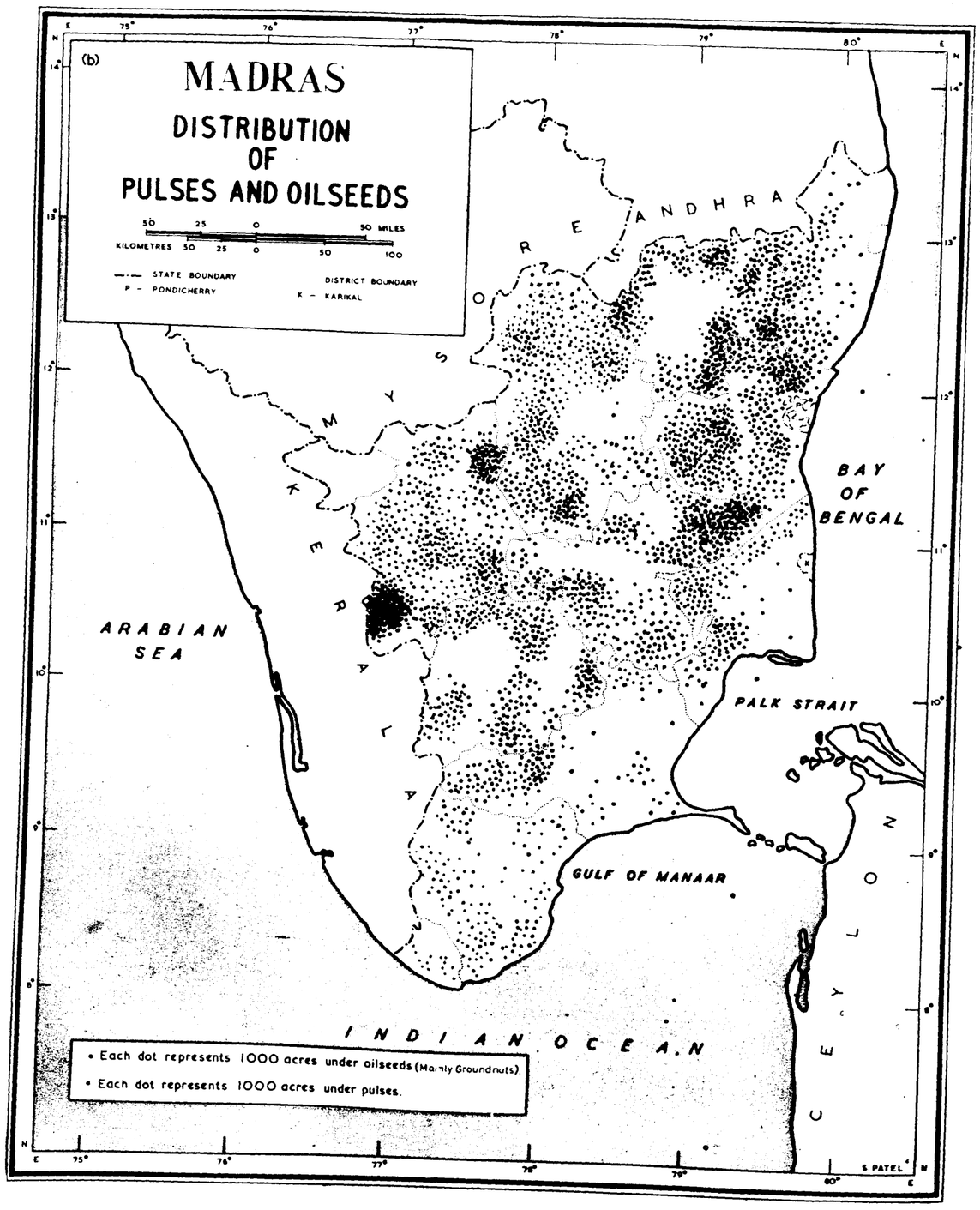
Groundnut is the most important oilseed occupying more than four-fifths of the total oilseeds area in the State. Next to groundnut, gingelly is important accounting for 8 per cent of the total area under oilseeds. The third important oilseed is castor.

Groundnut cultivation has enormously extended in the State in recent years due to its export value. Sandy or loamy soils with facilities for drainage are best suited to this crop. The most important groundnut growing areas are in North Arcot, South Arcot, Coimbatore and Tiruchirapalli districts. It is grown on a minor scale in Madurai, Western Ramanathapuram and in non-deltaic part of Tanjore district.

Gingelly is ordinarily raised in all places, because it is not very fastidious about soils. The greatest concentration is, however, in the Karur taluk of the Tiruchirapalli district.

Castor is grown chiefly in Salem and in the western part of the North Arcot district where rainfall is

Map 20 (b)



moderately light. Heavy rainfall is injurious to this crop. This crop is hardly grown along the east coast where the rainfall is sufficiently heavy.

3. Commercial Crops

Cotton cultivation is predominant in the black soil region of Coimbatore, Madurai, Ramanathapuram and Tirunelveli districts. There are mainly two varieties grown. In the black cotton soil region of the south (Ramanathapuram and Tirunelveli districts) the indigenous variety is grown, while in Coimbatore and Madurai districts the Cambodia variety is cultivated.

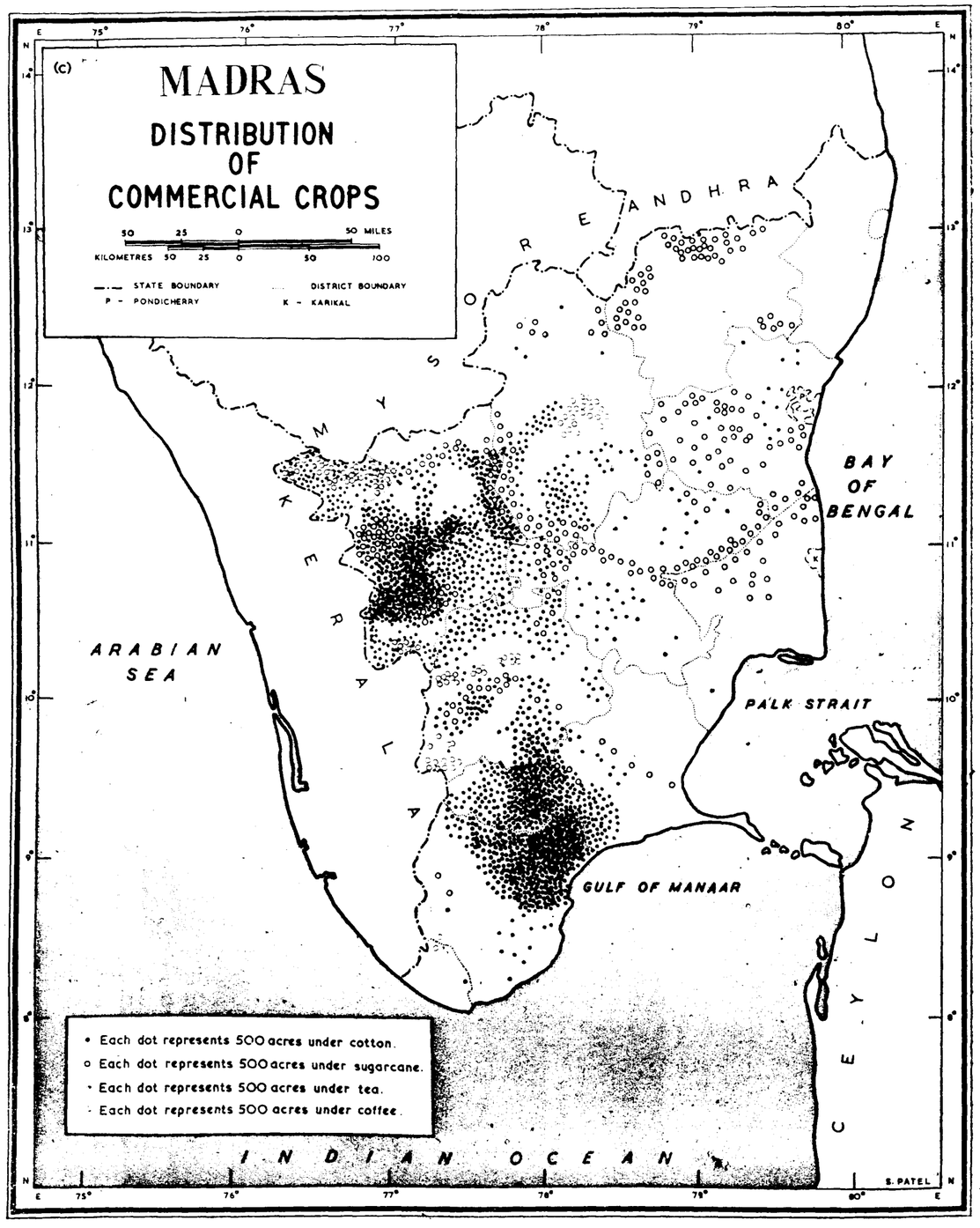
Sugarcane is cultivated mainly in the irrigated tracts of South Arcot district, the Cauvery valley in Salem, Tiruchirapalli and Tanjore districts, the Upper Pallar valley in North Arcot district, the Vaigai tract of Madurai district, and in Coimbatore district (generally as garden crop). In spite of irrigational facilities, sugarcane area is much smaller in Madras State than in Uttar Pradesh and Bihar. The impediments to the extension of sugarcane cultivation in the State are more economic than geographic in character. As the number of sugarcane factories is small, it is difficult for the cane growers to find a ready market for their expensive crop.

Tea plantation is concentrated in the hills of Nilgiri, Coimbatore, and Madurai districts. About 60 per cent of the tea plantation areas are in the Nilgiri district. The next important tea plantation areas are in Anaimalai hills of Coimbatore district and Palni hills of Madurai district.

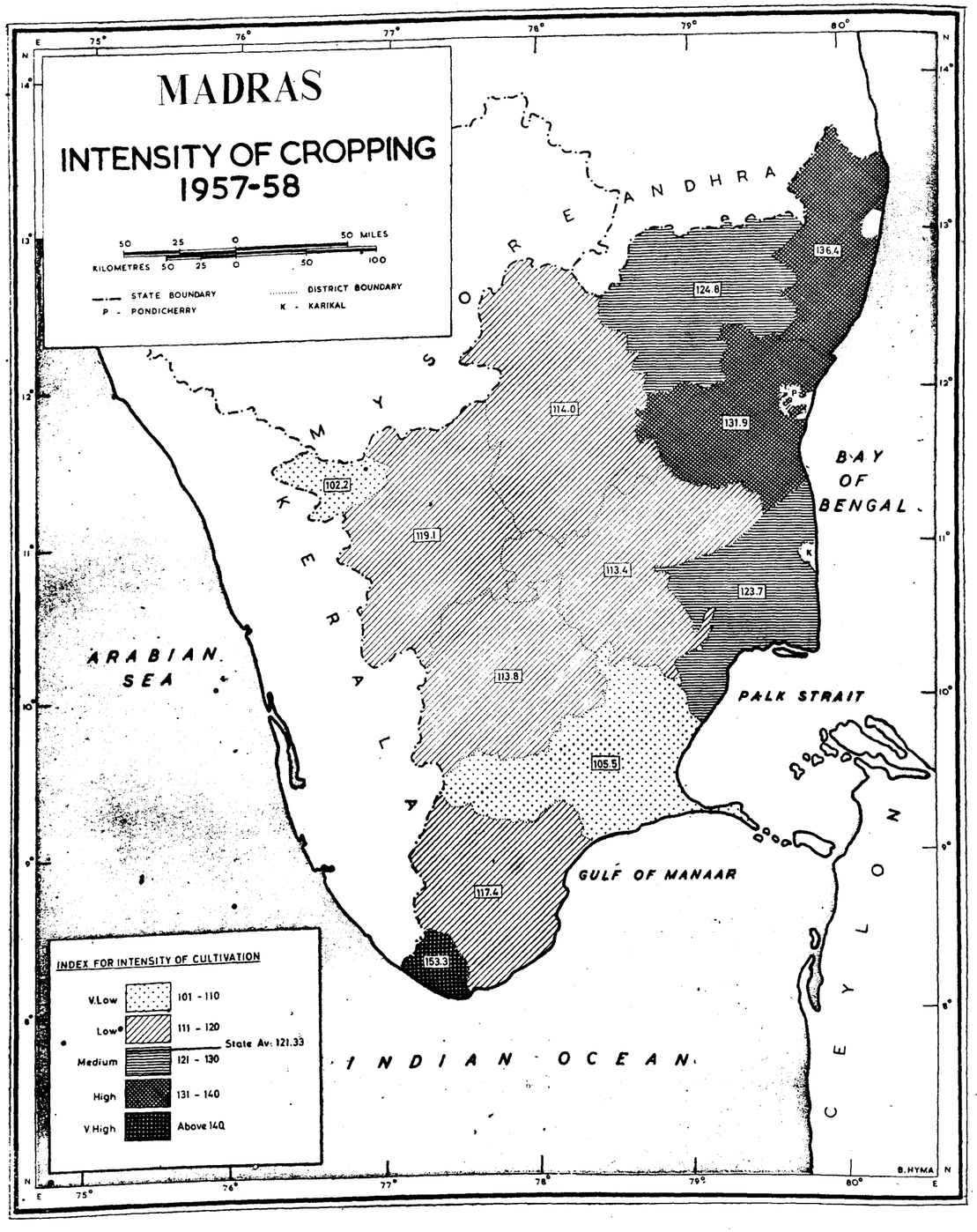
Coffee plantation is prevalent in the hill areas. It is grown mainly in Nilgiri, Palni and Anaimalai hills. Its plantation is to some extent carried on in the Shevaroy hills of Salem district and Andipatti hills of Madurai district.

SOURCE : *Season and Crop Report of the Madras State for the Agricultural Year* 1957-58 (July-June).

Map 20 (c)



Map 21



Map 21

Intensity of Cropping, 1957-58

Method

INDEX FOR INTENSITY of cropping is determined as $\frac{\text{Gross Sown Area}}{\text{Net Sown Area}} \times 100$. For each district the index for intensity of cropping is determined. The indices are arranged in descending order and classed as very high (above 140), high (131—140), medium (121—130), low (111—120), and very low (101—110).

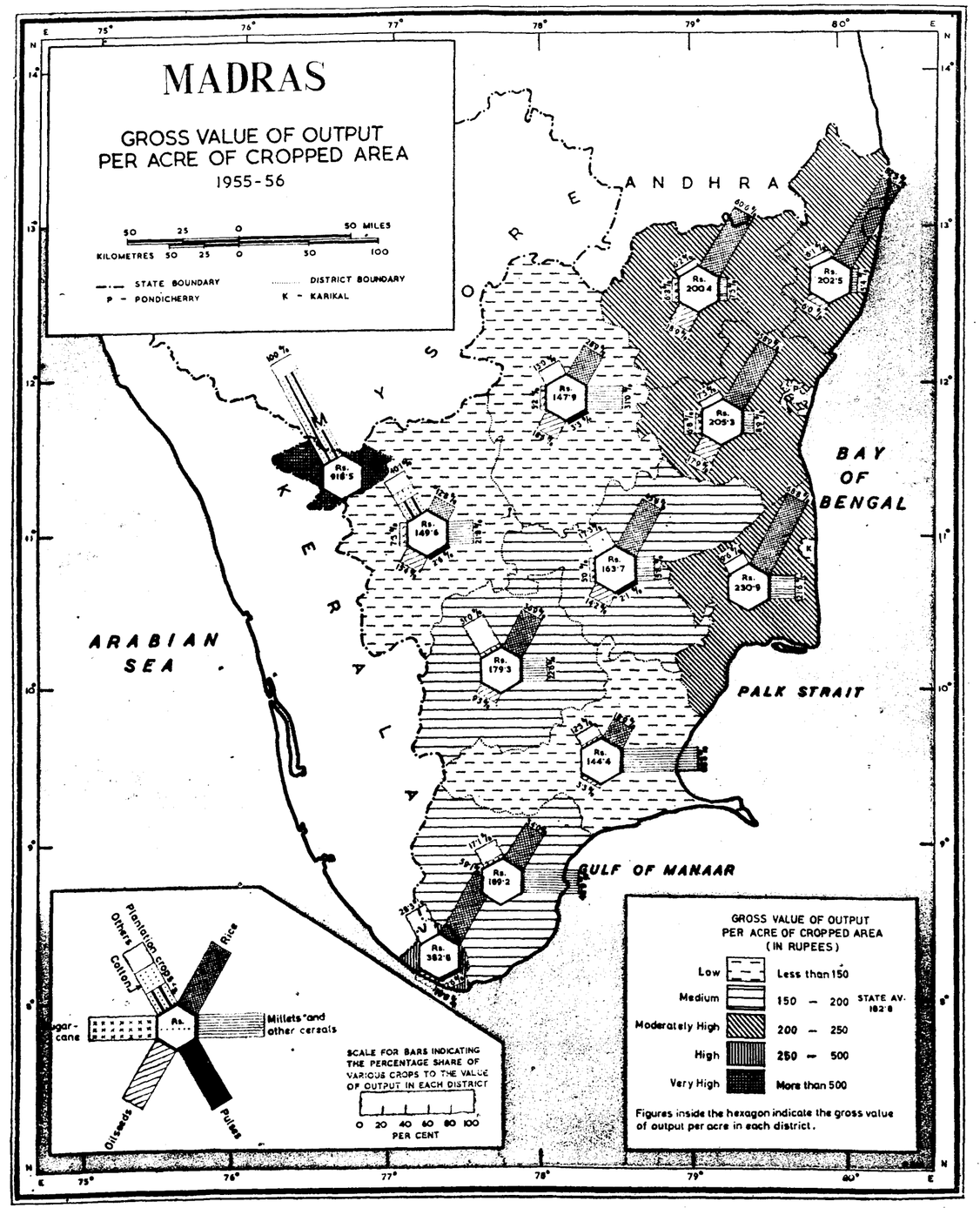
Analysis

The intensity of cropping is largely bound up with the condition of water supply. It will be on the higher side, if water supply is sufficiently high either from natural rainfall or from irrigational facilities. Crop intensity is strikingly high in Kanyakumari (153), Chingleput (136) and South Arcot (132) districts, because the annual rainfall of these districts exceeds 1,000 mm and irrigational facilities are quite good ; more than 50 per cent of the net sown area is irrigated. The districts of North Arcot and Tanjore show a medium intensity of cropping. Here rain water is supplemented by tank and canal irrigation.

Five districts—four in the north (Salem, Tiruchirapalli, Coimbatore and Madurai) and one in the south (Tirunelveli) are marked by a low crop intensity. Dearth of rain water, limited irrigational facilities, occurrences of hilly terrain account for this low intensity of cultivation. The districts of Ramanathapuram and Nilgiri exhibit a very low intensity of cropping. Crop intensity indices for these two districts are 105 and 102 respectively. The scarcity of rain water and sterile soils are the major factors inhibiting the high intensity of cropping in Ramanathapuram district. Hilly terrain and climatic handicaps do not permit intensive cropping in the Nilgiri district.

SOURCE : *Season and Crop Report of Madras State for the Agricultural Year* 1957-58 (July-June).

Map 22



Map 22

Gross Value of Output per Acre of Cropped Area, 1955-56

Method

THIS MAP INTENDS to show the regional variation in productivity of agricultural land in the State in terms of gross value of output per acre of cropped area. The productivity indices are graded as very high, moderately high, medium, and low. The districts are then shaded to show the regional variation in productivity. In each district the figure for gross value of output is put inside a hexagon and cropping pattern is indicated by columns proportional to the gross value shared by each crop radiating from this hexagon.

Analysis

The State undergoes five broad divisions according to the gradation of indices of agricultural productivity: (*i*) very highly productive area coinciding with the Nilgiri district; (*ii*) highly productive area corresponding to Kanyakumari district; (*iii*) area of moderately high productivity comprising North Arcot, Chingleput, South Arcot and Tanjore districts; (*iv*) area of medium productivity comprising Madurai, Tiruchirapalli and Tirunelveli districts; (*v*) area of low productivity consisting of Ramanathapuram, Coimbatore and Salem districts.

The gross value of agricultural output per acre is significantly high (Rs. 918) in the Nilgiri district. This high value is attributed to plantation crops—tea and coffee—which account for more than 85 per cent of the gross value of agricultural output of the district.

The next highly productive agricultural district is Kanyakumari where 59 per cent of the gross value of crop output is from rice and the remaining from high value crops like fruits, vegetable, cocoanuts and palmyras.

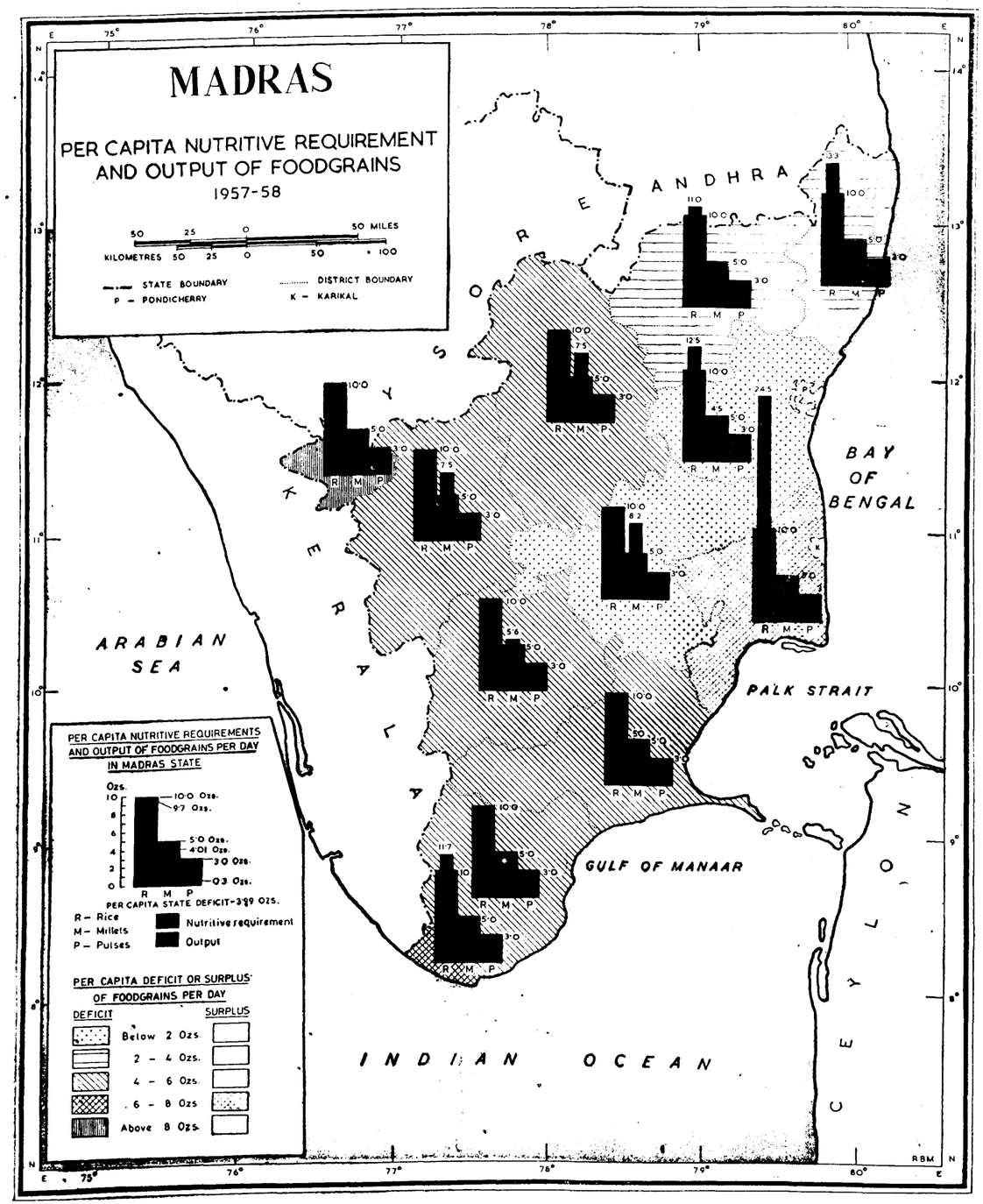
The third area with moderately high value of output lies in the east and northeast. It had 68 per cent of the gross value of agricultural output from rice and 14 per cent from high value crops like oilseeds. Another high value crop is sugarcane, which is grown mostly in South Arcot and North Arcot districts.

The area, where gross value of output is neither high nor low (Rs. 150—Rs. 200), comprises Tiruchirapalli, Madurai and Tirunelveli districts. Here millet and rice are the predominant crops. Millet, though occupying 36 per cent of the total cropped area, contributes only 29 per cent of the gross value of agricultural output, while rice sharing only 26 per cent of the cultivated area accounts for 39 per cent of the gross value. The other important crops, which contribute to the gross value of agricultural output, are cotton and oilseeds.

The area showing the lowest value of agricultural output comprises Salem and Coimbatore districts in the north and Ramanathapuram district in the south. Cropping pattern of these districts is highly diversified. Nevertheless, the gross value of output is significantly low due to their very low yield of crops per acre on account of aridity and inadequate irrigational facilities.

SOURCE: Calculation of data is based on the information available in the *Season and Crop Report of Madras State for the Agricultural Year* 1957-58 (July-June).

Map 23



Map 23

Per Capita Nutritive Requirement and Output of Foodgrains

Method

THIS MAP INTENDS to show the relative position of the districts with regard to the output and nutritive requirement of foodgrains such as rice, millet, and pulses per person. For this map the standard nutritive requirement of rice, millet and pulses has been taken as 10 ozs., 5 ozs., and 3 ozs. respectively after Dr. Aykroyd's conception of a balanced diet published in *Health Bulletin* (No. 23). For each district, the per capita production of rice, millet and pulses for the year 1957-58 is calculated. The per capita production of these three staple crops for each district is then compared with the total per capita nutritive requirement amounting to 18 ozs. The districts showing deficits are shaded black ranging from very high to very low, while the districts in surplus are shaded green. To show the cropwise deficit or surplus in each district the bar method is used. Green bars are drawn proportionate to 10 ozs. (for rice), 5 ozs. (for millet), and 3 ozs. (for pulses) to show the requirement of a balanced diet for each person. The actual productions of rice, millet and pulses per person are shown in black bars inside the green bars. Now these two sets of bar graphs would indicate the extent of surplus or deficit of each of the crops—rice, millet and pulses—in each district.

Analysis

In 1957-58 Madras State had a per capita deficit of 3.99 ozs. of foodgrains. The deficit was marked more in millet areas than in rice areas. The millet growing districts such as Coimbatore, Madurai, Salem, Ramanathapuram and Tirunelveli showed a per capita deficit of 4 to 6 ozs. The rice growing districts—Chingleput, South Arcot, North Arcot, Tiruchirapalli—showed a deficit of less than 4 ozs. Tanjore district, the largest rice growing area in the State, had a surplus production of 6—8 ozs. per person. Nevertheless, a very high deficit was noticeable in Kanyakumari district which is pre-eminently a rice growing district. Nilgiri district, which mainly grows tea and coffee, exhibited the highest deficit of 16.3 ozs.

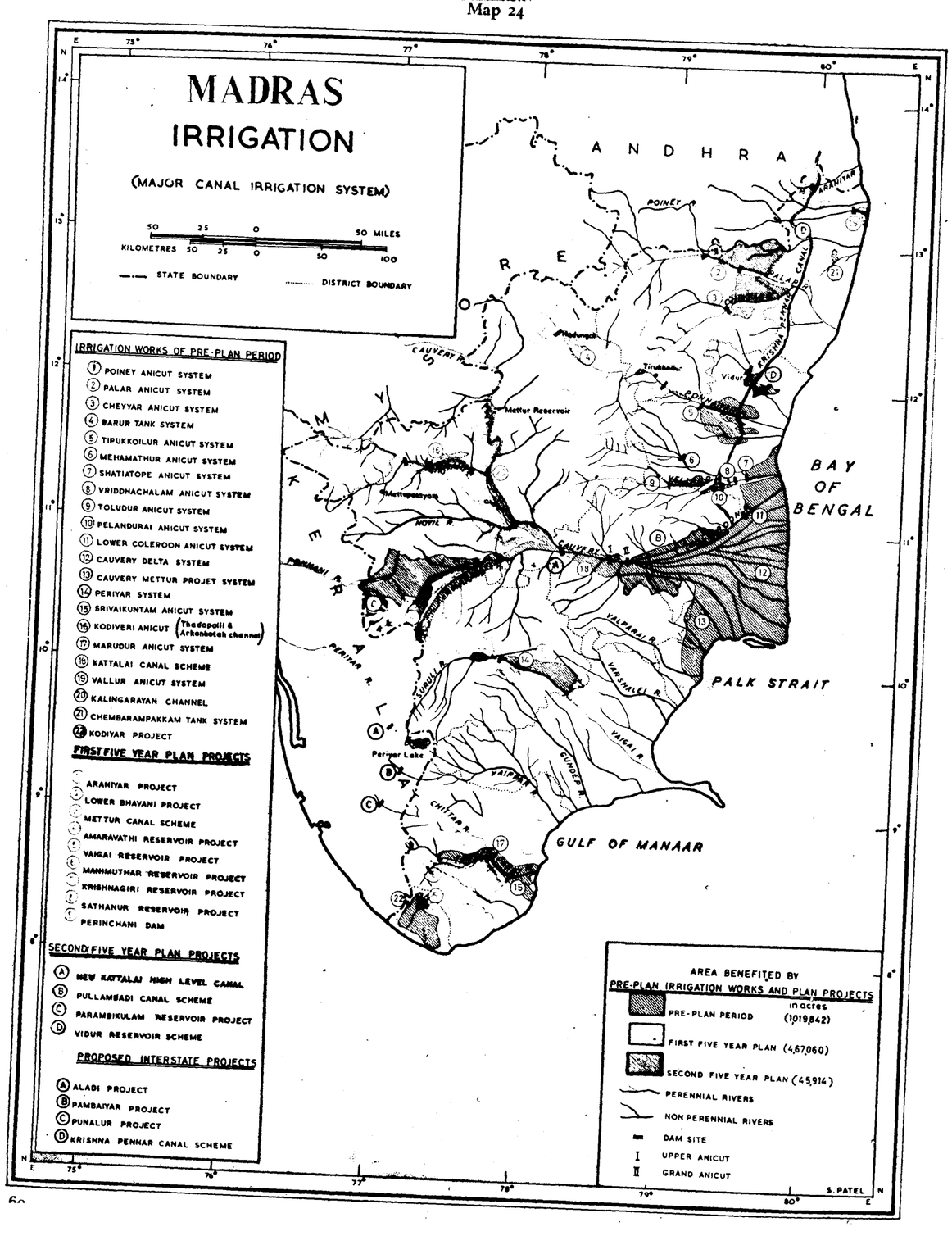
In rice growing areas, rice was in surplus, but millet and pulses were in deficit. The surplus of rice was high enough everywhere except in the Kanyakumari district to minimize the total deficit of foodgrains to 3 ozs. In Kanyakumari district, due to very high density of population (1,470 persons per square mile), the per capita surplus of rice was only 1.70 ozs., while the per capita deficit of millet and pulses was 7.74 ozs. With the result, this district showed a very high per capita deficit of foodgrains (above 6 ozs.). Tanjore district exhibited an exceptionally high per capita surplus of rice output (24.5 ozs.) which not only compensated for the deficit of millet and pulses totalling 7.04 ozs., but also led to a surplus of 7.46 ozs. of foodgrains per person.

Millet was in surplus of the requirement everywhere in millet growing areas except in Ramanathapuram and Tirunelveli districts, but rice and pulses were in deficit. Since the per capita demand for rice is much higher than that for millet and pulses, the rice deficit was strikingly high in millet areas. The surplus of millets could not make up the rice deficit. With the result, the total foodgrain deficit was marked more in millet areas (4—6 ozs.) than in rice areas (less than 4 ozs.).

Nilgiri district showed the highest deficit due to the predominance of plantation farming which occupied 83 per cent of its net sown area.

There was an overall deficit of about 0.3 oz. of rice, 1 oz. of millet and 2.7 ozs. of pulses per person for maintaining a balanced diet in the State. It is worthwhile to note that the production of pulses was everywhere in short of the demand. The chief attributory factors to this deficit supply of pulses are: (*a*) low yield per acre—298 lbs. per acre against India's average of 430 lbs. per acre, (*b*) very little area sown with pulses (7.0 per cent of the net sown area was devoted to pulses). Since pulses have a high protein content (22%—24%), its acreage should be increased and every effort should be made to push up its yield.

SOURCES: (1) *Season and Crop Report of the Madras State for the Agricultural Year* 1957-58 (July-June).
(2) 1961 *Census* (Provisional totals).
(3) *Health Bulletin* (No. 23), Ministry of Health, Government of India.



Irrigation

Method

THE CANALS AND canal-fed tanks form the major irrigation system of Madras State. This map intends to show the location of anicuts and dams on the rivers from which canals are taken off to feed the numerous chains of tanks and sub-canals. Three colours are used to differentiate the projects of the pre-Plan, the First Five Year Plan and the Second Five Year Plan periods.

Analysis

About 22 irrigation works were functioning in the pre-Plan period. The main river systems serving the irrigation works are the Palar, the Ponnaiyar, the Vellar, the Cauvery, the Vaigai and the Tambaraparni and the Kodiyar.

The river Palar with its important tributaries Chheyyar and the Poiney, feeds numerous chains of tanks in North Arcot district. Water is led by canals from anicuts to tanks for irrigation.

The Ponnaiyar is dammed at Nadungal in the Krishnagiri taluk of Salem district from where water is led and stored in the great Barur tank. The next important irrigation work across the river is the Tirukkoilur anicut four miles below the town of the same name.

The important works on the Vellar river system are the Toludur project, the Shatiatope anicut, Mehamathur anicut and Vriddhachalam and Pelandurai anicuts. The whole system serves South Arcot district.

The Cauvery system irrigates an extensive area in Salem, Coimbatore, Tiruchirapalli and Tanjore districts. There are two big reservoirs on the river Cauvery—the Krishnarajsagar in Mysore State and the Mettur in Madras State. The latter one is used as a flood moderator to protect the delta from frequent ravages by floods. It supplies water both for irrigation and power generation. The maximum utilization of the Cauvery irrigation system is in Tanjore district. Just before entering the delta (Tanjore district), the river divides into two branches, the Coleroon (Kolladam) and the Cauvery. One anicut is put across the Coleroon and two on the river Cauvery. The canals from these anicuts irrigate the entire delta area and its adjacent tracts.

The most ingenious irrigation scheme in the State is the Periyar project. The main feature of the project is the diversion of Periyar water from the rainy western slope of Kerala State to the dry eastern slope of Madras State, and joining with the Vaigai river flowing into the Bay of Bengal.

The perched plain of Tirunelveli owes a great deal to the river Tambaraparni. There are eight anicuts on the river, all of which except the lowest anicut at Srivaikuntam are ancient works.

The Kodiyar irrigation system serves the Kanyakumari district. The Kodiyar in the upper reach is turned into a reservoir by a dam across it. Though the canals are drawn from this point, the waterflow is regulated by an anicut in its lower reaches.

About nine more schemes were taken up under the First Five Year Plan. Of these the largest one is the Lower Bhavani Project.

It comprises a reservoir with a capacity of about 28,000 million cubic feet of water across the Bhavani river about 20 miles below Mettupalayam.

The next major project is Manimuthar in Tirunelveli district. It envisages the construction of a reservoir across the Manimuthar river, a few miles upstream of its confluences with the Tambaraparni.

The Mettur canal scheme was envisaged to irrigate areas in Salem and Coimbatore districts.

The Araniyar project consists of a reservoir across the Araniyar river four miles west of Negalapuram and a dam about 11 miles downstream in Chingleput district.

The Amaravathi reservoir project consists of a reservoir of 3,600 million cubic feet capacity across the river Amaravathi in Coimbatore district.

The Vaigai reservoir project is in Madurai district. It envisages the construction of a reservoir with a capacity of 6,800 million cubic feet of water across the Vaigai river to store the surplus water diverted from the Periyar river.

The seventh important project is Sathanur reservoir project. The reservoir is across the river Ponnaiyar near Sathanur village in North Arcot district.

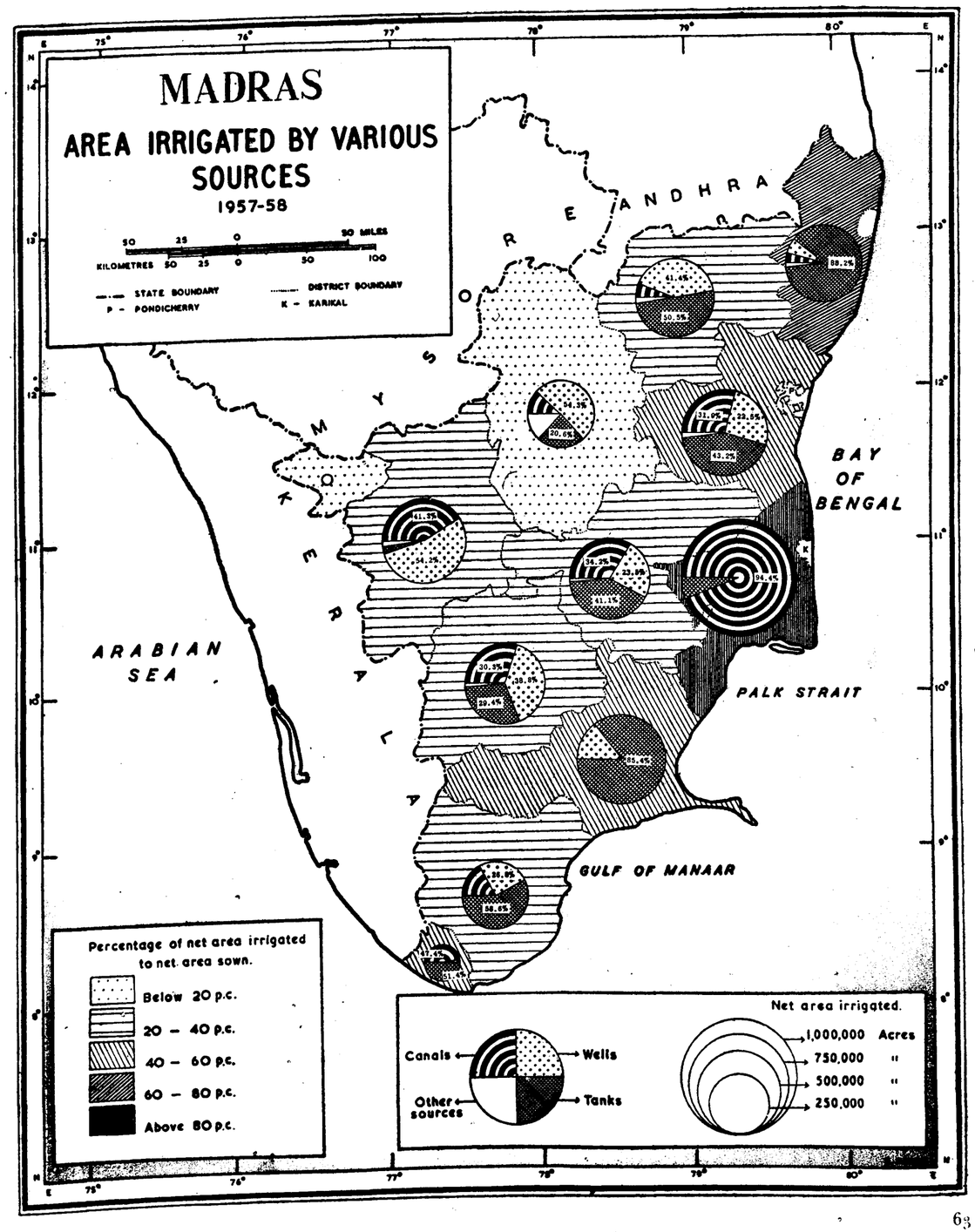
The next one is the Krishnagiri reservoir project. The reservoir is planned to be set up on the Ponnaiyar river in the Krishnagiri taluk of Salem district. The last one is the Perinchani dam project in Kanyakumari district.

Under the Second Five Year Plan, besides continuing the execution of the schemes started in the First Plan, four new schemes were undertaken. These were: (1) the new Kattalai high level canal scheme, (2) the Pullambadi canal scheme, (3) the Vidur reservoir project, and (4) the Parambikulam reservoir project, the scheme for diverting the west-flowing rivers. The New Kattalai high level canal will run on the right side of the Cauvery from above Kattalai bed regulator. The Pullambadi canal scheme is to excavate a similar canal on the left side of the Cauvery from above the upper anicut. The Vidur reservoir project is to construct a reservoir across the Varahanadhi near Vidur in South Arcot district and to excavate a canal on the left side for irrigation. Under the scheme of diverting westflowing rivers, a scheme called Parambikulam Aliyar reservoir project is contemplated.

Besides the above Plan Projects, about four inter-State irrigation projects are under contemplation. These are the Aladi project, Pambaiyar project, Punalur project and Krishna Pennar canal scheme. The first three are connected with the Kerala State and the fourth one with the Andhra State.

SOURCES: (1) *Madras in Maps and Pictures*, Government of Madras, 1959.
(2) K. Ramamurthy, Some Aspects of the Regional Geography of Tamilnad, *Indian Geographical Journal*, Vol. XIII, No. 2, April-June, 1948.

Map 25



Map 25

Area Irrigated by Various Sources, 1957-58

Method

THE MAP INTENDS to show the relative importance of canals, tanks and wells in the irrigation system of each district. First of all, districts are shaded to depict the variation in density of irrigation measured by the ratio of irrigated area to the net sown area. The circles are drawn in proportion to the net area irrigated, and are divided into sectors proportionate to the area irrigated by canals, tanks, and wells.

Analysis

In 1957-58 about 39.3 per cent of the State's net sown area was irrigated. Tank irrigation accounted for 38 per cent, canal irrigation 36 per cent, well irrigation 23 per cent, and others 3 per cent of the irrigated net sown area.

Tanjore district had the highest proportion of net sown area irrigated (83.7%) followed by the districts of Chingleput (67.7%), Kanyakumari (49.4%), Ramanathapuram (46.3%) and South Arcot (45.7%).

Compared to the coastal districts, the inland districts had lesser proportion of cropped area (about 29%) under irrigation. The use of irrigation for agriculture was negligible in the Nilgiri district. In 1957-58, only 1.6 per cent of the net sown area of the Nilgiri district was irrigated.

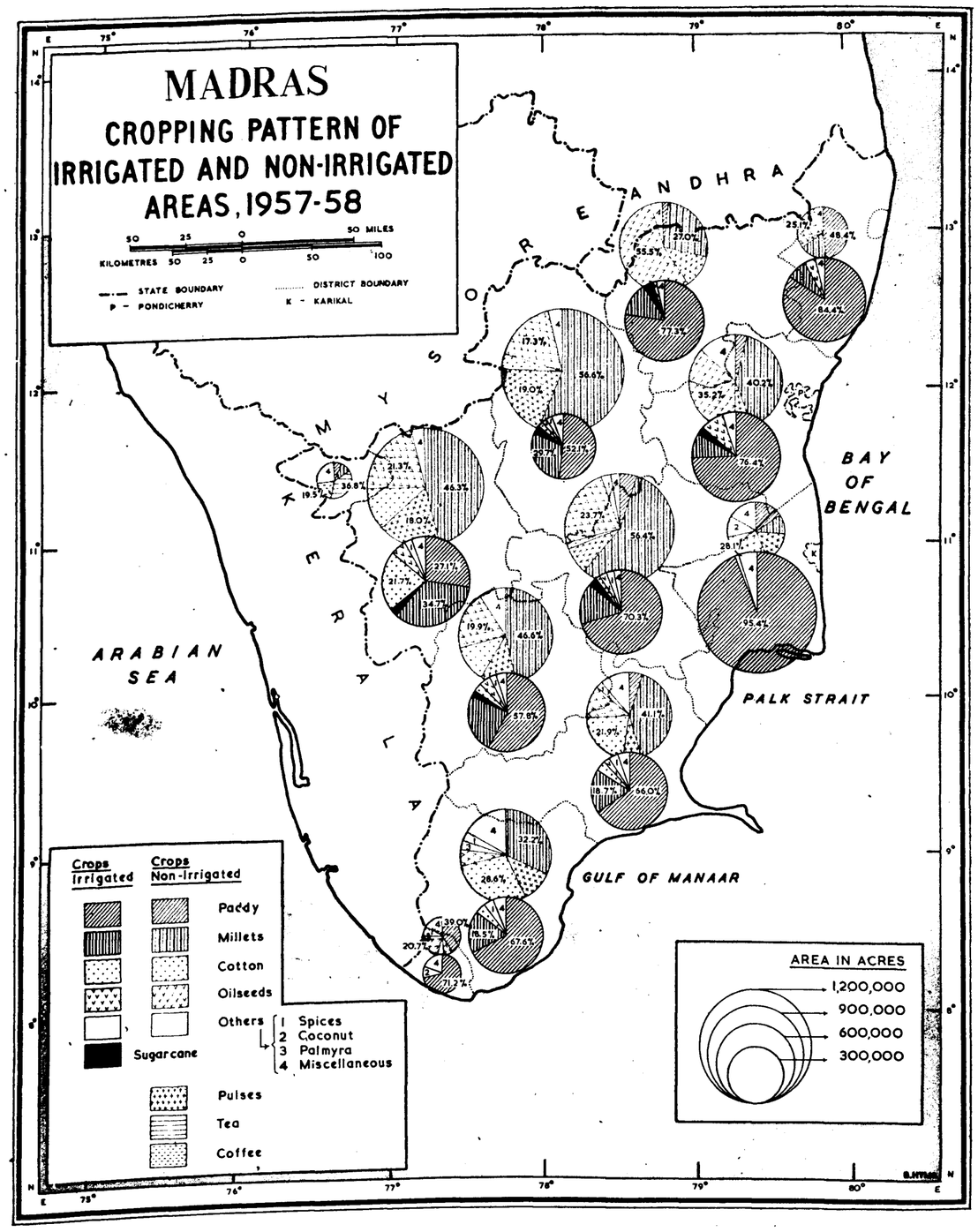
Tank irrigation commanded a very large proportion of the net irrigated area in the State except in the western upland region (Coimbatore, Salem, and Madurai districts) and the Cauvery delta (Tanjore district). About 85 per cent of the total irrigated area in Ramanathapuram district was commanded by tank irrigation. In North Arcot, Kanyakumari, and Tirunelveli districts more than half of the total irrigated area was fed by tanks. Tiruchirapalli and South Arcot districts had more than 45 per cent of the net irrigated area under tank irrigation.

Canal irrigation was predominant in Tanjore district. About 94 per cent of its irrigated areas was fed by the canal system. The other districts, where canal irrigation was significant, were Kanyakumari (47.4%), Coimbatore (41.3%), Tiruchirapalli (34.2%), South Arcot (31.9%), and Madurai (30.3%).

Well irrigation was more important than other irrigation systems in the western upland region. About 54 per cent of the net irrigated area in Salem and Coimbatore districts was fed by well irrigation. In Madurai and North Arcot districts well irrigation accounted for about 40 per cent of the net area irrigated.

SOURCE : *Season and Crop Report of the Madras State for the Agricultural Year* 1957-58 (July-June).

Map 26



Map 26

Cropping Pattern of Irrigated and Non-Irrigated Areas, 1957-58

Method

THIS MAP INTENDS to show the cropping pattern of irrigated and non-irrigated areas. In each district circles are drawn proportionate to the irrigated and non-irrigated areas. Each circle is then divided into sectors proportionate to acreages under various crops.

Analysis

Irrigation plays a dominant role in agriculture of Tanjore and Chingleput districts where irrigated area exceeds non-irrigated area by three and two times respectively. In Kanyakumari district, the proportion of irrigated and non-irrigated agricultural areas is almost equal. In other districts non-irrigated areas exceed irrigated areas.

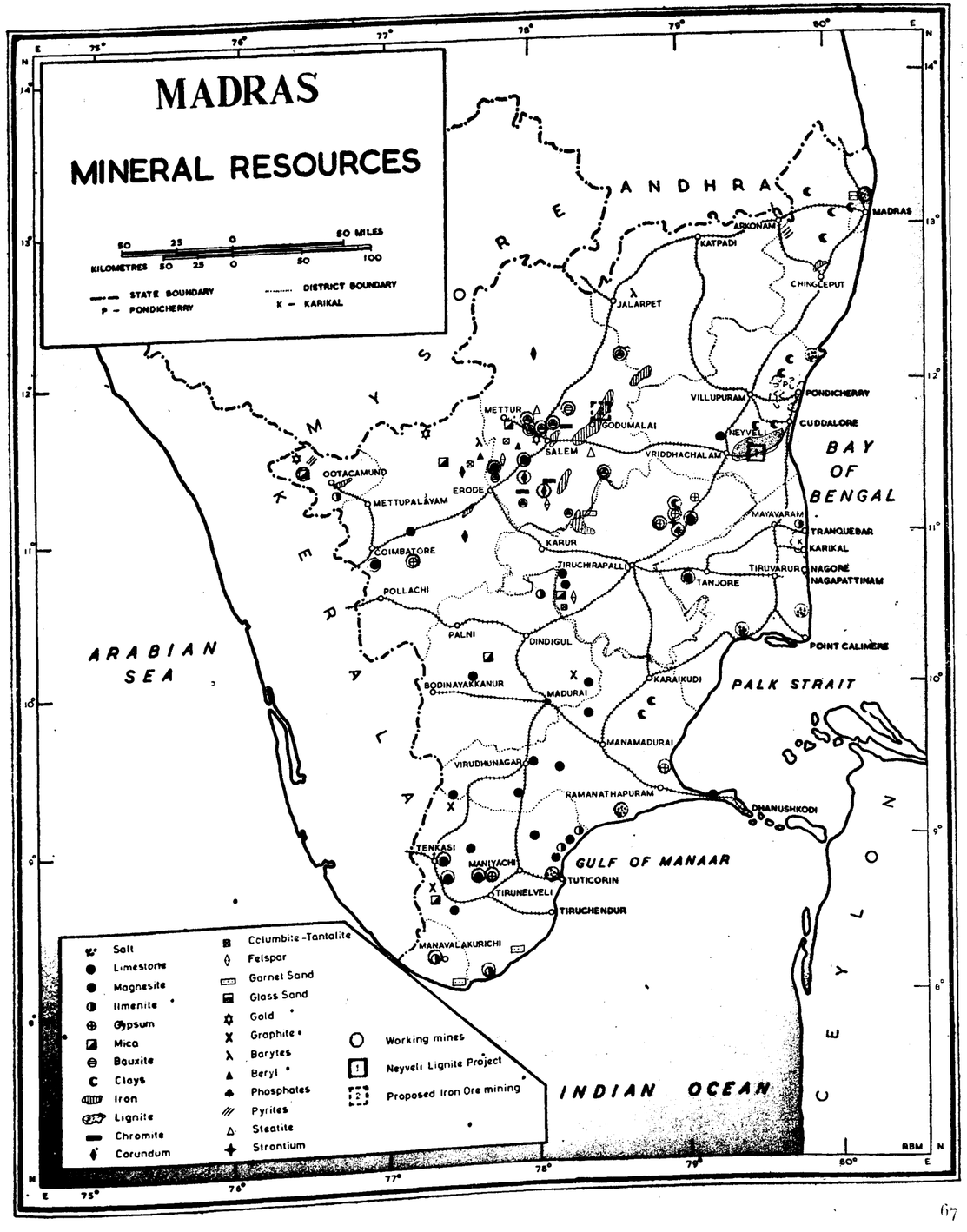
The cropping pattern changes significantly from irrigated to non-irrigated areas. Paddy is the predominant crop of the irrigated tract, while millet is the main crop of the non-irrigated tract. Irrigated area shows a specialized cropping pattern. In Tanjore district, for example, 95 per cent of its irrigated area in 1957-58 was under paddy, and the remaining 5 per cent under millets, sugarcane, oilseeds, etc. This intense specialization is noticeable only in the east coast region where natural rain-water supplemented by irrigation water offers unique facilities for growing paddy. The degree of specialization, however, decreases from the wet coastal area to the arid interior where irrigation is done by the wells. In Coimbatore district, for example, 35 per cent of its irrigated area was devoted to millets, 27 per cent to paddy, 22 per cent to cotton, 6 per cent to oilseeds, the remaining 10 per cent to miscellaneous crops.

Everywhere other than the Nilgiri district, the cropping pattern of non-irrigated area is diversified. In most of the districts millet is the predominant crop followed by oilseeds. The other important crops are cotton, pulses, paddy, and spices. In Coimbatore district, for example, millets accounted for 46.3 per cent, oilseeds 21.3 per cent, pulses 18.0 per cent, cotton 11.4 per cent of the total non-irrigated areas in 1957-58. The east coast districts, however, showed a different cropping pattern of non-irrigated tracts. In Chingleput district paddy was the domineering crop (48.4%), followed by oilseeds (25.1%), millet (17.8%), pulses (4.0%), spices (1.0%). In Tanjore district oilseeds (28.1%) ranked first, pulses (17.5%) second, paddy (15.8%) third, and millet (11.5%) fourth, in land occupancy strength of non-irrigated areas. Nilgiri district is an exceptional area where cropping pattern of non-irrigated area is highly specialized. About 60 per cent of the total cropped area in 1957-58 (non-irrigated) was under plantation crops—mainly, tea and coffee.

The above analysis brings out that irrigated areas devote an overwhelming proportion of the acreage to foodcrops such as rice and millets, while non-irrigated areas devote almost equal proportion of land to food crops and to commercial crops such as cotton, oilseeds, tea and coffee.

SOURCE: *Season and Crop Report of the Madras State for the Agricultural Year* 1957-58 (July-June).

Map 27



Map 27

Mineral Resources

Method

THIS MAP SHOWS the location of working mines, mines under development, and workable mineral deposits.

Analysis

The State has a variety of minerals which are widely distributed. They are salt, limestone, magnesite, gypsum, crude mica, bauxite, ilmenite, fireclay, lignite, iron-ore, etc. Only a few of these are commercially exploited. The others are either small deposits or the economic feasibility of their exploitation has not been thoroughly investigated yet. Description of the minerals, which have been exploited so far, is given below :

Working Mines

Salt. Salt is obtained by the solar evaporation of brine all along the coast. The major concentration of the industry is, however, in Tuticorin which produces about 20 per cent of the total production of salt in the State.

Limestone. Large deposits of limestone are found in Tirunelveli, Tiruchirapalli, Coimbatore and Salem districts. Limestone is almost entirely used by the local cement industry.

Magnesite. The Salem (Chalk hill) deposits are the largest deposits of magnesite in India. About 95 per cent of the total output of magnesite in India comes from these deposits. Magnesite is mainly used in the manufacture of refractories.

Ilmenite. Ilmenite, the fourth important mineral of the State occurs in Kanyakumari and Tirunelveli districts. The largest deposit in the State is the one at Manavalakurichi in the Kanyakumari district. The quality of this mineral is, however, poor. The main uses of this mineral are in paints and pigments, titanium metal and alloys and ceramic industry.

Gypsum. Gypsum reserves occur in Tiruchirapalli, Coimbatore, Tirunelveli and Ramanathapuram districts. Tiruchirapalli reserves are, however, considered to be the most important. Gypsum is largely used in cement and fertilizer industries.

Mica. Nilgiri district is the sole producer of mica in the State. Workable deposits of this mineral are, however, found in Coimbatore, Salem, Tiruchirapalli, Madurai and Tirunelveli districts.

Bauxite. The main occurrences of bauxite in Madras State are in the Shevaroy Hills in Salem district. Bauxite is the ore for the aluminium metal, but it is also used for the manufacture of refractories.

Clays. Many types of clays occur in the State. Fireclay, however, is the most important. Clay deposits occur in Tiruchirapalli, Ramanathapuram, South Arcot, and Chingleput districts of Madras. The main use of fireclay is in refractoryware and bricks.

Mines under Development

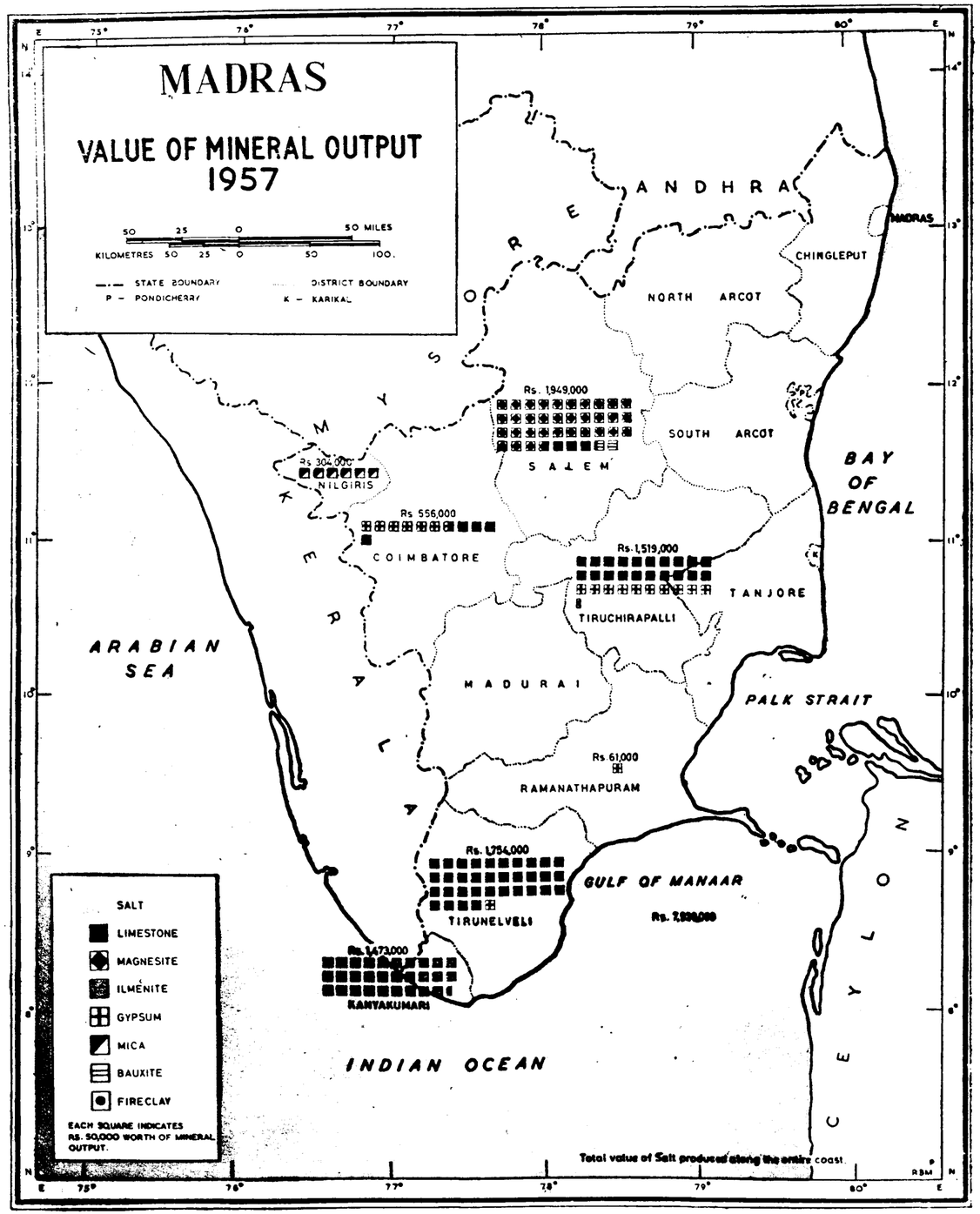
Lignite. large deposits of lignite coal occur in South Arcot district. The known reserves of lignite are estimated at 2,000 million tons over an area of 100 square miles (256 sq. kms). The more easily workable deposits with reserves of 200 million tons are spread over an area of 5½ square miles (14.1 sq. kms) at Neyveli. Mining operations under the 'Lignite Project' have been started.

Iron-Ore. The known deposits of iron-ore in Madras State are mainly concentrated in the Salem district with some bands extending into Tiruchirapalli and North Arcot districts. The quality of iron-ore is quite poor. Nevertheless the average iron content in many cases is as high as 50 per cent compared to 60 per cent of Orissa ore. The ore has not yet been exploited due to the absence of metallurgical coal in the State. However, the Neyveli project, which proposes to produce carbonized briquettes for coking purposes will remove the handicap to smelting the ore within the State. The proposed site for iron-ore mining is at Godumalai in Salem district.

Workable Mineral Deposits

Besides the mineral deposits which are either mined or proposed to be mined, there are small workable deposits of corundum, graphite, beryl, strontium, garnets, monazite, barytes, steatite, phosphoric nodules, etc. The present production of these minerals is insignificant and in some cases the deposits are untouched.

SOURCES : (1) *Geological Map of India and Adjacent Countries*, 1″=32 *miles.*
(2) *National Atlas of India*, 1957.



Value of Mineral Output, 1957

Method

THIS MAP SHOWS the districtwise distribution of the value of mineral output. Value has been shown for each district by the graphical method. For this map the values given by the Indian Bureau of Mines have been used, but since the districtwise distribution of these values is not available from this source, it is calculated by applying the percentage share of each district to the total value of output, as supplied by the Department of Industries and Commerce, Government of Madras.

The bulk of mineral production in the State consists of salt (50%), limestone (20%), magnesite (11%), ilmenite (9%), gypsum (6%), mica (2%). Salem, Tirunelveli, Tiruchirapalli and Kanyakumari districts are the main contributors to this value.

Salt. In 1957, Madras produced 794,000 tons of salt worth Rs. 79.0 lakhs, accounting for 11 per cent of the country's total output. Salt is extracted all along the coast. Its major concentration is, however, in Tuticorin where 13 large salt factories are working.

Limestone. In 1957, Madras produced 1,116,000 tons of limestone worth Rs. 31.0 lakhs. The districts contributing to this output were, Tirunelveli (55.1%), Tiruchirapalli (32.0%), Coimbatore (7.4%), and Salem (5.5%).

Magnesite. The production of magnesite was concentrated in the Chalk hills of Salem district. In 1957, Madras produced 87,000 tons of magnesite valued at Rs. 17.0 lakhs, accounting for 95 per cent of the total output of magnesite in India.

Ilmenite. Kanyakumari and Tirunelveli districts have large reserves of ilmenite. The quality of this mineral is, however, poor. It cannot compete with the superior products of Kerala mines. Moreover, its local demand is not very large. Only the Kanyakumari deposits are mined. In 1957 about 28,000 tons of ilmenite worth Rs. 15.0 lakhs was produced from Kanyakumari deposits.

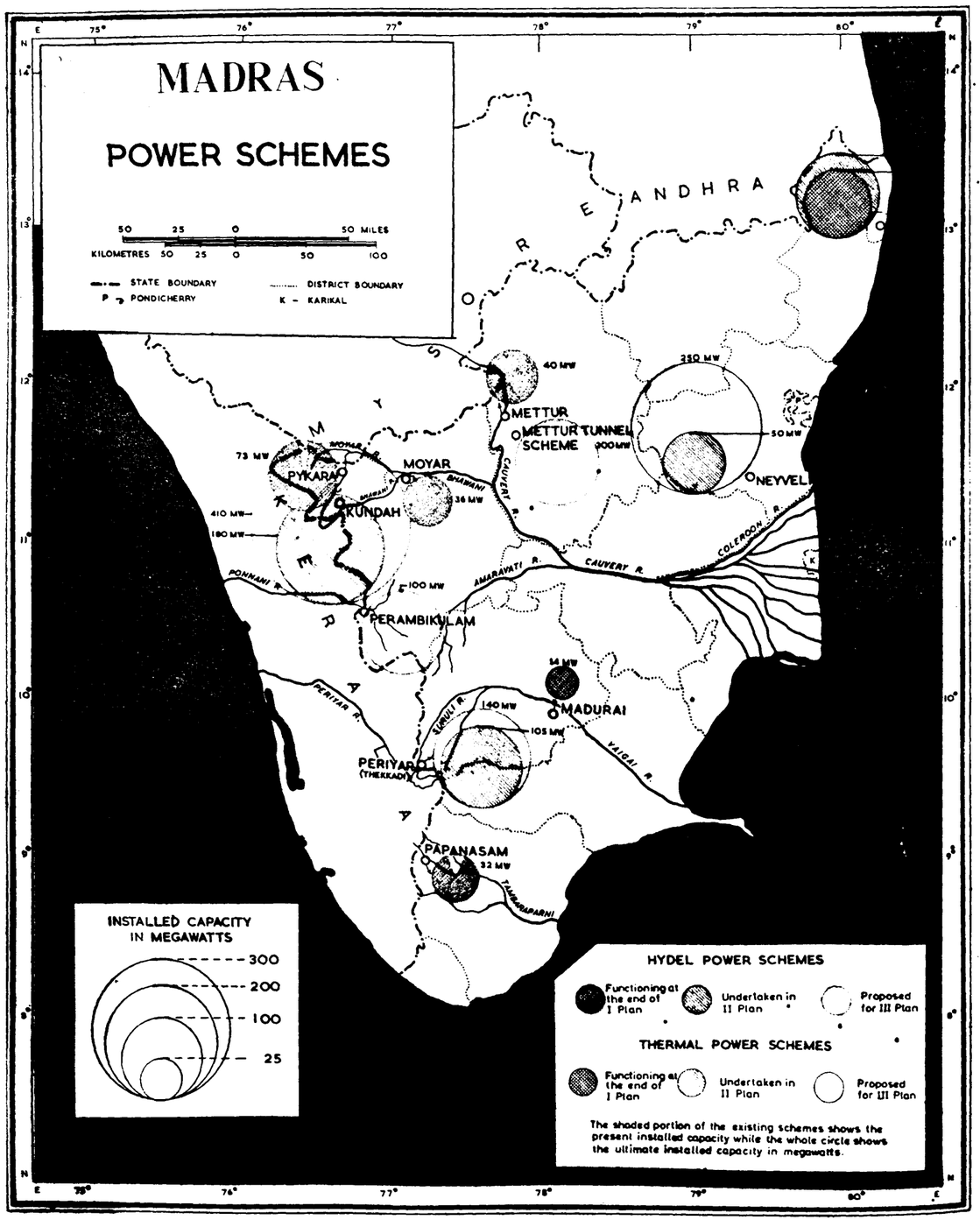
Gypsum. In 1957, Madras produced 69,000 tons of gypsum valued at Rs. 9.7 lakhs Contributors to this output were Tiruchirapalli (52.6%), Coimbatore (36.7%), Ramanathapuram (6.3%) and Tirunelveli (4.4%) districts.

Mica. About 542 tons of mica valued at Rs. 304,000 was produced in the State, in 1957. Nilgiri district was the sole producer of mica in the State.

Bauxite. In 1957 about 2,800 tons of bauxite valued at Rs. 88,000 was produced from the Shevaroy hills in Salem district. The bauxite reserves of this area are estimated at 67.0 lakhs tons and the maximum rate of extraction possible with the existing reserves is estimated at 100,000 tons a year.

Fireclay. In 1957, about 4,000 tons of fireclay valued at Rs. 15,000 was produced in the State. Tiruchirapalli district was the sole producer of this mineral, although workable deposits also occur in Salem and Ramanathapuram districts.

SOURCES : (1) *Mineral Production of India*, 1957, Indian Bureau of Mines.
(2) Department of Industries and Commerce, Government of Madras.



Power Schemes

Method

THIS MAP IS drawn to show the location of power schemes of three categories : (*i*) the schemes functioning at the end of the First Plan, (*ii*) the schemes undertaken in the Second Plan, and (*iii*) the proposed schemes under the Third Plan. The installed capacity of each of these schemes is shown by Pie graphs.

Analysis

Madras ranks third in generation and utilization of power among the States in India. It is second in hydro-electric power development and first in rural electrification. Nevertheless, Madras can hardly claim to be rich in hydel and thermal power resources, though she has considerable potentialities in nuclear power resources.

(*i*) Schemes functioning at the end of the First Plan

A. Hydel Projects

1. The first undertaking of hydro-electric power scheme in the State is the *Pykara project*. It dates back to 1929. It is the highest hydel plant in Asia. It serves the districts of Nilgiri and Coimbatore. Its present installed capacity is 70 MW, and ultimate capacity would be 73 MW.

2. *The Mettur hydro-electric scheme* is the second project taken up by the State Government in the pre-Plan period. Mettur dam is one of the largest structures of its kind in the world. It is built across the Cauvery river at Mettur in Salem district. The power house reached its ultimate installed capacity of 40 MW by the end of the First Plan. This scheme serves the districts of Coimbatore, Salem, North Arcot, South Arcot, Tiruchirapalli and Tanjore.

3. *The Papanasam power scheme*. The third hydel scheme comprises a masonry dam across the Tambaraparni river and a power house at the Papanasam falls in Tirunelveli district. Its present installed capacity is 28 MW and ultimate capacity by Papanasam dam power house is 32 MW. It serves the southern part of the State comprising Tirunelveli, Kanyakumari, Ramanathapuram, and Madurai districts.

4. *The Moyar project*. The fourth hydel scheme is the Moyar project which has been taken up in the post-war period. It utilizes tail-race waters of the Pykara power house to produce 36 MW of electricity which is fed into inter-connected grid.

B. Thermal Projects

5. The *Madras thermal power station* is the largest station (installed capacity 68.5 MW) of its kind in the State. It is connected by transmission lines with the five hydel power stations, and one thermal power station along the western margin of the State. This inter-connection between hydel and thermal power stations ensures a continuous power supply in deficit areas.

6. The *Madurai or Samayanallur power station* was designed to firm up the seasonal power supply of Papanasam power house. It has an installed capacity of 14 MW and serves the Madurai city and its suburbs.

(*ii*) Schemes undertaken in the Second Plan

A. Hydel Schemes

1. The *Kundah hydro-electric scheme* was designed to harness the power potentialities of Kundah basin in the Nilgiri hills by two power houses, one with an installed capacity of 40 MW and the other with an installed capacity of 140 MW.

2. The *Periyar hydro-electric scheme* is designed to utilize 1,230 feet (36 ms) fall of the irrigation water of the Periyar lake in Madurai district. This project is completed and all the three generators of 35 MW each, have gone into commission. It will serve the southern districts of Madurai, Tirunelveli, and Kanyakumari.

B. Thermal Projects

3. The *Neyveli thermal power scheme* was taken up by the State in 1956. This power plant is designed to have an installed capacity of 250 MW by using 1.5 million tons of lignite. It will have five power generating sets of 50 MW each. The first set was envisaged for completion in early 1961 and the remaining proposed sets will add a capacity of 200 MW at Neyveli at the end of the Third Plan.

(*iii*) Proposed Schemes under the Third Plan

Hydel Schemes

1. *Mettur tunnel scheme* is designed to utilize the irrigation discharge at Mettur dam to develop seasonal power for about seven months in a year. During this period the storages in Kundah and Pykara are conserved to the extent necessary for utilization in the summer months for firming up the Mettur power. The scheme will have an installed capacity of 200 MW.

2. *Kundah hydro-electric scheme* (*III and IV stages*). In the Third Plan one more generating set of 20 MW will be added to the power house I and one of 35 MW to power house II. The scheme further envisages the construction of two more power houses with an installed capacity of 175 MW to utilize the balance of load available after running the power houses I & II. The ultimate installed capacity at the end of the Third Plan will thus reach 410 MW.

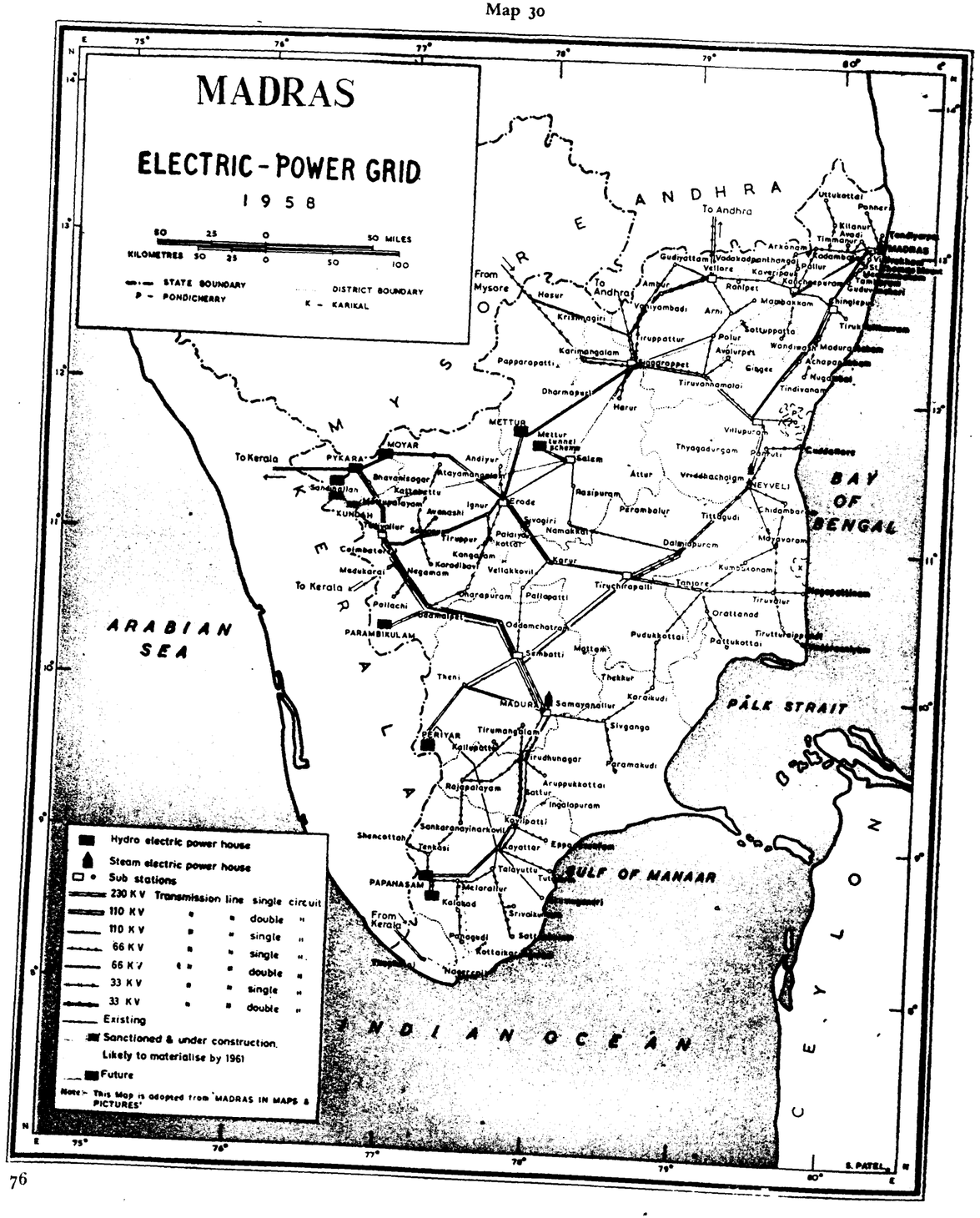
3. *Periyar hydro-electric scheme*. This scheme would be taken up for the construction of one more 35 MW generating set at the Periyar power house increasing the installed capacity of that station to 140 MW.

4. *Anaimalai hydro-electric scheme* (Parambikulam Project). This is an inter-State power scheme designed to utilize the waters of the Sholiyar, Parambikulam, and Aliyar rivers in the Anaimalai hills of Coimbatore district. It is expected to generate about 100 MW of power.

The above analysis brings out the fact that there is an imbalance between thermal and hydel power generation in the State. Hydro-electrical power, which accounts for two-thirds of the installed capacity of the State, is unreliable and insecure from the angle of supply during the summer months (February-June). The dependence of a large proportion of the State's power system on hydro-electricity is a serious problem in Madras and calls for a measure to redress the imbalance.

SOURCES : (1) Madras State Electricity Board, Chief Engineer, Electricity, Madras.
(2) *Report of the Working Group in Power Development in the Third Five Year Plan.*

Map 30



Map 30

Electric-Power Grid

Method

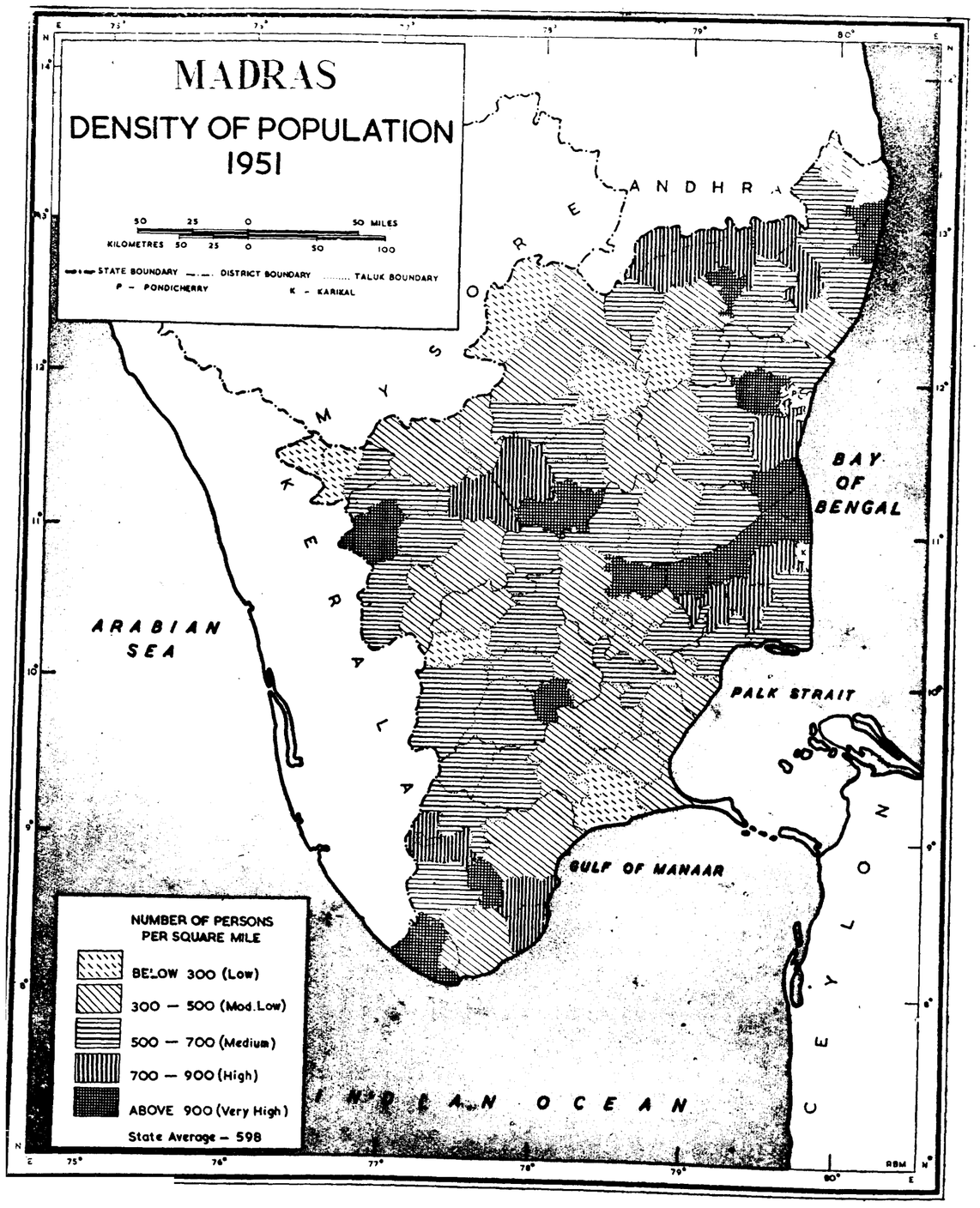
THIS MAP IS drawn to show the transmission lines of the Madras electric grid—at the end of the First Plan, undertaken in the Second Plan, and proposed for the Third Plan. Three colours are used to differentiate these lines.

Analysis

The installed capacity of the Madras grid at the end of First Plan was 256.7 MW made up of four hydel plants (Pykara, Moyar, Mettur, and Papanasam), and two thermal plants (Madras and Madurai). Over 5,000 miles of high transmission lines, and 5,000 miles of low transmission lines carry the power for distribution to urban and rural areas. With the completion of the three schemes undertaken in the Second Plan—Periyar, Kundah hydel schemes, and Madras thermal extension scheme—the installed capacity of the Madras grid will be doubled from 256.7 MW to 571.7 MW. But continuous generation to the maximum capacity is possible only during the irrigation season of nine months. Hence, there is always a disparity between the figures of effective capacity and installed capacity. It is expected that the effective capacity would be 346.0 MW against the installed capacity of 571.7 MW. This disparity is the major weakness of the Madras grid. This imbalance of generation is enhanced further in the years of drought or with delayed monsoon leading to drastic power cuts.

During the Third Plan the Mettur tunnel scheme will add to the grid an installed capacity of 200 MW, the Kundah hydro-electric scheme 230 MW, the Periyar hydro-electric scheme 35 MW, and Anaimalai hydro-electric scheme (Parambikulam Project) 100 MW, and Neyveli thermal power station 200 MW. In all, there will be an addition of 765 MW to the installed capacity of the Madras grid and about 500 miles of high tension lines will be extended at the end of the Third Plan. It is worthy to note that there is a wide gap between the two sets of power plants—hydel plants in the western part and thermal plants in the eastern part. This condition necessitated the construction of a long network of high transmission lines to make power available all over the State. But the use of these long transmission lines resulted in about 14 per cent loss of the energy generated in power plants. This loss is, however, compensated by the benefit accruing from the rural electrification scheme.

SOURCES: (1) *Report of the Working Group on Power Development in the Third Five Year Plan.*
(2) *Madras in Maps and Pictures*, Government of Madras, 1959.
(3) NCAER: *Techno-Economic Survey of Madras*, Government of Madras, 1961.



Density of Population, 1951

Method

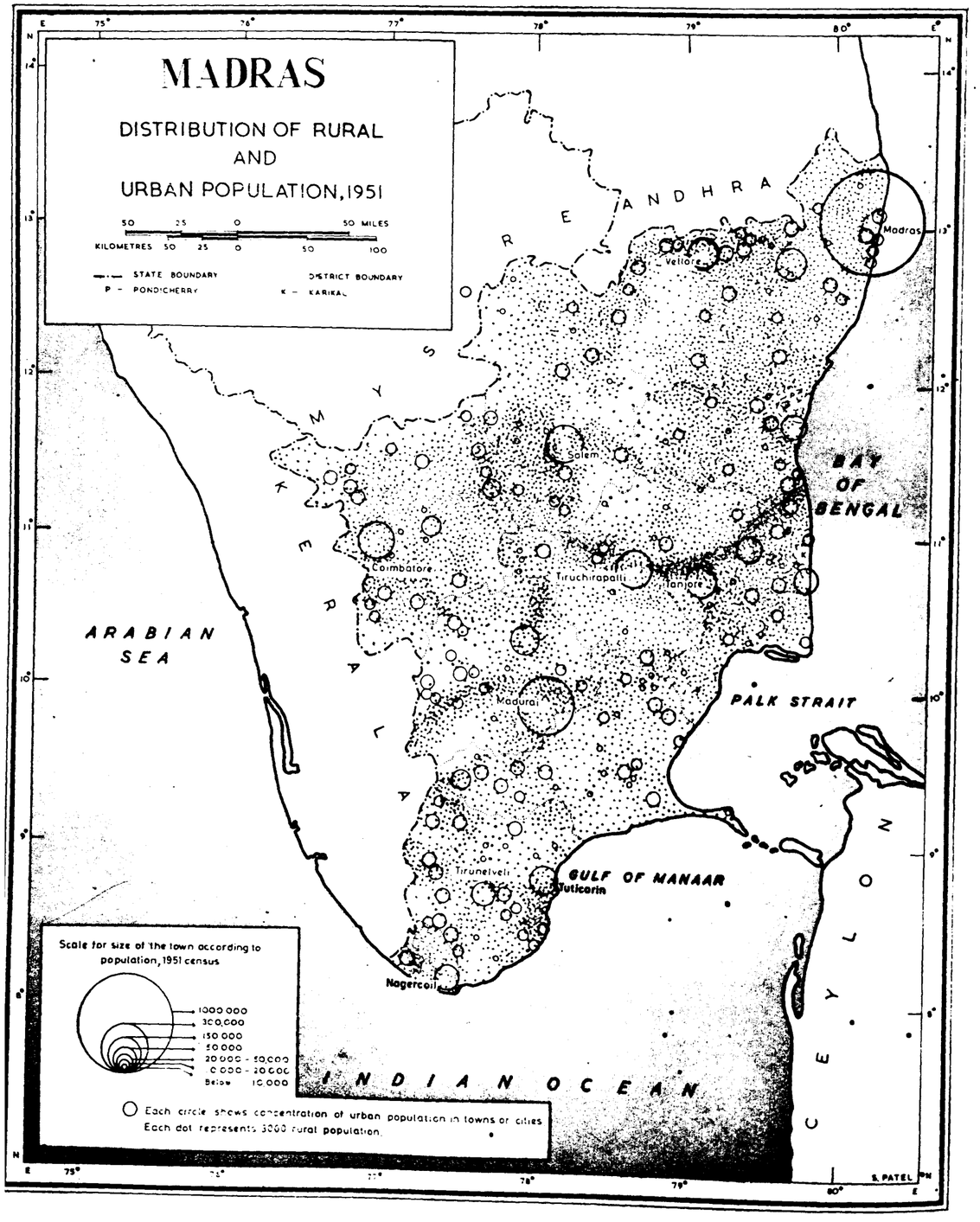
THIS MAP SHOWS the regional variation in density of population per square mile in 1951. Density is calculated for each taluk and the State as a whole. The values have been classified above and below the State average, ranging from very high to low. These taluks are grouped and the regional variation in density is marked by various shades.

Analysis

This map brings out significant regional differences. The sparsely populated forested hills and plateaus stand in contrast to the densely populated river valleys and the deltas. The lowest density is marked in the Nilgiri district, Kodaikanal taluk of Madurai district, in Hosur, Harur and Yercaud taluks of Salem district, Chengam taluk of North Arcot district and Mudukulattur taluk of Ramanathapuram district. Much of this region is hilly and forested. Density is strikingly below the State average in arid areas. To the south of the Cauvery river there is a long stretch of land across Tiruchirapalli, Ramanathapuram and Tirunelveli districts with a low density of population, 300—500 persons per square mile. Aridity, aggravated by inadequate irrigational facilities, accounts for a low density of population in this part. The most densely populated parts are the Cauvery-Coleroon tract in the centre, Tambaraparni valley in Tirunelveli district and Kanyakumari district in the south. This high density is accounted for by intensive agriculture due to excellent irrigational facilities. Other than these tracts there are pockets of dense population around the cities of industrial importance. Madras, Coimbatore, Madurai, Vellore, Salem, Erode, Tiruppur are important industrial cities with a dense concentration of population.

It is interesting to note that in the north the coastal plain supports a dense population in contrast to the western upland with lesser rainfall and inadequate irrigational facilities. In the southern part, the reverse condition prevails. Here population is dense at the foot of the Western Ghats and thins out towards the coast in accordance with the increasing aridity.

SOURCE : *Census of India*, 1951.



Distribution of Rural and Urban Population, 1951

Method

THIS MAP SHOWS the distribution of rural population by red dots, each dot representing 3,000 persons, and urban population by black circles proportionate to the size of towns and cities.

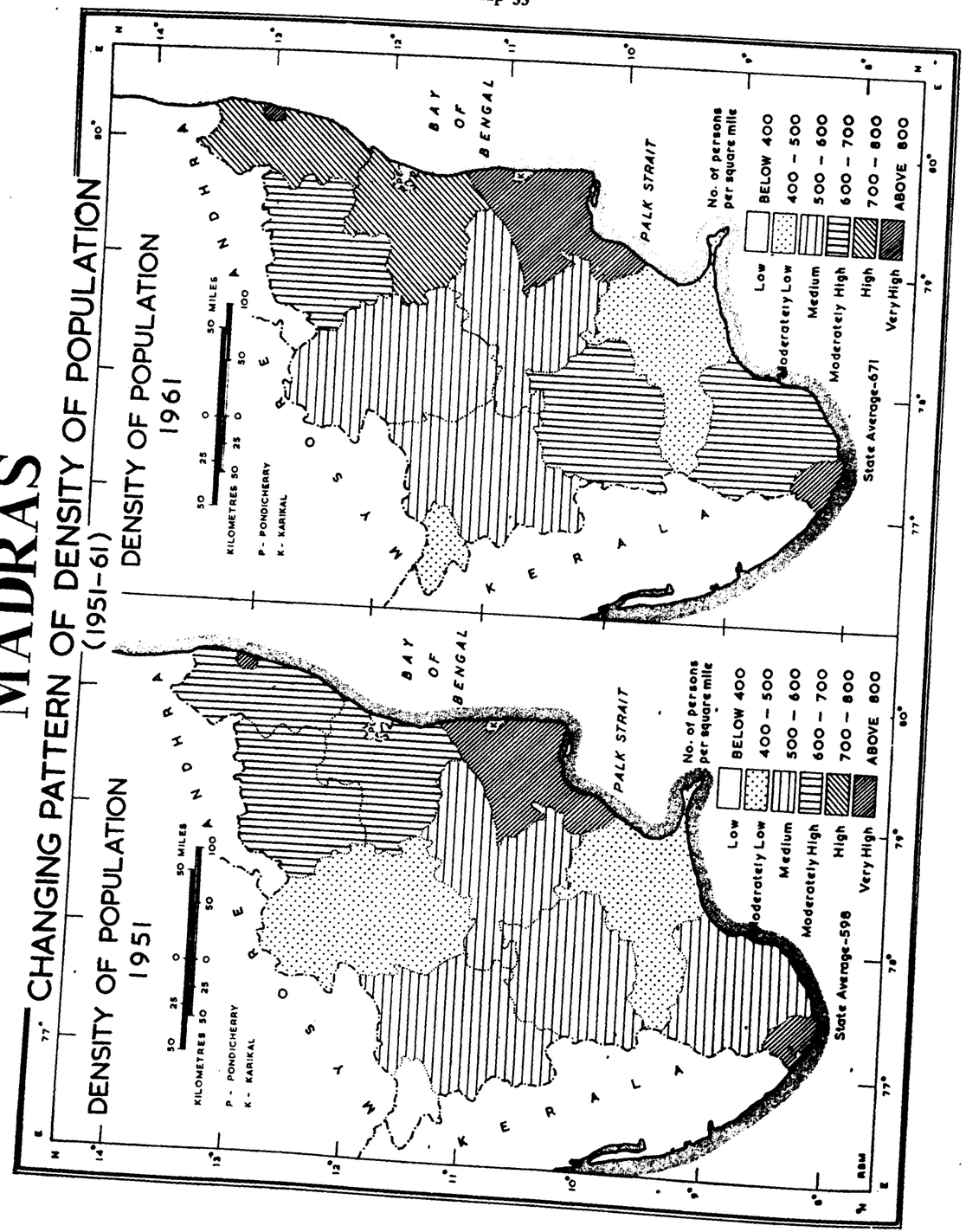
Analysis

Since agriculture is the principal occupation of people living in rural areas all over India, the distribution of rural population is closely linked up with the agricultural value of different tracts which in turn depend upon rainfall conditions, availability of irrigation water, and the fertility of soils. Obviously the densest concentration of rural population of Madras State in 1951 was in heavily irrigated tracts—such as the Cauvery delta, the Upper Vaigai basin, the Tambaraparni valley, and the Kanyakumari district. The entire coastal region from Chingleput to Tanjore district showed a very high density of rural population due to high rainfall conditions coupled with irrigational facilities. To the south of the Cauvery delta the density of rural population was thinner specially in the southeast coast where aridity and sterile soils always stand in the way of good harvests. On the whole, the rural population was relatively dense in the valleys of the principal rivers such as the Palar, the Ponnaiyar, the Vellar, the Cauvery, the Vaigai, and the Tambaraparni.

Although all the major cities of the State were concentrated in the northern and central parts, the towns were more closely spaced in the south than in the north. All the seven Class I cities (Population over 1,00,000 persons) were in the northern and central parts—the districts of Madras, Salem, North Arcot, Coimbatore, Tiruchirapalli, Tanjore and Madurai. Of these cities, Madras, Coimbatore, and Madurai had conurbation areas. Each of them had a number of satellite towns and was the core of an industrial zone specialized in textile industry.

The southern districts—Ramanathapuram, Tirunelveli and Kanyakumari—supported a large number of urban population in relatively small towns which were widespread in distribution. Tuticorin was the largest town in the south followed by Tirunelveli and Nagercoil. A number of small towns were linear with the railways leading from Tirunelveli to Tiruchendur. Another agglomeration of small towns was in the eastern part of Kanyakumari district.

SOURCE : *Census of India*, 1951.



Changing Pattern of the Density of Population, 1951-61

Method

THE RATIO BETWEEN population and area is taken as the index for density of population. The indices are graded as very high (above 800), high (700—800), moderately high (600—700), medium (500—600), moderately low (400—500) and low (below 400) on the basis of State average density. The districts are shaded according to these grades of indices for both the years, 1951 and 1961.

Analysis

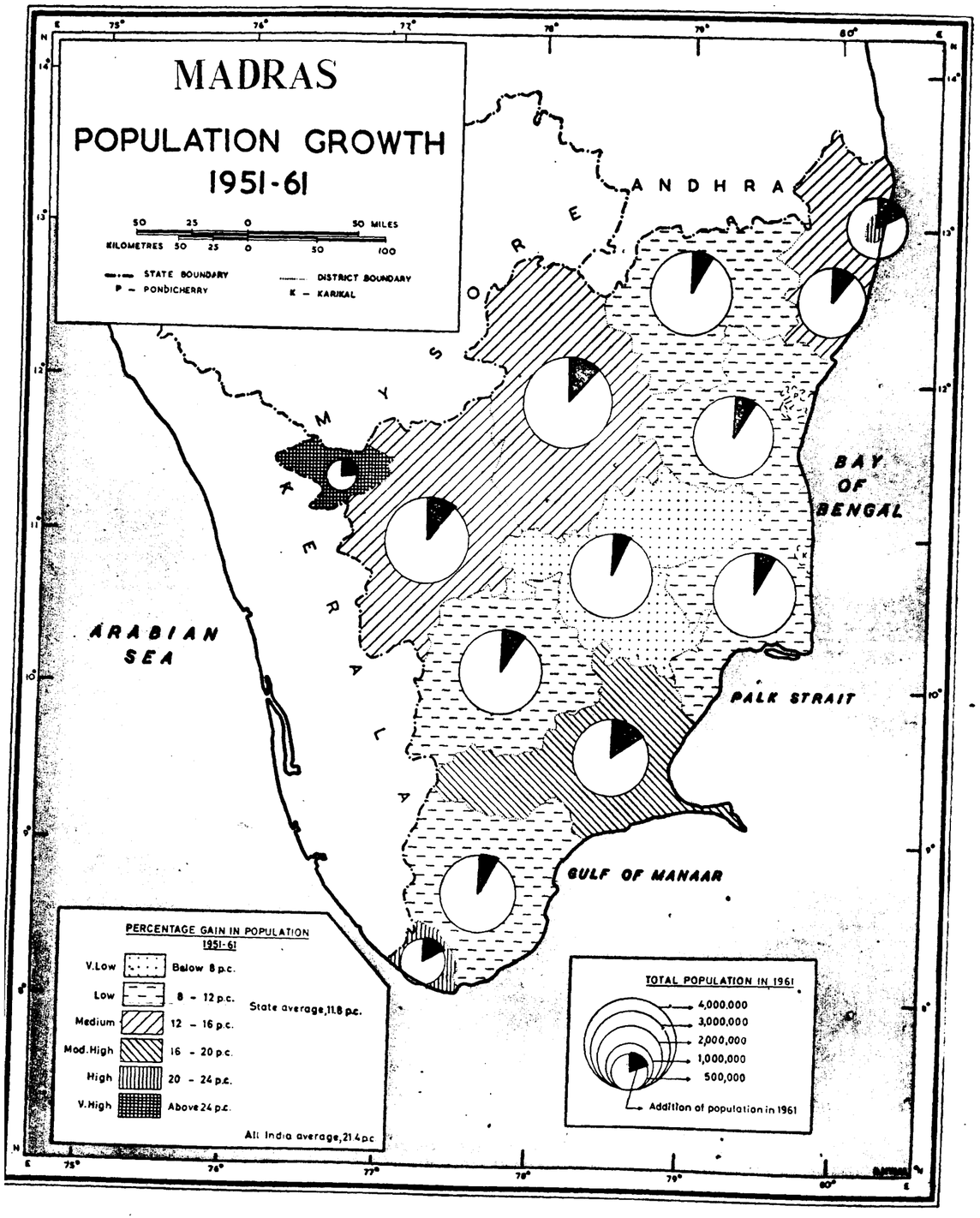
The State of Madras shows a higher density of population than the national average. It increased from 598 in 1951 to 671 in 1961 as compared to 316 in 1951 to 384 in 1961 in India as a whole. During 1951—61, the overall pattern of the distribution of population in the State has remained the same. The densest concentration of population is in the east and southwest coast and the thinnest concentration is in the hill areas. It is worthy to note that paddy growing areas—Chingleput, South Arcot, Tanjore and Kanyakumari districts—have always been the highest density areas. Density gets thinner in the interior as millet replaces paddy.

In 1951, population density was very high in Madras, Tanjore and Kanyakumari districts. There was no area showing the category of high density (700—800) in 1951. Three districts in the northeast—Chingleput, North Arcot and South Arcot—had a moderately high density (600—700) in 1951. The region showing a medium density (500—600) covered an extensive area in the centre and south comprising Coimbatore, Madurai, Tiruchirapalli and Tirunelveli districts. The area with moderately low density (400—500) was scattered—Salem district in the north and Ramanathapuram district in the south. The district of Nilgiri showed the lowest density (below 400) in the State.

The area of very high density (above 800) was same in 1961 as in 1951. A notable change in density is however marked in Chingleput and South Arcot districts. They show a high density (700—800) in 1961 compared to moderately high density (600—700) in 1951. The area of moderately high density (600—700) in 1961 is no more a compact unit. It is rather scattered in the north (North Arcot district), centre (Madurai district) and south (Tirunelveli district). There has been a shrinkage of medium density (500—600) area. It covers only three districts (Salem, Coimbatore, and Tiruchirapalli) in 1961 compared to four districts in 1951. The moderately low density (400—500) area has decreased and the low density (below 400) area has disappeared in 1961. Following are the salient features of transition :

(*i*) The disappearance of low density area (below 400).
(*ii*) The emergence of high density area (700—800).
(*iii*) The shrinkage of medium and moderately low density area (500—600).

SOURCES : (1) *Census of India*, 1951.
(2) Provisional Population Totals, *Census of India*, 1961.



Population Growth, 1951-61

Method

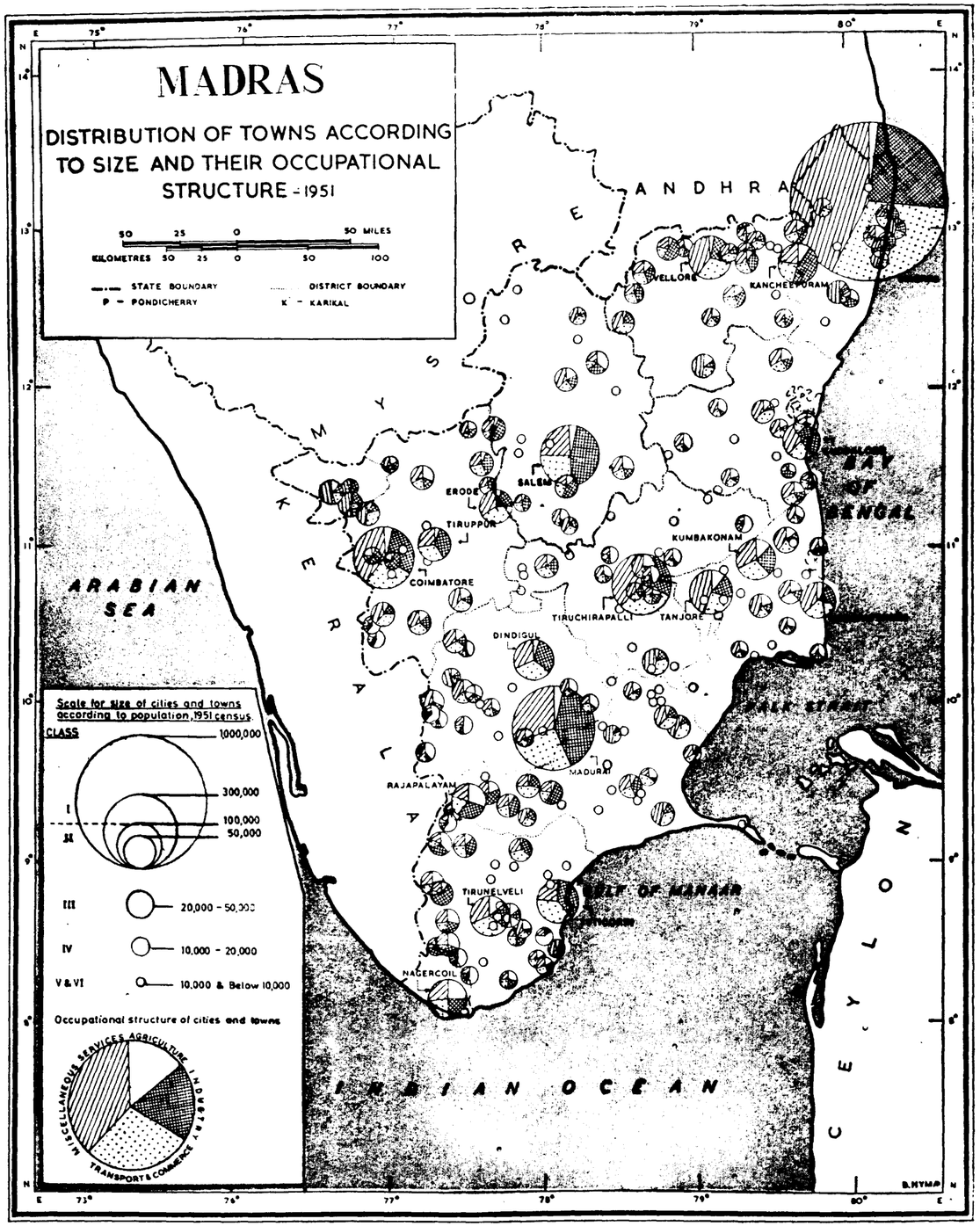
THE INTERCENSAL CHANGE of population during 1951—61 is shown directly in the form of percentage change, as increase or decrease of population which has occurred between the two censuses. The percentage changes (here all gains) are plotted in each district and then the districts are shaded according to the range from high to low. On this map the circles are drawn proportionate to the total population for each district. In each circle the addition of population in 1961 over that of 1951 is marked by red shade.

Analysis

The rate of population growth during 1951—61 is much lower in Madras (11.8%) than in India as a whole (21.4%). More than half of the State area shows its rate of growth as being lower than the State average. The district of Tiruchirapalli shows the lowest rate of population growth (7.7%) followed by Tanjore (8.9%), Tirunelveli (8.9%), North Arcot (8.4%), South Arcot (9.5%), and Madurai (10.8%) districts.

The districts of Coimbatore and Salem have undergone a growth slightly higher than the State average—12.3 per cent and 13.5 per cent respectively. The rate of growth is moderately high in the Ramanathapuram district (16.3%), and significantly high in the Nilgiri (31.3%) and Kanyakumari (20.6%) districts.

SOURCES : (1) *The Census of India*, 1951.
(2) Provisional Population Totals, *Census of India*, 1961.



Distribution of Towns according to Size and Occupational Structure, 1951

Method

THIS MAP INTENDS to show the distribution of towns according to size and their occupational structure. The size of the town is shown by circles proportionate to the total population. Occupational structure is shown by sectoral division of the circles.

Analysis

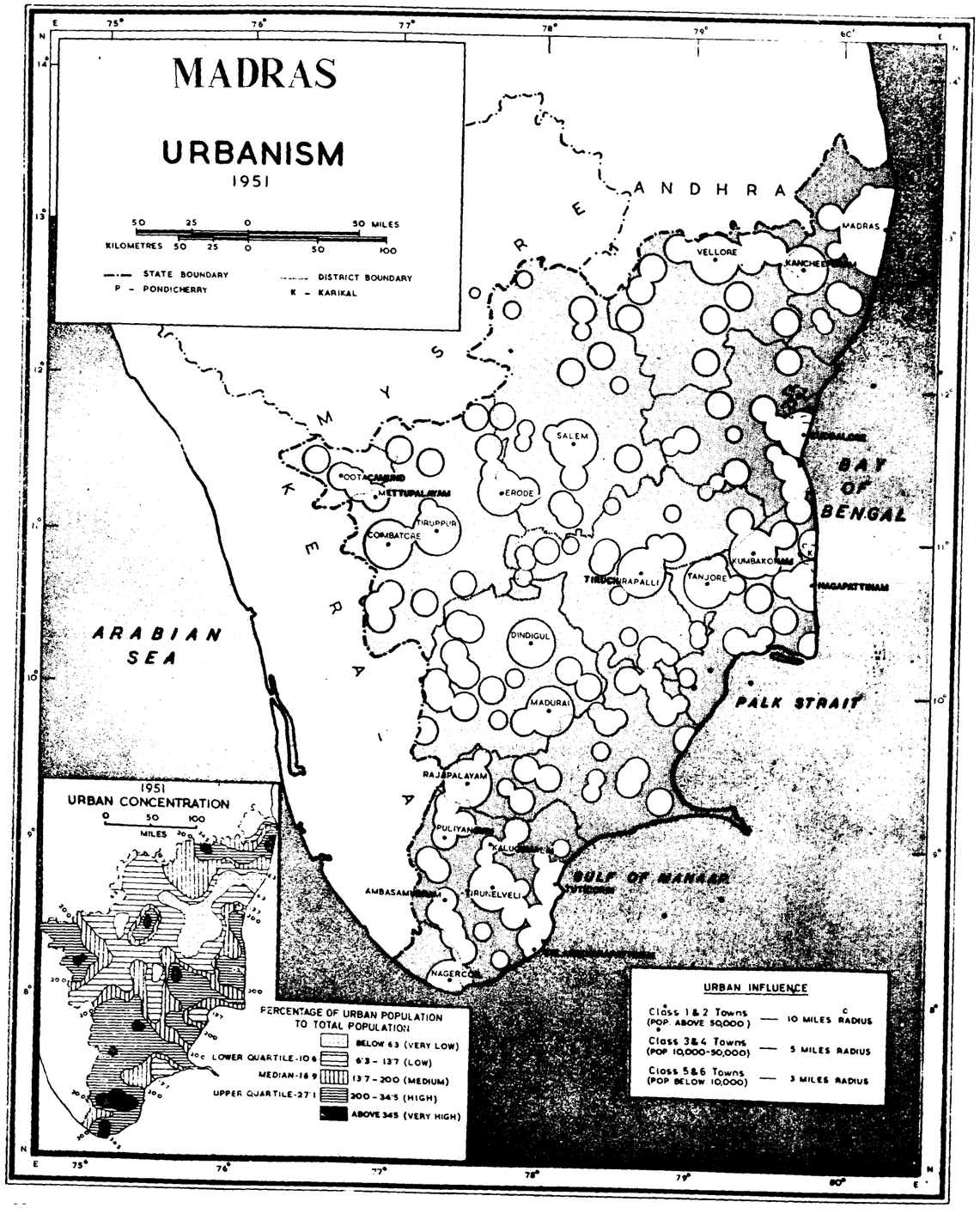
In 1951, Madras supported 7.3 million people in 272 towns. Of these only seven were Class I cities with population above 1,00,000 and eleven were Class II cities with population between 50,000—1,00,000. Of the remaining, more than two-thirds were small towns with population below 10,000.

The Class I cities are situated in northern and central districts of the State. They have sites at the nodal points of roads and railways. Madras is the biggest metropolitan city in the State. It functions as an important port as well as an industrial centre. Of the remaining Class I cities, Coimbatore, Madurai, Salem and Vellore are industrially important, while Tanjore and Tiruchirapalli are commercially important. Each of the Class I cities has a number of satellite towns attributing a conurbation look to its layout. The Class II cities (population 50,000—1,00,000) are more dispersed than the Class I cities. They are either coastal towns with port facilities or cities with agglomeration of some industries.

The Class III cities (population 20,000—50,000) are concentrated more in the south (Tirunelveli and Ramanathapuram districts) than in the north. Most of them are engaged in agricultural processing and marketing of agricultural products. In the north they function as satellite towns to the industrial cities of Coimbatore, Vellore, Salem and Madras.

Class IV, Class V and Class VI cities (population below 20,000) are scattered all over the State. They are not truly urban in character. A significant proportion of people (50%) live on agricultural activities. They are either administrative centres or market towns in the heart of rural areas.

SOURCE : *Census of India*, 1951.



Urbanism

Method

THIS MAP BRINGS out the regional diversity in the scatter location and concentration of towns. The area, which can be treated as a local tributary area to the town, is assumed to vary according to the size of the towns.

For Class I (over 1,00,000 persons) and Class II (50,000 persons) cities the urban influence is assumed to extend up to a radius of 10 miles (16 kms), for Class III (20,000—50,000 persons), and Class IV (10,000—20,000 persons) cities a radius of 5 miles (8.0 kms), and for Class V (5,000—10,000 persons) and Class VI (below 5,000 persons) cities a distance of 3 miles (4.8 kms).

For the convenience of mapping the tributary areas are assumed to be circular. Hence circles are drawn with the respective radii around each town. If the distances between two towns are less than six miles (9.6 kms), the circles overlap each other. In that case, the arcs are joined to demarcate the contiguous urban areas. The area outside the circle is shaded to differentiate the rural from the urban areas.

Analysis

The towns are irregularly scattered in the central part of the State. They show a linear concentration along the coast. Between Cuddalore and Nagapattinam there is a continuous chain of towns for more than 50 miles (80 kms). The second area of linear urban concentration is between Tuticorin and Kulasekharapattinam. The major ports, Madras and Tuticorin, are each joined with their hinterland by a chain of towns. Urbanism is continuous for about 80 miles (128 kms) from Madras to Vellore City. Contiguity of towns is perceptible for about 50 miles (80 kms) between Tuticorin and Kalugumalai.

At the foot of the Ghats, urban centres again show a linear concentration. Towns are continuous for about 40 miles (64 kms) between Nagercoil and Ambasamundrum. The second area of linear concentration is for 40 miles (64 kms) between Rajapalayam and Puliyangudi. Further in the north, towns are concentrated in an irregular manner. A very large concentration of urban centres is, however, near Coimbatore-Tiruppur area. Towns are again linear for about 30 miles (48 kms) between Ootacamund and Mettupalayam.

In the central part there are four scattered areas with significant urban concentration around Salem, Erode, Madurai and Tiruchirapalli cities.

Inset Map

This map shows the zones of urban concentration ranging from very high to very low.

Method

The percentage values of urban population to the total population in each taluk are arranged in descending order and the upper quartile, medium and lower quartiles are chosen for grading the values from very high to very low. The values have been graded as very high (above 34.5), high (20.0—34.5), medium

(13.7—20.0), low (6.3—13.7) and very low (below 6.3). Isopleths are drawn for each of these values and the intervening space between two isopleths is shaded according to the gradation of values.

Analysis

The areas of very high urban concentration stand out as islands of various sizes and shape, scattered all over the State except in South Arcot and Tanjore districts.

There are six zones with a high value of urban concentration : (*i*) between Vellore and Madras, (*ii*) between Salem and Erode, (*iii*) around Coimbatore, (*iv*) from Nagercoil (in Kanyakumari district) to Madurai, (*v*) around Tiruchirapalli, and (*vi*) along the east coast of Tanjore and South Arcot districts. These zones, except the last one can contain one or more nuclei of very high urban concentration. The regional core of urbanization of the first zone can be identified with Madras and Vellore, that of the second zone with Salem, the third zone with Coimbatore, the fourth zone with Madurai, Rajapalayam, Tirunelveli, and Nagercoil and the fifth zone with Tiruchirapalli. The coastal zone has no core of urbanization.

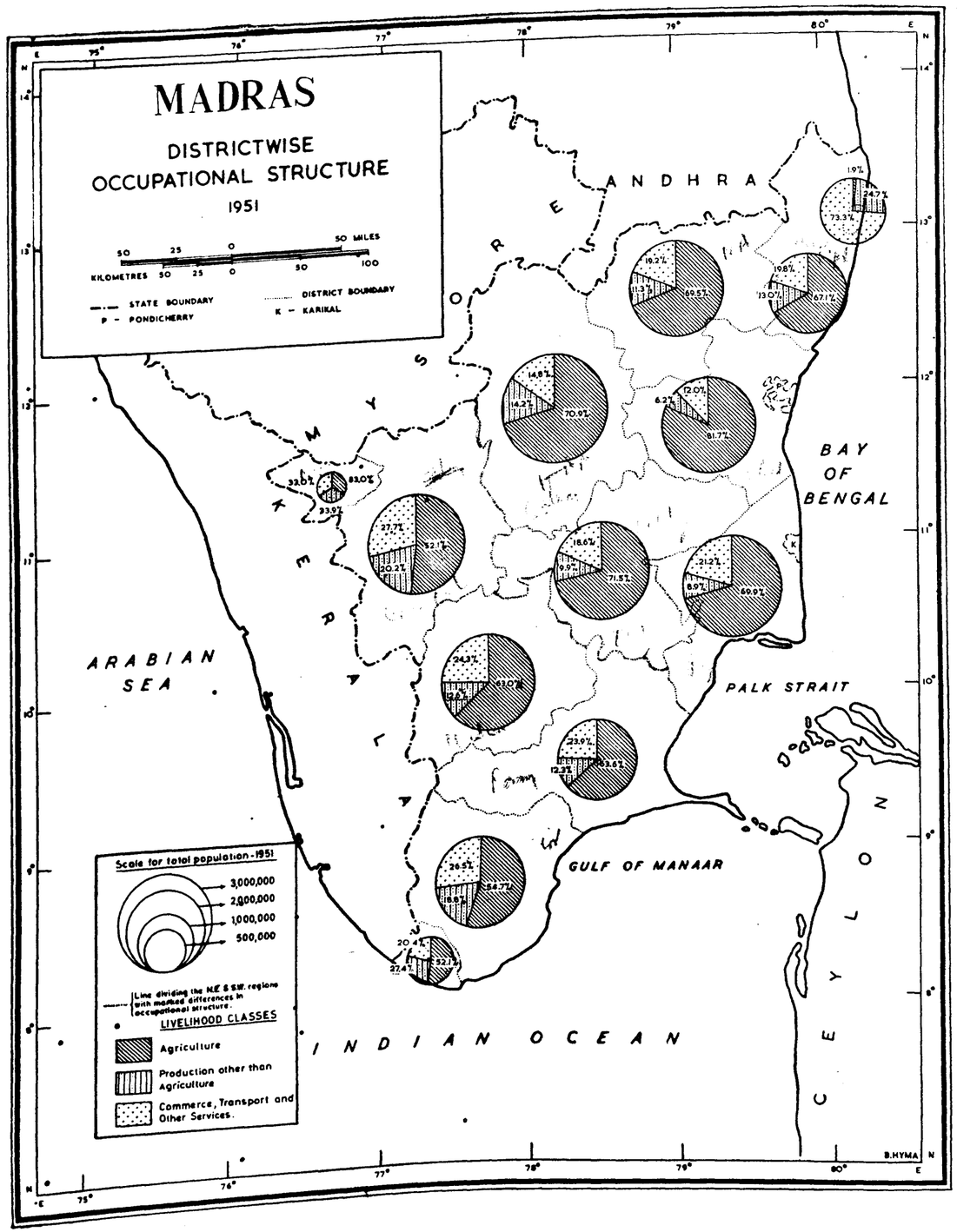
The intermediate areas are sandwiched between the two isopleths of high and low value of urban concentration. Obviously, there is a steep zonal gradient from high to low all over the State. The gradient is remarkably steep in the northern part of Chingleput and North Arcot districts. The highly urbanized area joining Madras and Vellore yields abruptly to the least urbanized area in the south stretching through Chingleput, North Arcot, Salem and South Arcot districts.

Much of this area is still inaccessible by railways and highways (Map 50). Other than this belt, there are a few scattered patches of under-urbanized area in Salem, Coimbatore, Chingleput and Tiruchirapalli districts. Urban growth is significantly low in parts of Chingleput, North Arcot, Salem, Tiruchirapalli and South Arcot districts.

Although the southern part does not contain any Class I city, its urbanization is more significant than that of the northern part. A number of contiguous, small sized towns occupy an overwhelming proportion of the land in Tirunelveli and Kanyakumari districts of the south.

SOURCE : *Census of India*, 1951.

Map 37



Map 37

Districtwise Occupational Structure, 1951

Method

THIS MAP IS drawn to show the occupational structure of various districts in 1951. According to the census definition, livelihood classes are grouped into two broad categories—agricultural and non-agricultural.

Under agricultural group there are four classes of occupation :

I Cultivators of land wholly or mainly owned.
II Cultivators of land wholly or mainly unowned.
III Cultivating labourers.
IV Non-cultivating owners of land; and other agricultural rent-receivers.

The non-agricultural groups comprise four livelihood classes :

V Persons engaged in non-agricultural production together with dependents.
VI Persons engaged in commerce and their dependents.
VII Persons engaged in transport.
VIII Persons engaged in other services, mostly utility services.

For this map livelihood classes are grouped into three categories : (*a*) agricultural activities comprising I—IV classes, (*b*) Production other than agriculture corresponding to class V, and (*c*) Tertiary activities comprising VI—VIII classes.

In 1951 about 62.7 per cent of the total population in Madras lived on agriculture compared to 69 per cent in India as a whole. Production other than agriculture employed 13.9 per cent, commerce and transport 19.8 per cent, and other services 3.6 per cent against 10.2 per cent, 7.7 per cent, and 9.2 per cent in India, respectively.

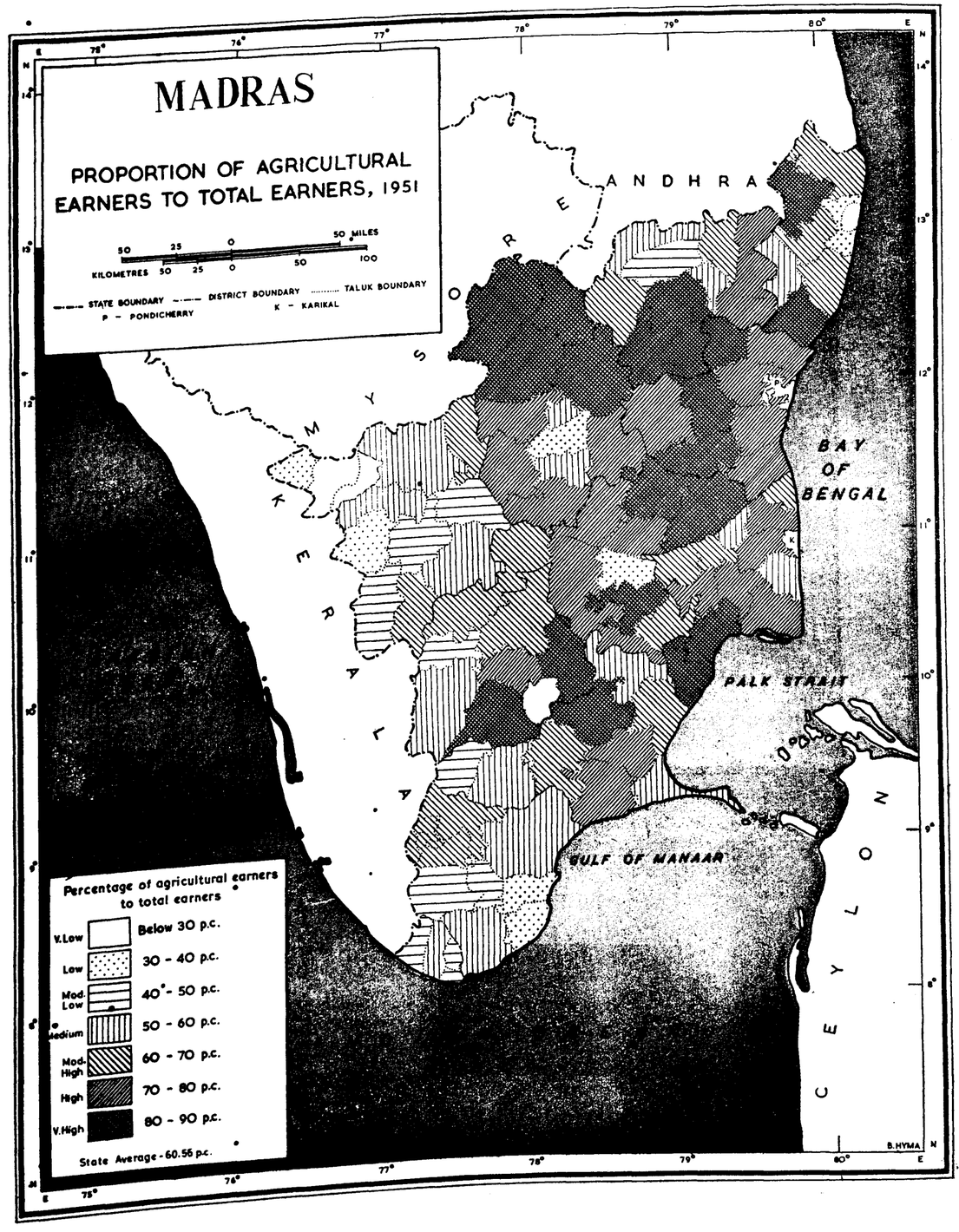
The State can roughly be divided into northeastern and southwestern regions with unlike occupational structure by a N.W./S.E. line joining the western boundary of Salem, Tiruchirapalli, and Tanjore districts. The N.E. region comprises Chingleput, North Arcot, South Arcot, Tanjore, Salem, and Tiruchirapalli districts. This part shows an overwhelming importance of agricultural activities in employme nt structure because of its better rainfall conditions and irrigational facilities. More than two-thirds of its population are dependent upon agriculture for their livelihood.

The southwestern region comprises Coimbatore, Madurai, Ramanathapuram, Tirunelveli and Kanyakumari districts. Nature is not as kind in the southwestern region as in the northeastern region with regard to agricultural activities. Nevertheless, its hydel-power and transport facilities gave an incentive to the growth of activities other than agriculture. About 45 per cent of its population were dependent upon non-agricultural activities.

The districts of Nilgiri and Madras are individualistic in occupational structure. In the former district agriculture, industry and tertiary activities are equally important in employment structure. In Madras district, on the other hand, tertiary activities—commerce, transport, and other services—form the most important source of employment to the people because of the City's functioning as the leading port in the whole of South India. About three-fourths of the population in Madras City is employed in tertiary activities.

SOURCE : *Census of India*, 1951.

Map 38



Map 38

Proportion of Agricultural Earners to Total Earners, 1951

Method

EARNERS ARE DEFINED as self-supporting persons and earning dependents. This map is drawn to show the areas where agricultural earners were either major or minor components of the earning population in 1951. For each taluk the proportion of agricultural earners to the total earners is calculated. The ratios are then graded from very high to very low and taluks are shaded according to this gradation.

Analysis

Agriculture was the main occupation all over the State except in large cities and industrial areas. About half of the State area in the northeast region supported an overwhelming proportion (68%) of agricultural earners (Map 37). It is mainly due to the predominance of paddy cultivation which creates a heavy demand for manpower particularly at the time of transplantation and harvesting.

In contrast with the northeastern region, southwestern region had more non-agricultural earners. The reasons are not very far to seek. First, this part grows millet as the staple food crop and the millet cultivation does not require much labour ; secondly, the southwestern region had a number of dispersed industrial zones which supported a large proportion of the working force.

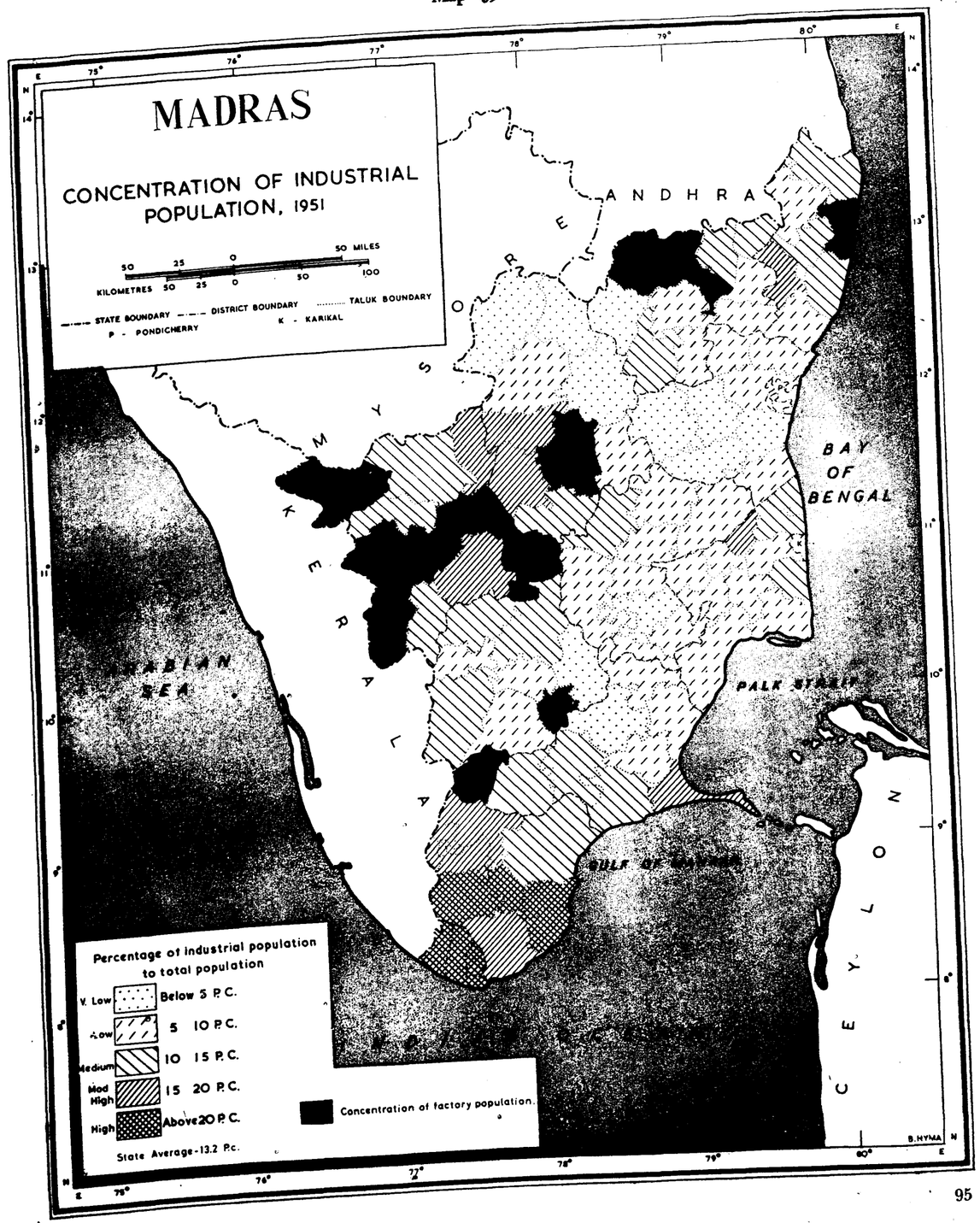
The largest area with the predominance of non-agricultural earners was in the heart of Coimbatore district stretching from Erode through Palldam, Coimbatore to Pollachi taluks. Textile industry and agro-industries including tea manufacturing, absorb a large proportion of the working population of Coimbatore district.

The second area with a large concentration of non-agricultural population was in the hinterland of Tuticorin in Tirunelveli district. A number of small scale and cottage industries employed these non-agricultural workers.

The third important area with concentration of non-agricultural workers was Nilgiri district. Here plantation industry (coffee and tea factory) offered employment to these workers. Other than the three major concentrations, there were three scattered centres of non-agricultural population around Madurai, Rajapalayam and Nagercoil. The first two centres supported earners in the textile industries and the third one in small scale and cottage industries.

SOURCE : *Census of India*, 1951.

Map 39



Map 39

Concentration of Industrial Population, 1951

Method

INDUSTRIAL POPULATION IS defined in the Census of India, 1951 as persons engaged in the following activities and their dependents : (*i*) Primary industries such as stock raising, rearing of animals and insects, plantations, etc., (*ii*) Mining and quarrying, and (*iii*) Manufacturing and processing. The ratio $\frac{p}{P}$, where p is the industrial population and P is the total population for each taluk. The indices are then classified as high, moderately high, medium, low and very low. After plotting these indices the taluks are shaded according to the degree of concentration.

Analysis

The State, as a whole, was under-developed in industries. Only 13.2 per cent of its total population were engaged in production other than agriculture, and only about 1 per cent was employed in factory establishments.

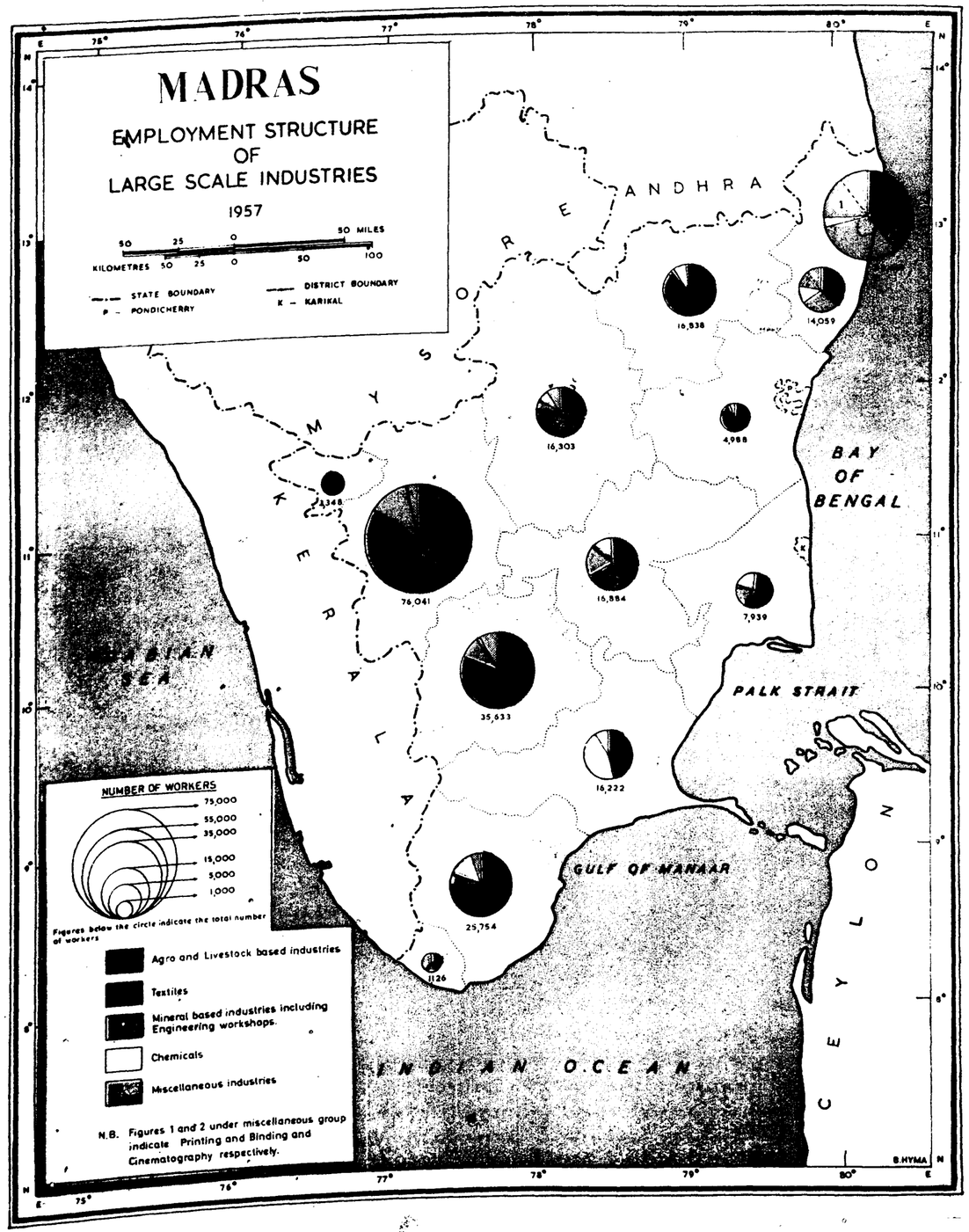
The largest concentration of factory population was around Madras and Coimbatore cities. The other agglomerations of factory population were around the cities of Vellore, Salem, Erode, Madurai, and Rajapalayam, and also in tea plantation areas of the Nilgiri district.

Besides the factory towns mentioned above, there are scattered agglomerations of industrial population engaged in small scale and cottage industries. In Kanyakumari district, for example, more than 30 per cent of its population was engaged in primary and cottage industries.

It is interesting to note that industrial population was concentrated more in the west than in the east. The reason for this regional imbalance in the distribution of industrial population lies in the fact that the eastern part due to its favourable rainfall conditions and excellent irrigational facilities could support an overwhelming proportion of its population on agriculture, while in the western part on account of climatic handicaps continuous farming was not possible, the people were compelled to take to production other than agriculture.

SOURCE : *Census of India*, 1951.

Map 40



Map 40

Employment Structure of Large Scale Industries, 1957

Method

THIS MAP IS drawn to show the break-down of industrial employment in large scale industries in 1957, into components such as agro-and livestock-based industries, textiles, mineral-based industries, chemical and miscellaneous group of industries for each district. The circles are drawn proportionate to the total industrial employment in each district. Each circle is then divided into sectors in proportion to the workers employed by various groups of industries.

Analysis

Coimbatore was the leading industrialized district, employing more than one-fourth of the workers engaged in large scale industries in the State. Textile was the premier industry of the district accounting for 72 per cent of its total industrial employment in 1957. The prevalence of cotton cultivation and the availability of cheap hydel power were the determining factors for attracting the textile industry to this district. Next to textiles, stand agro-based and mineral-based industries, each sharing about 12 per cent of the total industrial employment in the district. The other industries are insignificant from the point of view of employment strength. This district obviously showed its industrial structure intensely specialized in textiles.

Madras district ranked next to Coimbatore in industrial employment. It supported about 19 per cent of the State's total factory population. Its principal industries were textiles, mineral-based, and miscellaneous consumer industries including printing and publishing works. These three types absorbed more than nine-tenths of the total factory workers in the district. The remaining population was distributed among agro-based, chemical and forest-based industries. Madras City, thus, exhibited in its industrial structure a greater diversification than in any other district.

The third important industrialized district was Madurai. Like the Coimbatore district, Madurai is specialized in textile industry. This single industry absorbed more than two-thirds of its total industrial workers. Next to textiles, agro-industry was important employing 15 per cent of the total industrial workers in the district. Engineering industries ranked third with 9 per cent of its total workers.

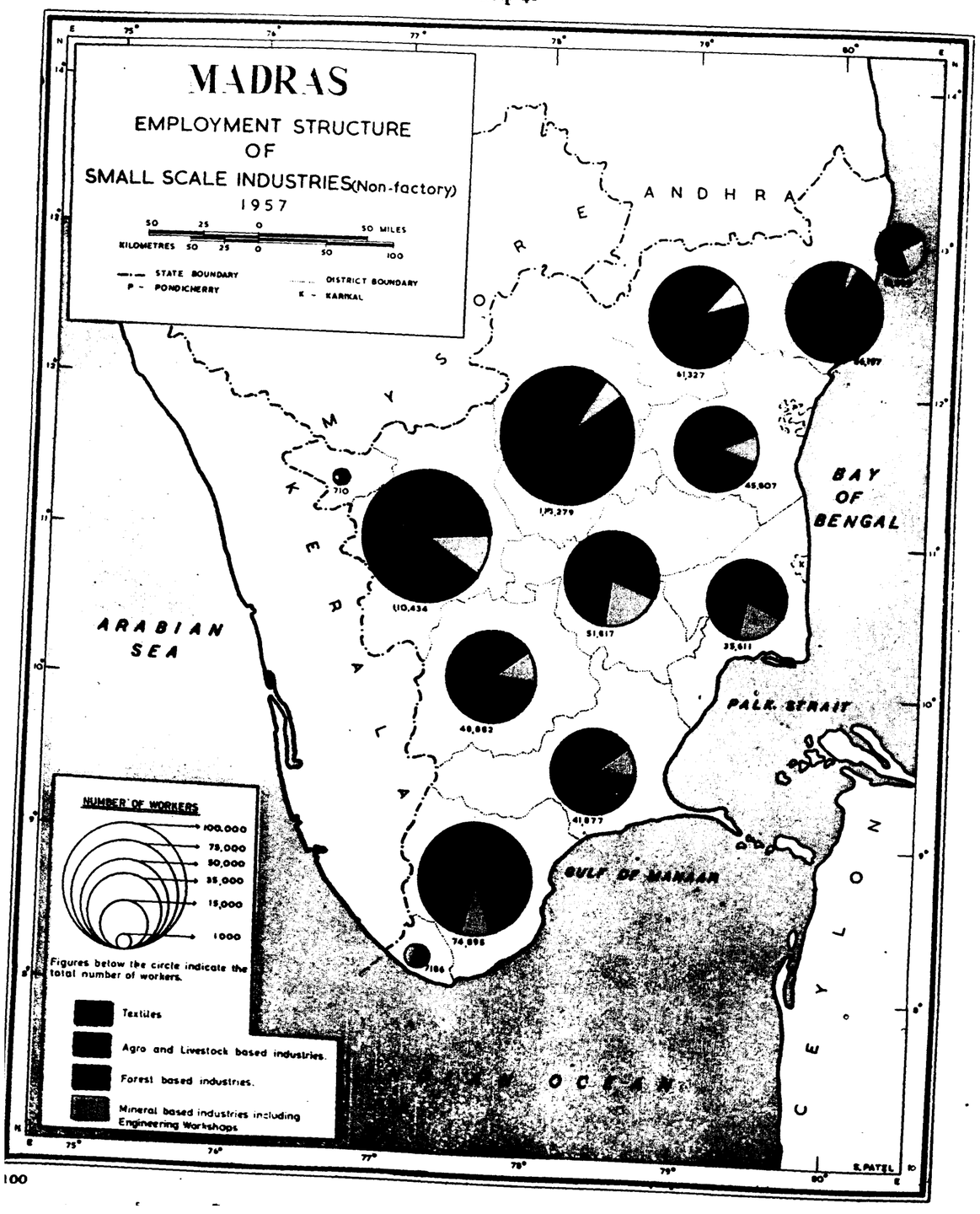
Tirunelveli district was the fourth important industrialized district in the State absorbing 9 per cent of the total manufacturing population of the State. Its industrial structure is specialized in textiles which supported about 69 per cent of its total industrial workers in 1957. Chemical industry was the second important industry employing about 15 per cent of its total industrial workers in 1957. The remaining factory population was distributed among agro-based (6%), mineral-based (4%) and miscellaneous industries (6%).

Each of the four districts, Tiruchirapalli, North Arcot, Salem and Ramanathapuram, employed about 6 per cent of the total industrial workers in the State. Of these four, Tiruchirapalli and Salem are specialized in textiles which offered employment to nearly half of their total factory workers. Agro-based industry is also important absorbing one-fourth of their total industrial population. North Arcot district was another specialized industrial district. Its agro and livestock-based industries employed more than 70 per cent of the total industrial working force. Ramanathapuram district is specialized in chemical (match factory) and textile industries. Three-fourths of the total industrial workers were employed by these two types of industries. This district supported more persons in chemical industries (mainly match factories) than any other district in the State.

The other districts, Chingleput, South Arcot, Tanjore, Kanyakumari and Nilgiri, had a thinner concentration of factory population. Each of these hardly supported more than 2 per cent of the total industrial population in the State.

From the above analysis it is clear that majority of the districts in 1957 exhibited a specialized industrial structure. The drier western districts—Coimbatore, Madurai, Ramanathapuram and Tirunelveli—are specialized in textiles, while the wetter districts—Nilgiri, North Arcot, South Arcot, Tanjore —are specialized in agro-based industries mainly food-processing. The City of Madras like other metropolitan cities of the world showed a diversified industrial structure.

SOURCE : *Large Industrial Establishments in India*, 1957, Government of India, Ministry of Labour and Employment (Labour Bureau).



Employment Structure of Small Scale Industries (Non-Factory), 1957

Method

THIS MAP SHOWS the employment structure of non-factory small scale industries in 1957. They are usually cottage industries scattered in rural areas of the State. They comprise hand-spinning and weaving, oil crushing, hand-pounding of paddy, leather tanning, village pottery, flaying and bone-crushing, palm-gur, bee-keeping, cottage match industry, carpentry, metal and brassware, blacksmithy, stone-crushing, etc. They are, however, grouped into four types—textiles, agro and livestock-based industries, forest-based industries, and mineral-based industries. In each district, circles are drawn proportionate to the total employment in small scale cottage industries. Each circle is then divided into sectors proportionate to the employees under each type of industries.

Analysis

In 1957, village maintenance crafts of the State employed about 653,000 workers compared to 288,000 workers engaged in factories. A very high concentration of non-factory workers was in Salem, Coimbatore, Tirunelveli and Chingleput districts. As compared to every group of 1000 persons about 32—38 persons were non-factory workers. The districts of Ramanathapuram, North Arcot and Tiruchirapalli supported a fairly high number of workers in small scale cottage industries—about 25 workers per 1,000 persons. The density of non-factory population was relatively thin in other districts, less than 20 workers per 1,000 persons.

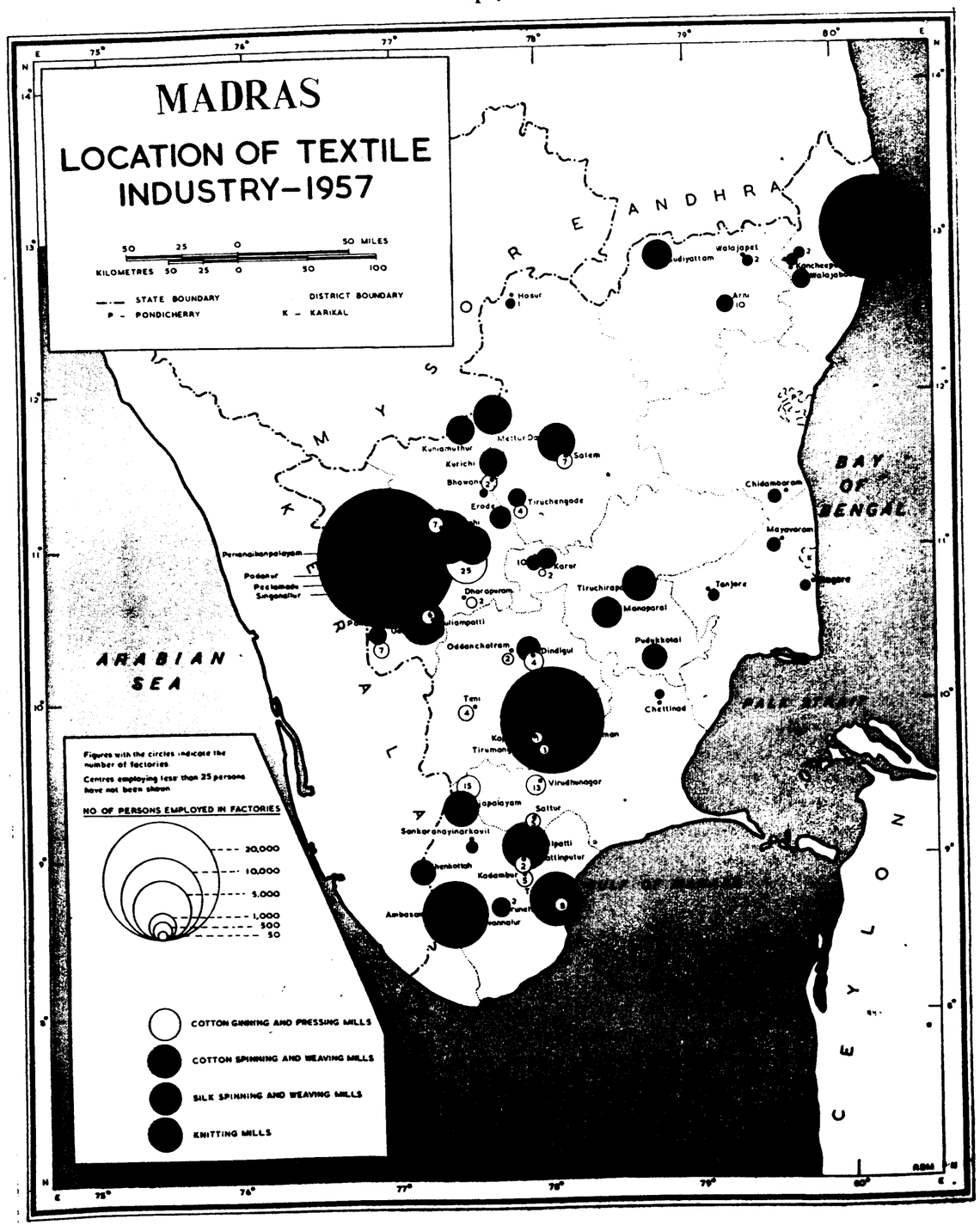
The chief small scale industry in the State was textiles. An overwhelming proportion of workers in small scale industries was engaged in textiles in all districts, except Kanyakumari and Nilgiri.

In Chingleput and Salem districts more than 85 per cent of the workers in cottage industries were employed in hand spinning and weaving. Their industrial structure was intensely specialized in textiles.

The districts of North Arcot, Madurai and Ramanathapuram were highly specialized in textiles. About 70-80 per cent of the non-factory workers were absorbed by this single industry. Industrial structure of South Arcot and Coimbatore districts was slightly diversified, though textile was their domineering industry. Agro-based industry stood second to textiles in employment, supporting 19 per cent of the total workers in cottage industries in these two districts. In Madras district, textile (56%) and mineral-based industry (27%) absorbed more than four-fifths of the non-factory workers.

Industrial structure was relatively diversified in Tiruchirapalli, Tanjore, Tirunelveli and Nilgiri districts. More than half the workers in the first three districts were distributed almost equally among industries other than textiles. In the latter district agro-based and mineral-based industries supported 80 per cent, textiles 13 per cent, and forest-based industry about 7 per cent of the workers engaged in small scale industries. The industrial structure of Kanyakumari district was conspicuous on account of the absence of textiles. Forest-based and mineral-based industries absorbed more than nine-tenths of the working force in its cottage industry sector.

SOURCE : Data supplied by Industries and Commerce Department, Government of Madras.



Location of Textile Industries

Method

THIS MAP SHOWS the location of textile industries in the State. It is divided into three main branches and the circles are drawn proportionate to employment in each branch for each centre.

Analysis

The textile industry of Madras State can be divided into three branches—cotton manufacturing, silk mills, and knitting mills. In 1957, it was the largest of the industrial groups absorbing about 40 per cent of the total factory workers and contributing about 38 per cent of the State's net industrial output.

In 1957 there were 226 cotton ginning and pressing mills and 184 cotton spinning and weaving mills. It was the largest among the branches of the textile industries offering about 88 per cent of the total employment. Cotton manufacturing was the most pronounced industry of the major cities of the State such as Madras, Coimbatore, and Madurai. The largest concentration was, however, in Coimbatore City. More than 40 per cent of the total workers of cotton industry were agglomerated at this centre. The main attraction of Coimbatore for cotton manufacturing was an ample supply of power and raw materials. The second important area of cotton manufacturing was Madurai City. About 18 per cent of the workers under cotton industry were concentrated in the mills around Madurai City. The chief factors contributing to this concentration are the availability of skilled labourers, raw materials and capital. The third important cotton milling centre was Madras City. It supported two big cotton mills with a total employment of about 16,000 workers. Transport and marketing facilities were the criteria for determining their location at this metropolitan city. The fourth cotton manufacturing area was in Tirunelveli district. Here cotton mills were usually dispersed in small towns. Their scattered locations may be accounted for by the search for low wage location. Wages tend to be lower in small towns than in big cities. The availability of cotton and cheap labour are likely to be the reasons for the dispersal of cotton mills in Tirunelveli district. There were a few small sized cotton mills dispersed in Tiruchirapalli, Salem and Tanjore districts. Their growth was rather sporadic.

Among the textile branches the knitting mills stood second to cotton manufacturing in the number of employees. Nevertheless, only 2 per cent of the workers under textile industry were employed in hosiery mills. The largest concentration of knitting mills was in Tiruppur of Coimbatore district. It was a subsidiary industry to the local cotton mills.

Silk industry is in the luxury class. It absorbed only 0.5 per cent of the workers under textile industry. There were only a few silk mills concentrated in the northern districts of Salem, North Arcot and Chingleput. This industry is characterized by small plants confined to the small towns of Hosur, Arni, Kancheepuram and Walajapet. The people living in the area have traditional skill in silk-rearing, silk-spinning and weaving which has provided the incentive to the growth of silk industry in these centres.

Besides these three main branches of textile industry, two other branches, that of woollen industry and miscellaneous industries allied to textiles employed 9.5 per cent of the total textile workers of the State. These two groups, however, are not shown in this map, mainly because they consist of small units offering employment to less than 25 persons.

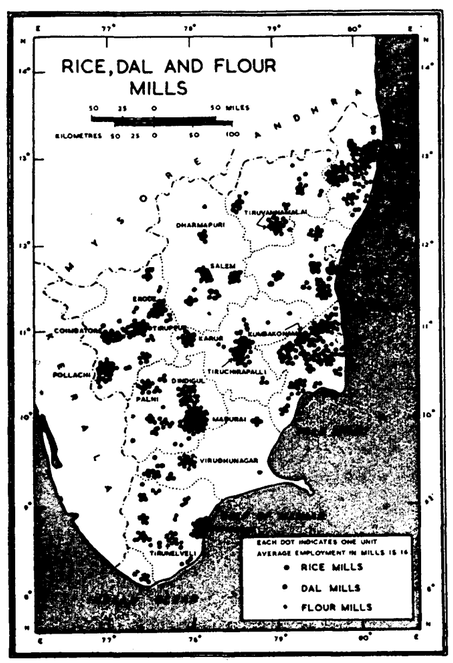
Woollen industry was not much developed in Madras State due to its limited demand because of hot weather prevailing throughout the year. There were only eight woollen mills with 187 workers dispersed in Salem district.

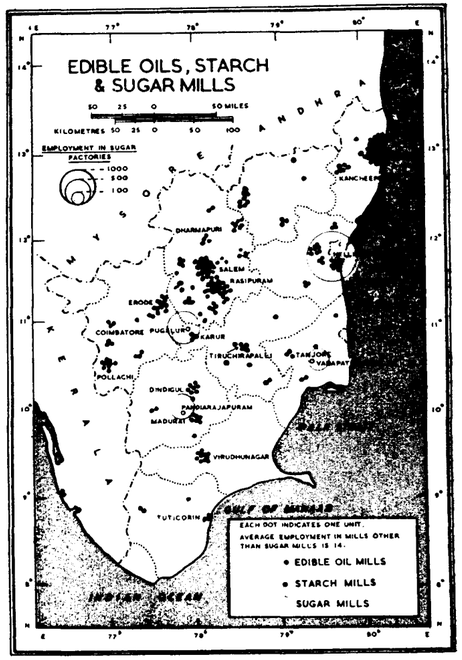
The miscellaneous branch comprising carpet weaving, rope and cordage making, wearing apparel industry, shoes and umbrella making employed 9 per cent of the workers under textile industry. They were mostly market oriented; hence they flourished in the major cities like Madras, Salem, Coimbatore and Madurai.

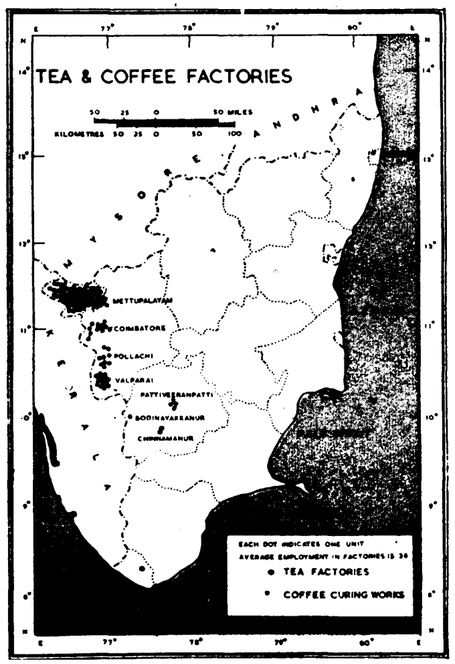
SOURCE: *Large Industrial Establishments in India*, 1957, Government of India, Ministry of Labour and Employment (Labour Bureau).

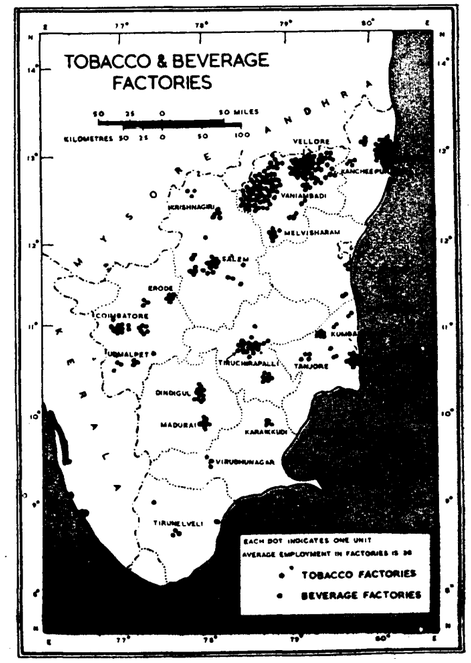
Map 43

MADRAS
LOCATION OF AGRO-BASED INDUSTRIES-1957









Map 43

Agro-based Industries

Method

AGRO-BASED INDUSTRIES ARE classified into four groups: (1) Processing of paddy, pulses and wheat (Rice, Dal and Flour), (2) Manufacturing of edible oil, starch and sugar, (3) Tea processing and coffee curing, (4) Tobacco and beverage factories. Location of each group is shown separately. Since average size of the factory other than sugar mill is small (employing less than 50 persons), each factory unit is shown by a dot. Sugar mills are, however, shown by circles proportionate to employment.

Analysis

1. *The Processing of Rice, Wheat and Pulses.* Rice milling industry employed more people than any other branch of food processing industry. In 1957, there were about 846 rice mills with a total employment of about 13,400 persons in the State. The biggest concentration of rice mills was in Tanjore, the most important rice growing district in the State. Average employment in rice mills was 16 persons. Rice mills are usually in sites along or close to the transport lines, railways and highways for the advantage of assembling raw materials and distributing finished rice to the market. Compared to rice mills, dal and flour mills are rather insignificant from the employment angle. The largest concentration of dal mills was near Virudhunagar in Ramanathapuram district.

2. *Edible oils, Starch and Sugar.* Among these three types of food processing industries, sugar manufacturing is carried on in big establishments offering employment to more than 500 persons. Others are small scale establishments with an average employment strength of 14 persons. Edible oil mills were located in towns not very far from the areas growing groundnuts, gingelly and castor seeds. The largest number of oil mills were concentrated in Madras City, and Salem City and its satellite towns of Rasipuram, Erode, Coimbatore and Pollachi in Coimbatore district, Dindigul and Madurai in Madurai district and Virudhunagar in Ramanathapuram district. Ramanathapuram district had a number of oil mills. Starch manufacturing units followed the distribution of tapioca. Almost all the starch mills were located in Salem district mainly because it is an important tapioca producing district in the State.

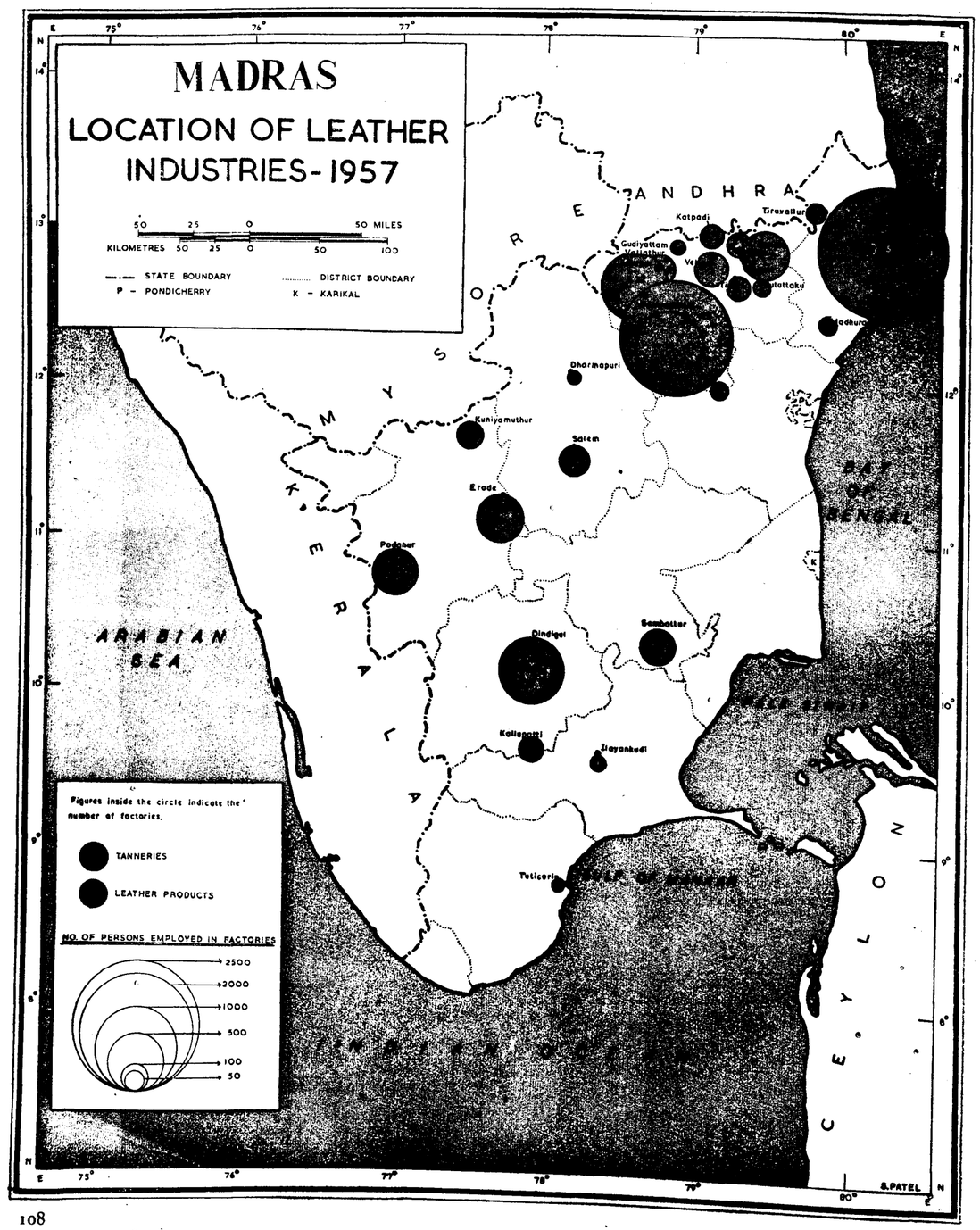
There were only four sugar mills in the State. The biggest sugar mill was at Nellikuppam employing about 2,100 persons. Since sugar manufacturing is a raw material oriented industry, all the mills other than that in Nellikuppam sprang up in the rural areas. Sugar processing is the outstanding industry of Nellikuppam, to which locality it was attracted on account of the ample supply of sugarcane from the neighbouring areas and the advantages of marketing due to its nearness to the port town of Cuddalore. The second big sugar mill was in Pugalur, a village in Tiruchirapalli district. It is located in the centre of sugar-growing tracts on the river Cauvery. The third important sugar mill was in Pandiarajapuram, a village very near to Madurai City. Advantages of raw materials and market facilities attracted this mill at this centre. The smallest sugar mill was at Vadapathimangalam in the heart of the Tanjore district.

3. *Tea and Coffee Processing.* The third branch of agro-processing industries comprises tea and coffee processing. Tea factories are small sized enterprises with an average employment of 36 persons. They were concentrated in the tea plantation areas of Nilgiri and Coimbatore districts. Coffee curing centres do not strictly follow their location in coffee plantation areas. Some are market oriented and some are raw material oriented. Of the five coffee curing centres in the State, those at Valparai and Pattiveeranpatti were dominated by advantages of raw material, while those in Madras and Coimbatore were market oriented and that in Mettupalayam was power oriented.

4. *Tobacco and Beverages.* Tobacco factories and beverages form the fourth group of agro-based industries. In 1957, the manufacture of tobacco employed about 13,600 workers. It was, perhaps, the biggest employment potential agro-based industry in the State. Tobacco manufacturing from the locational point of view, should be divided into two—*bidis* and cigars. *Bidi* factories were concentrated in the northern districts—Coimbatore, Salem, North Arcot and Madras City. A very heavy agglomeration of *bidi* factories was in the northern and northwestern part of North Arcot district. The availability of *kendu* leaf in the local forest areas was the chief determining factor for their location in this part. *Bidi* factories of Madras City have the advantages of a large local market. Cigar manufacturing centres were dispersed in coastal and southern districts of the State. The largest agglomeration of cigar factories was at Dindigul in Madurai district. The growing of Virginia variety of tobacco in this district gave an incentive to the rise of cigar factory at Dindigul, an important railway junction of the State.

Beverage factories are small sized establishments. They are more ubiquitous in distribution and market oriented. Madras City had the largest concentration of beverage factories in 1957.

SOURCE : *Large Industrial Establishments in India*, 1957, Government of India, Ministry of Labour and Employment (Labour Bureau).



Location of Leather Industries, 1957

Method

THIS MAP BRINGS out the pattern of location of leather industry in the State. This industry can be divided into two branches—tanning industry and leather products. They are differentiated in this map by two shades of colour. Around each industrial centre circles are drawn proportionate to the workers absorbed by each type of leather industry. Figures within the circle indicate the number of factories.

Analysis

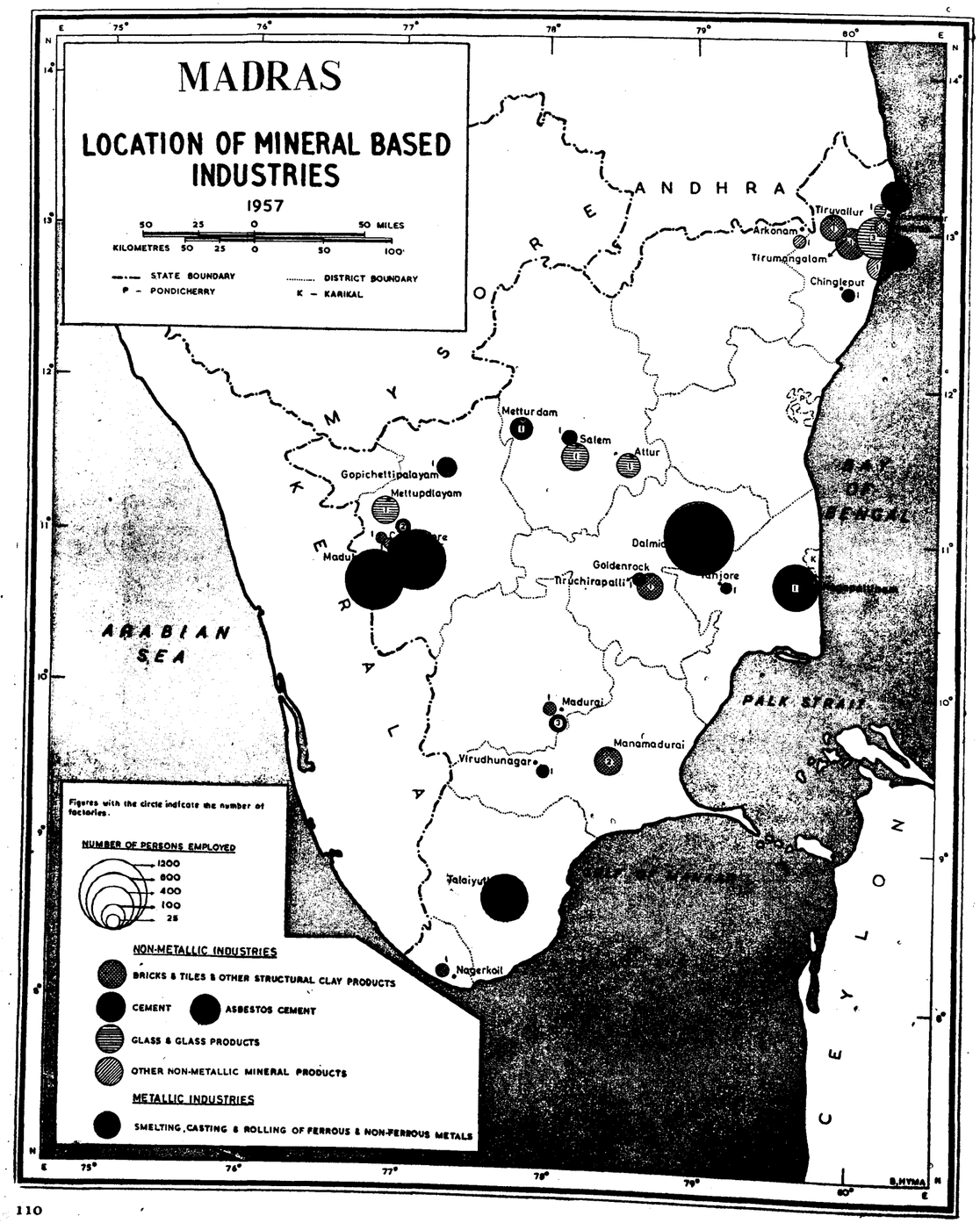
In 1957, Madras State had 251 tanneries with a total employment of 9,257 workers and seven leather product units with 218 workers. It is clear that tannery industry was the domineering leather industry absorbing about 97 per cent of its total workers.

The district of North Arcot has been by far the most important tannery area in the State. More than half the tannery centres of the State were concentrated in this district. The main attraction of this area for tannery industry was an ample supply of raw hides and skins because of its very high density of cattle and buffalo population (249 per square mile). The second important area of tannery industry was around Madras City in Chingleput district. Tanneries of this area absorbed about 27 per cent of the workers employed by the tannery industry of the State. The chief reasons for this heavy concentration may be attributed to the availability of raw materials in the local areas and the advantage of having Madras port for exporting finished products.

The other tanneries were dispersed in Coimbatore, Madurai, Salem and Tiruchirapalli districts where the density of livestock population is higher than the State average. They were located at important railway junctions of Erode, Salem, Dindigul, Podanur, etc., each of them having a river front. Transport facilities, the availability of raw materials and abundant water supplies were the chief criteria for selecting the sites of the tanneries at these centres.

Compared to tannery industry, the available employment in leather product industry was insignificant. This branch of industry employed only 2.7 per cent of the workers employed by the leather industry. Of the total seven units, five were concentrated in the satellite towns of Madras City. The local tannery industry and marketing facilities in the city stimulated the growth of this industry in this area. The other two are dispersed small units.

SOURCE: *Large Industrial Establishments in India*, 1957, Government of India, Ministry of Labour and Employment (Labour Bureau).



Mineral-based Industries

Method

THIS MAP SHOWS the location of mineral-based industries. These industries may be classified into two major groups—non-metallic and metallic industries. Non-metallic industries comprise cement, bricks and tiles, other structural clay products, glass and glassware and other miscellaneous products. The metallic industries indicate the fabrication of primary metals. The method of drawing used here is same as in the previous map.

Analysis

In 1957, Madras supported about 57 units of mineral-based industries with a total employment of 7,000 workers. About 78 per cent of these workers were absorbed by non-metallic industries and 22 per cent by metallic industries.

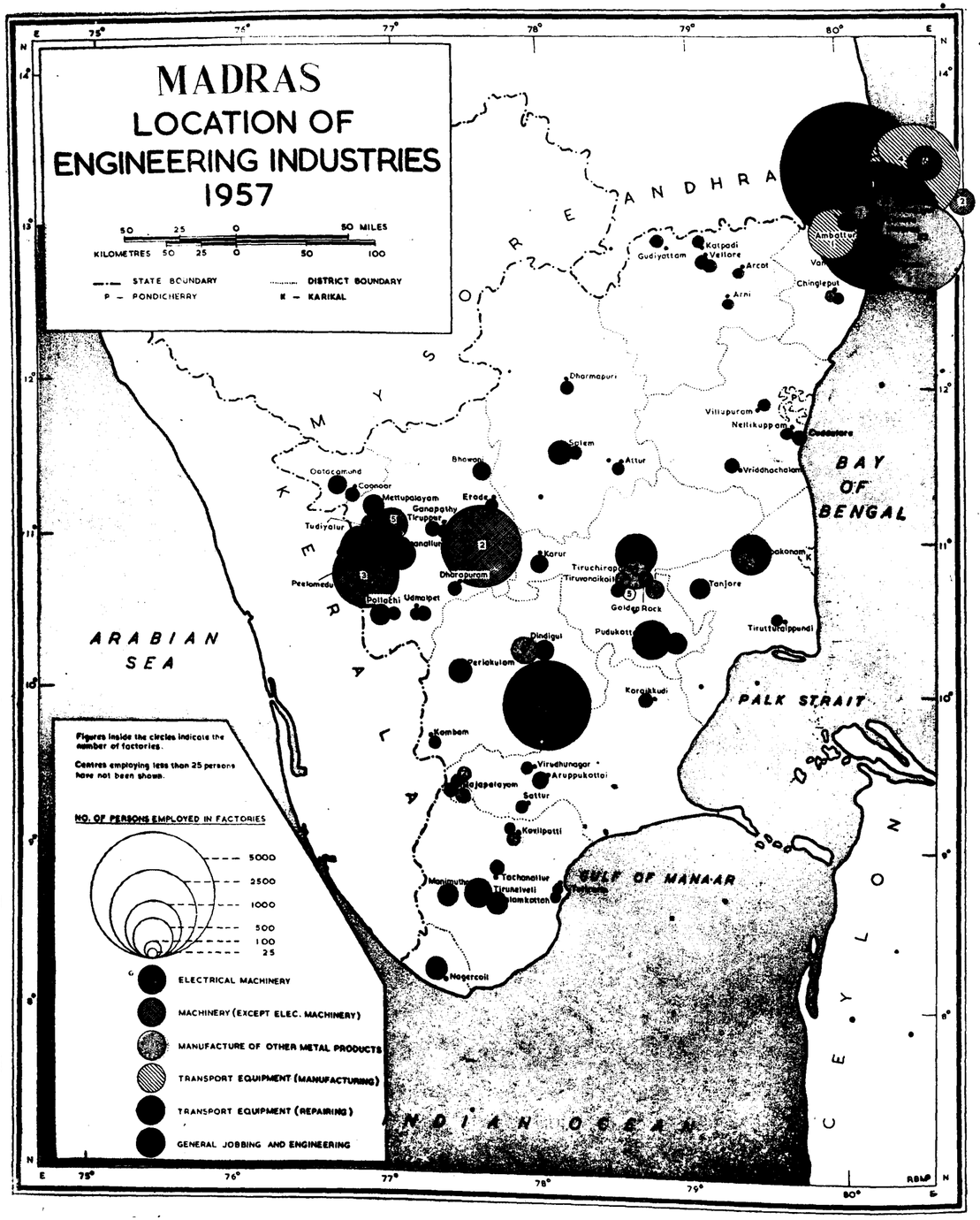
Cement manufacturing has by far been the most important non-metallic industry in the State. It absorbed about half the workers of mineral-based industries. The location of cement industries in Madras State follows the distribution of limestone. There were three dispersed cement plants at Madukarai (Coimbatore district), Dalmiapuram (Tiruchirapalli district) and Talaiyuthu (Tirunelveli district). Deposits of excellent limestone, transport facilities, and availability of power attracted cement manufacturing industry to these centres. The cement industry of Madukarai gave an incentive to the growth of an asbestos cement factory at Podanur with a total employment of 790.

Brick and tile manufacturing units are scattered because the distribution of raw material (clay) is ubiquitous. They selected sites near the towns and cities which are the main markets for these bulky finished products.

The glass factories found sites in towns or cities nearest to the quartzite or glass-sand deposits. The largest concentration was in Madras City due to the abundance of glass-sands in the locality and its transport facilities for assembling soda ash. The other glass manufacturing centres were in Salem and Coimbatore districts where the availability of glass-sands and cheap hydel power decided their location. A number of miscellaneous non-metallic industries had grown up in Madras City to serve the local market.

The other major branch of mineral-based industry is the fabrication of primary metals. Despite the dearth of iron ore and other ferrous minerals, Madras State supported a few steel rolling mills. Nagapattinam supported the biggest steel rolling mill in the State with a total employment of 575 workers. The advantage of low assembling cost of raw materials due to the use of coastal waterways attracted this centre for the opening of this steel mill. For a similar reason Madras City with its satellite town of Tiruvottiyur supported three small metal fabrication units. The other metallurgical centres of small size selected their sites in big industrial towns of Madurai, Coimbatore, Salem, Mettur, Gopichettipalayam, etc. Market stands out as the single deciding factor for the location of these industries in these inland cities.

SOURCE : *Large Industrial Establishments in India*, 1957, Government of India, Ministry of Labour and Employment (Labour Bureau).



Location of Engineering Industries

Method

THIS MAP SHOWS the location of engineering industries in the State. These are classified into six groups:

(*i*) Electrical Machinery,
(*ii*) Machinery (other than Electrical Machinery),
(*iii*) Manufacture of other Metal Products,
(*iv*) Transport Equipment (Manufacturing),
(*v*) Transport Equipment (Repairing),
(*vi*) General Jobbing and Engineering.

The method of drawing used here is same as in the previous maps (Maps 42–44).

Analysis

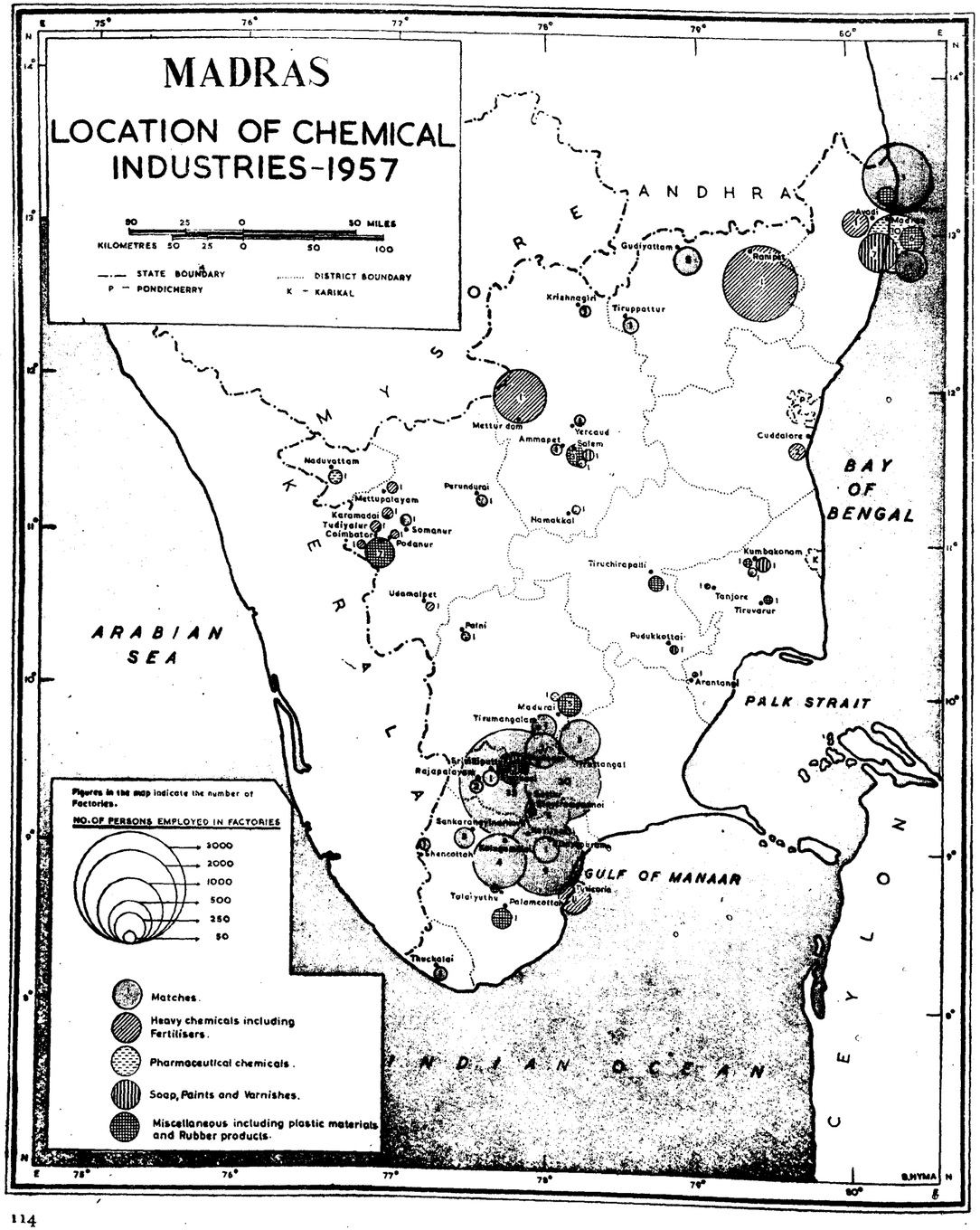
Madras ranked third among the States leading in engineering industries. In 1957, about 35,000 workers were employed in about 600 engineering workshops of this State. Among the six branches of engineering industries, the repairing service shops ranked first in employment strength (38%) followed by general jobbing and engineering industries (25%), machinery industry (14.0%), transport equipment manufacturing (12%), manufacturing of metal products (9%) and electrical machinery (2%) industry. Madras City and its immediate suburban areas lying in Chingleput district had the largest concentration of engineering industries. About 57 per cent of the total employees in the engineering industries in the State were concentrated in this part of the State. Transport equipment factories, general jobbing and engineering, and metal product manufacturing are the major branches of engineering industries in this centre. Transport facilities and market advantages attracted the industries to this centre.

The second area of heavy concentration of engineering industries was Coimbatore City and its satellite towns. Here manufacturing of machinery is the predominant industry followed by general jobbing and engineering and transport equipment repairing workshops. Incentive to the growth of machinery industry in this centre appears to have come from the demand for machinery for textile and tea-processing industry.

Madurai and Tiruchirapalli are other important centres with an agglomeration of transport equipment repairing workshops. Railway repair shops constitute the most important branch of engineering industries in these centres mainly because they are the most important railway junctions in the State.

Other than the above four centres, engineering industries are hardly agglomerated. They are usually small repairing workshops dispersed all over the State.

SOURCE : *Large Industrial Establishments in India*, 1957, Government of India, Ministry of Labour and Employment (Labour Bureau).



Location of Chemical Industries

Method

THIS MAP INTENDS to show the location of chemical industries. The chemical industries of Madras State may be classified into five categories—matches, heavy chemicals, pharmaceuticals, soap-paint-varnishes, and miscellaneous chemicals including rubber and plastic products. The method of drawing used here is the same as in the other industry map.

Analysis

In 1957, Madras absorbed only 13 per cent of the country's total employees in chemical industries and contributed only 6.4 per cent of the country's net value of chemical output. In 1957 there were 231 chemical factories employing 19,204 persons.

Manufacture of matches was the main chemical industry of the State absorbing about 66 per cent of the total workers employed in chemical industries in the State. In 1957, Madras had 127 match factories with a total employment of 12,800. This industry was highly localized in the heart of Ramanathapuram and Tirunelveli districts. About 80 per cent of the workers in the match factories were concentrated in these two districts because they had the advantage of having a special kind of softwood trees known as *Salamalia malabaricum* which can be used for making match stick. The heaviest concentration of match factories (all were small units) was at Sivakasi, a nodal town of roads and railways. The biggest match factory was, however, in Tiruvottiyur, adjacent to Madras City. It absorbed about 1200 workers. A large labour reserve, a strategic location with regard to market, and easy access to raw materials attracted this big factory to the town.

Heavy chemicals is the second important employment potential chemical industry in the State. There were about 29 heavy chemical factories in 1957 absorbing about 16 per cent of the workers employed in chemical industries. The biggest heavy chemical plant was at Ranipet in North Arcot district. It produces diverse chemical products such as sugar, coffee, starch, superphosphate, etc. It selected its location in a district whose high density of livestock population helps in keeping the assembly cost of milk and bones low, the two basic raw materials for toffees and superphosphate manufacturing respectively. The second big heavy chemical plant is at Mettur dam with a total employment of more than 700 workers. It manufactures caustic soda and chlorine. The greatest attraction for this industry to be located at Mettur dam is the cheap hydro-electric power from the Mettur project. Salt refineries and artificial manures are the other two heavy chemical industries of the State. Tuticorin was the most important centre of salt refinery industry in the State with 11 small units engaging 311 workers. The marine location and the natural advantages of strong solar insolation attracted the salt refinery industry at Tuticorin. There were a number of small sized artificial manure factories in the western part of the Coimbatore district. They are linear with the railway between Coimbatore and Mettupalayam. The transport facilities for assembling raw materials and the availability of cheap hydel power were the chief criteria for selecting sites of these factories at this area.

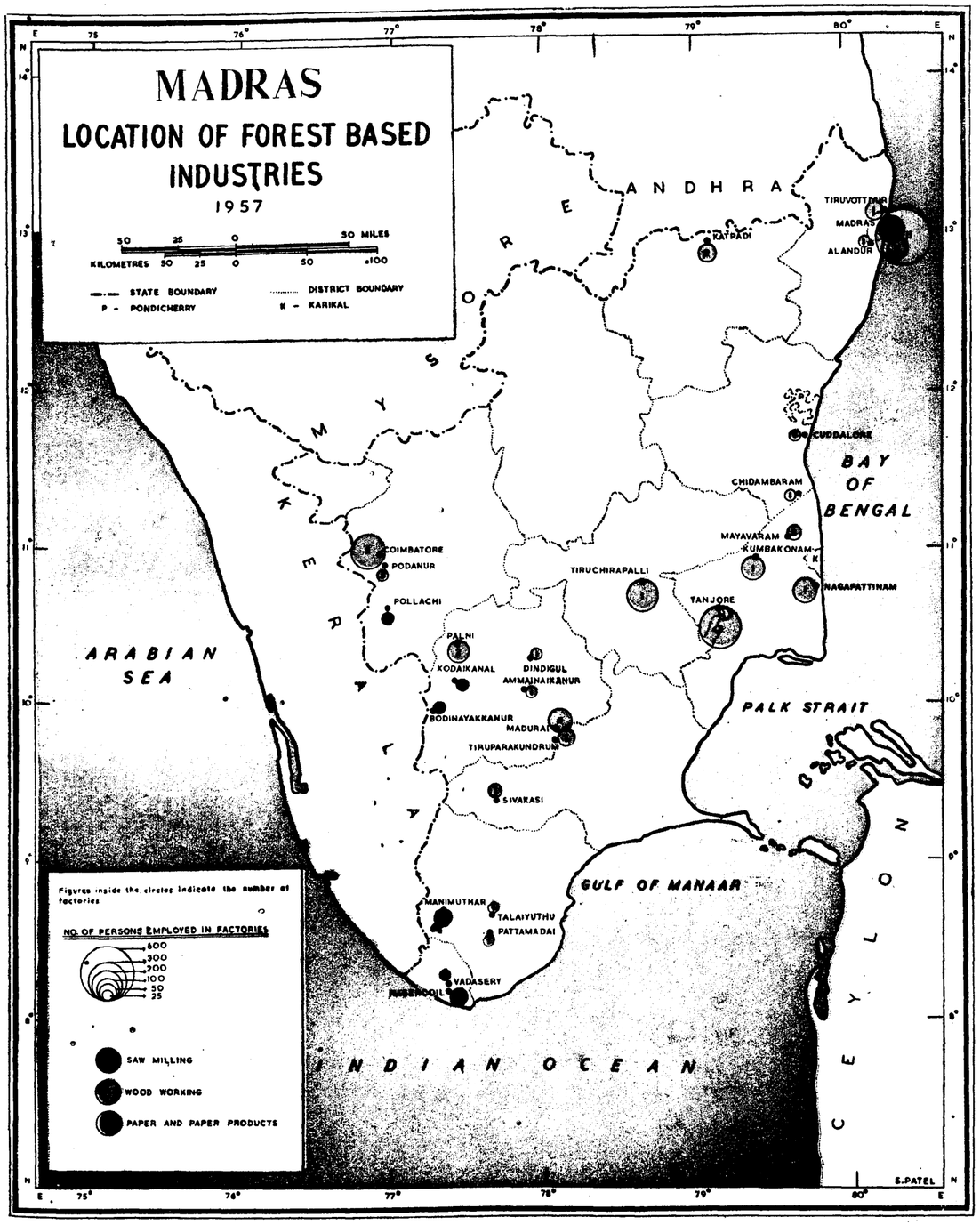
Pharmaceutical industry ranked third in employment potentiality among the chemical industries. It was concentrated in Madras City and its adjacent town of Tiruvottiyur mainly because of the ready market and easy accessibility to raw materials.

Soaps, paints, and varnish factories were agglomerated around Madras City. The advantages of a large market have attracted these industries at this centre.

Among the miscellaneous group rubber product is important. There were three rubber plants of fairly medium size (employment between 100—200 persons) located in the State. Of these, two are raw material oriented and one is market oriented. The raw material oriented centres are at Coimbatore and Madurai cities, which are close to the rubber growing areas of the State. The third centre was at Tiruvottiyur, a satellite town of Madras City. This factory is conveniently located to serve the City's demand for rubber goods.

SOURCE : *Large Industrial Establishments in India*, 1957, Government of India, Ministry of Labour and Employment (Labour Bureau).

Map 48



Map 48

Location of Forest-based Industries

Method

THIS MAP SHOWS the location of industries using wood as raw material. These industries are wood working saw milling, and paper manufacturing. The method of drawing in this map is the same as in the other industry map.

Analysis

In 1957, wood working was the principal forest-based industry absorbing about 80 per cent of workers engaged in forest-based industries followed by saw milling absorbing 11 per cent, and paper industry 9 per cent.

Furniture making—the major branch of wood working industry—is composed largely of small units. Except for six medium sized units (with employment between 100—400 persons), all the other units are small with employment hardly exceeding 50 workers. The largest concentration of furniture manufacturing units was in Madras City. There were 11 factories with a total employment of 638 in this city. Tanjore district was the second important furniture making area in the State. It supported seven factories, four of which were of medium size. Nagapattinam, Kumbakonam and Tanjore are important towns in the district for making furniture. Tiruchirapalli and Coimbatore are the other two towns with some significance in furniture making. The existing locations of furniture industry in the State indicate that they are market oriented.

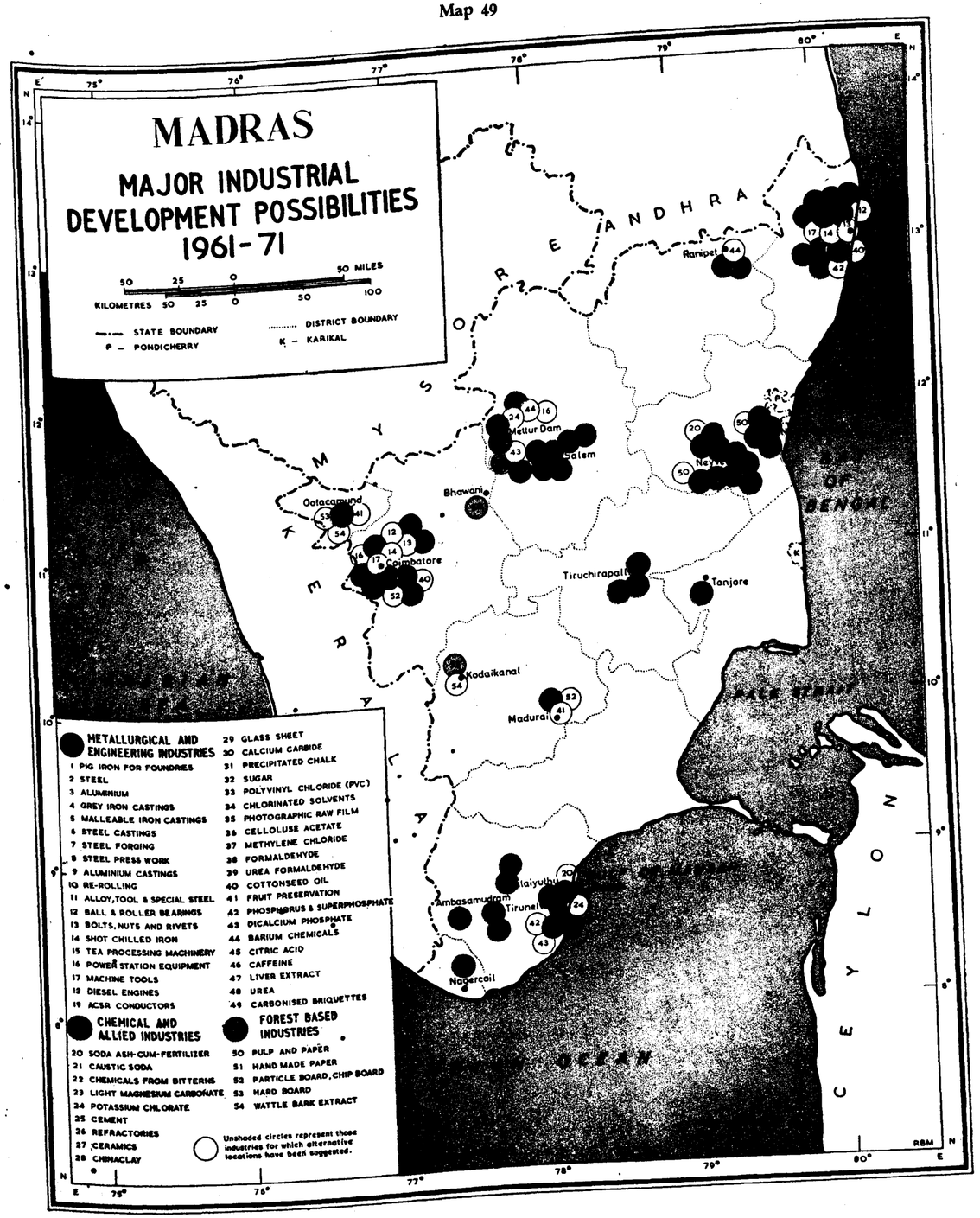
Carpentry and joinery mills form the other branch of wood working industry. Majority of these units are small and show a wider distribution. The largest concentration of carpentry works was in the forest area of Madras district, i.e., in Palni taluk.

The general distribution of saw milling industry except in Madras City, followed the distribution of forests. Their concentration was in the forest area of Kanyakumari, Tirunelveli and Madurai districts. In all, there were 15 saw milling centres with a total employment of 303. They are all small units with employment hardly exceeding 20.

Paper and paperboard industry engaged only 9 per cent of the workers under forest-based industry. There were merely 10 small sized paper manufacturing units dispersed in Sivakasi, Madurai, Dindigul, Podanur, Madras, Chidambaram and Tanjore. The present distribution of paper and paperboard industry indicates the sporadic character of its growth in the State.

SOURCE : *Large Industrial Establishments in India*, 1957, Government of India, Ministry of Labour and Employment (Labour Bureau).

Map 49



Map 49

Major Industrial Development Possibilities

Method

THIS MAP SHOWS the location of prospective industries during 1961—71. They are divided into three major groups : (*a*) Metallurgical and Engineering industries, (*b*) Chemical and Allied industries, and (*c*) Forest-based industries. They are shown by circles with uniform radii and the number within the circle indicates the type of industries under each group.

Analysis

About nineteen categories of metallurgical and engineering industries show possibilities of development in Madras State. The National Council suggested the location of two pig iron plants—one at Salem and the other at Coimbatore—and one steel plant at Salem. The reasons for selecting sites for iron and steel plants at these centres are to provide encouragement to the dispersal of industries, to give relief to the highly congested traffic on the line between Vijayawada and Madras, to have a relatively more dependable source of supply for local consumers and for offering incentive to the development of engineering industries.

Since the engineering industry of the State is largely handicapped by the inadequacy of intermediate processing facilities such as foundries and forges, the National Council has suggested the opening of factories for grey and malleable iron castings, steel forgings and castings, steel press work, aluminium castings, electrical and steel sheets, re-rolled steel and alloys in the State. Salem is considered the best location for re-rolling mill, Madurai for malleable iron castings, Coimbatore for grey iron castings and Madras for the rest. The National Council has further recommended the establishment of nine types of engineering industries :

(*i*) Alloy, Tool and Special Steel,
(*ii*) Ball and Roller Bearings,
(*iii*) Bolts, Nuts and Rivets,
(*iv*) Shot Chilled Iron,
(*v*) Tea Processing Machinery,
(*vi*) Power Station Equipment,
(*vii*) Machine Tools,
(*viii*) Diesel Engines,
(*ix*) ACSR Conductors.

The sites recommended for their location are Madras, Salem and Coimbatore which are the major industrial cities of the State.

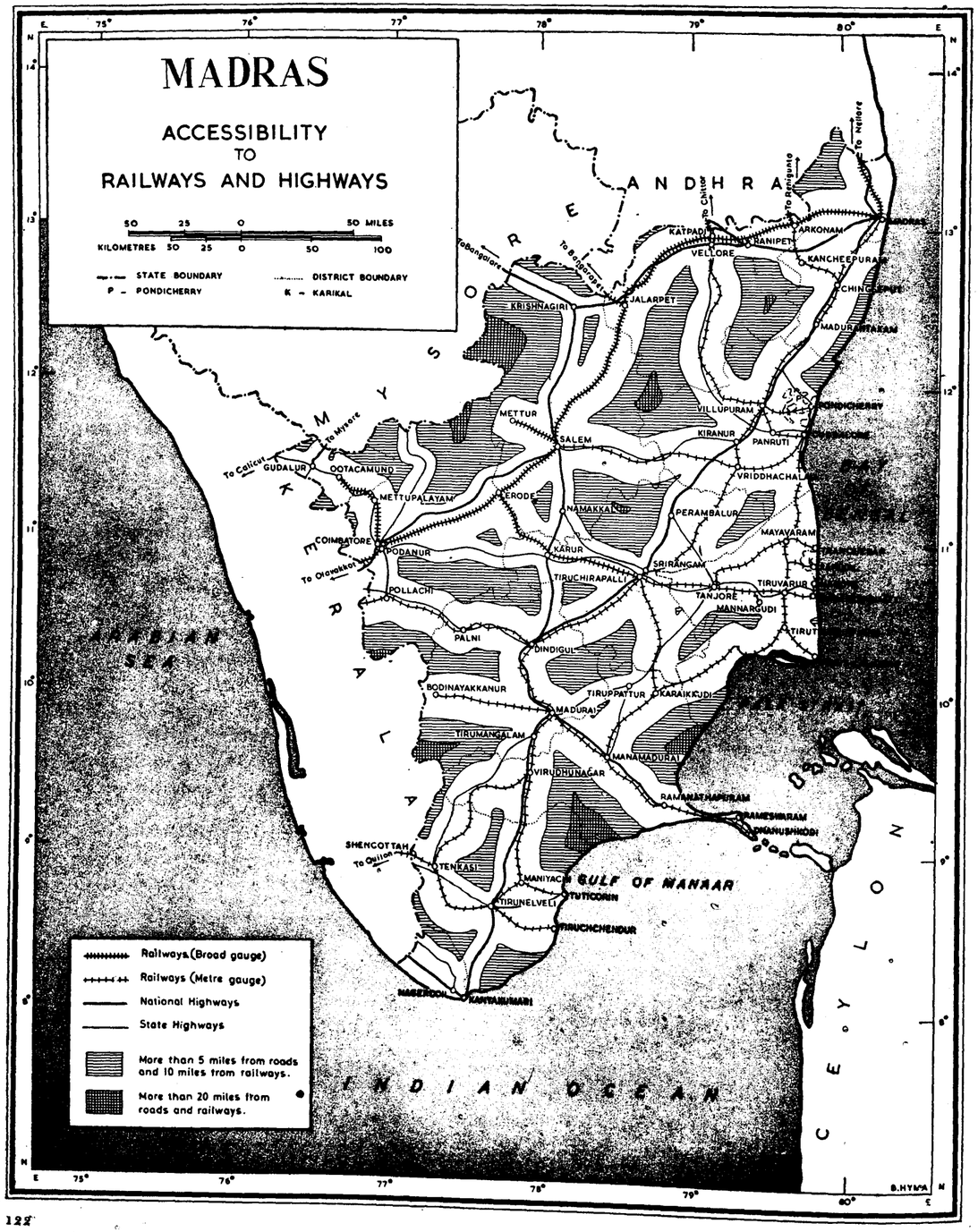
About thirty types of chemicals and allied industries have been recommended. Chemical industries would be based mainly on marine salt and lignite deposits of Neyveli. The others are refractories, ceramic industries, sugar industry and industries based on magnesite, clay, quartzite, etc.

Tuticorin, which is the chief centre of salt extraction in the State, has been recommended as the site for various marine chemical industries. The chemical industries which are possible to develop from the lignite deposits of Neyveli are Polyvinyl Chloride, Chlorinated Solvents, Methylene Chloride, Formaldehyde, Urea, Carbonized Briquettes, Citric Acids, etc. Neyveli and Nellikuppam have been recommended as sites for these industries by the National Council.

The National Council has further recommended Salem and Tiruchirapalli as the sites for Magnesite refractories, Madras for Carborundum refractories and crucibles, and Ranipet for Ceramic industry. Over and above these units, about sixteen sugar mills have been recommended for dispersal into six districts of South Arcot, Tanjore, Tiruchirapalli, Coimbatore, Kanyakumari and Tirunelveli (only a few possible sites have been shown in the map).

The prospective forest-based industries in the State are paper and paper pulp, paper board, hard board, particle board and wattle bark extraction. Based on the supply of bamboo, wattle, bluegum, straw and bagasse likely to be available from the forests of the State, a 15,000-ton plant for making paper at Mettur dam, a 15,000-ton plant for the manufacture of rayon pulp and paper pulp at Bhavanisagar, a 25,000-ton plant for making printing and wrapping paper at Nellikuppam or Neyveli are recommended. With the availability of Urea Formaldehyde and Phenol Formaldehyde from domestic sources, a plant for manufacturing particle board could be established at Kodaikanal using the wattle bark available in the neighbourhood. The National Council has also recommended the setting up of a hard board plant in the Nilgiri district. In anticipation of the availability of wattle bark from the plantation areas, two plants for manufacturing wattle bark extraction are recommended for establishment—one at Kodaikanal and the other in the Nilgiri district.

SOURCE : NCAER : *Techno-Economic Survey of Madras*, Government of Madras, 1961.



Accessibility to Railways and Highways

Method

ON AN OUTLINE map of Madras, (scale 1 : 1,260,000) the railways, the National and the State highways, are first plotted. The areas, within 10 miles from the railways and 5 miles from the highways, are delineated for differentiating them from the areas not easily accessible to railways and highways. Areas more than ten miles away from the railways and five miles away from the highways are considered as inaccessible. These inaccessible areas are presumed to be highly inaccessible if the distances from either road or railways exceed twenty miles. The areas, which are inaccessible to the highways and the railways, are shaded according to the degree of isolation. This map focuses attention on the location where the development of railways and the National and State highways is still necessary.

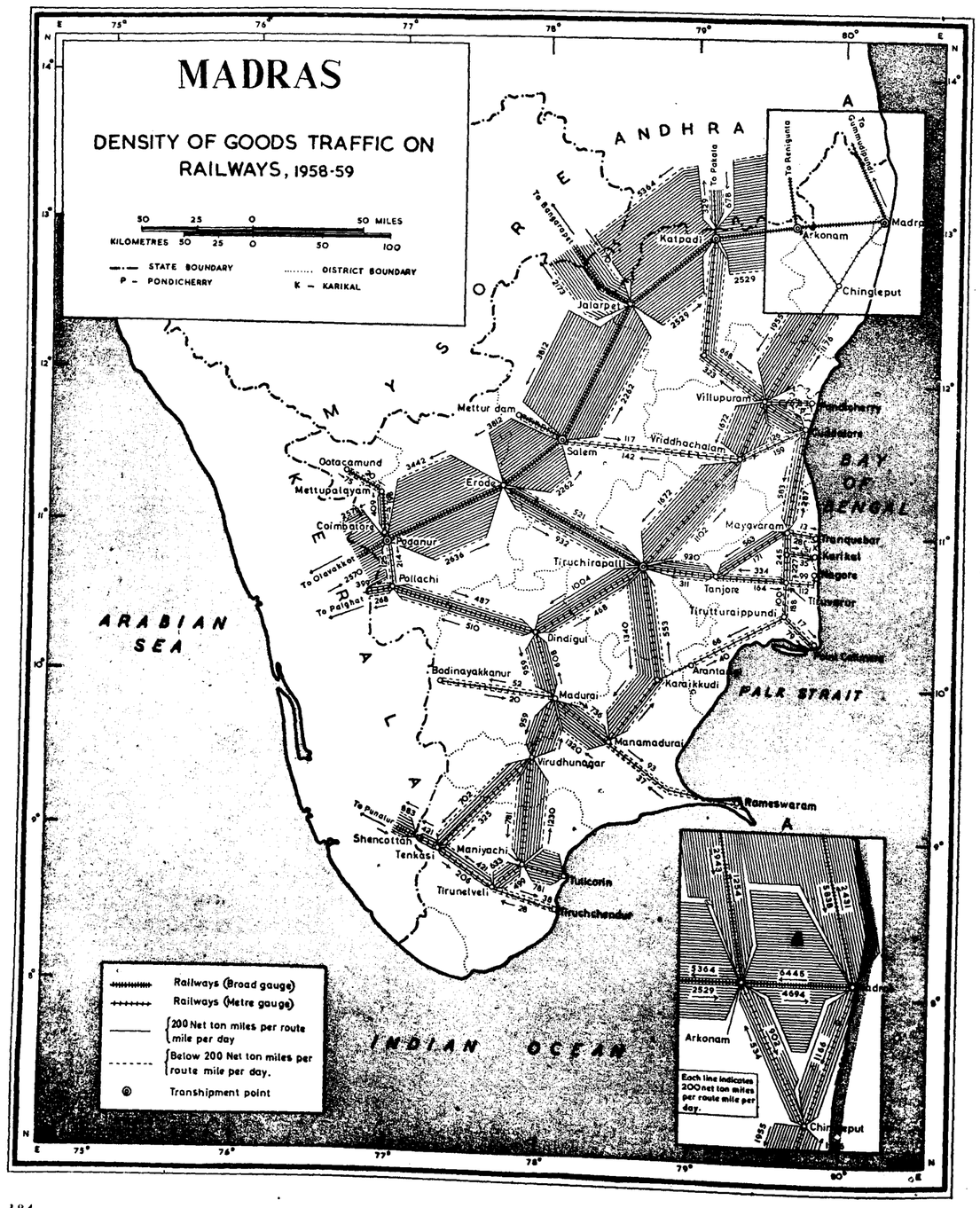
Analysis

The three coastal districts of the north—Chingleput, South Arcot and Tanjore—have an excellent network of roads and railways. There is not a single station whose distance from the railways and highways exceeds 20 miles. All the towns and cities have both rail and road accessibility. Unlike the northern coast, the southern coast has a relatively thinner concentration of highways and railways. There are two big patches of inaccessible tracts which stand out conspicuously on either side of the railway line connecting Madurai and Rameswaram. The absence of a good network of roads and railways in this part (Ramanathapuram district) can be attributed to its slack trade, not enough commercial activity and little industrial growth, because its environmental factors have not been congenial. Except in Tuticorin-Tiruchandur area, there is hardly any railway in the whole of south coast. This part is in need of more railway constructions.

Inaccessible tracts are quite prominent in northern and western districts where limitations to road and railway constructions are set by rugged relief. They can roughly be identified with the forested plateau of Coimbatore and Salem districts, the Shevaroy-Javadi-Pachaimalai-Kollamalai group of hills in the north, and the Anaimalai-Varushanad-Andipatti hills in the west. The only exceptional hill area is the Nilgiri district which is well served by the highways and railways. This is mainly because of the predominance of the tea plantation industry in this district.

SOURCE: *India and Adjacent Countries, Survey of India,* scale 1 : 2,534,400.

Map 51



Map 51

Density of Goods Traffic on Railways, 1958-59

Method

THIS MAP BRINGS out the density of inward and outward rail-borne goods traffic for 1958-59. The flow of goods traffic is shown by solid lines, each indicating 200 net ton miles per route mile per day, moving in each direction, and by broken lines, each indicating below 200 net ton miles per route mile per day.

Analysis

Madras has 2,118 miles (3,388 kms) of railways. The railway network touches all districts except Kanyakumari district at the southern end of the State. The total railway mileage in the State is made up of 494 miles (790 kms) of broad gauge and 1,624 miles (2,598 kms) of metre gauge. The eastern and southern regions of the State are served entirely by metre gauge line, while the northern and western regions are linked by the broad gauge trunk line between Madras and Coimbatore.

It is worth noticing that the inward goods traffic exceeds the outward goods traffic in every section of the railway. This is mainly because of the fact that Madras is a terminal State largely deficient in some basic industrial raw materials and fuels. Madras has to import bulky goods such as coal, iron ore, steel, etc., and export relatively light processed goods (textiles, foodgrains, salt, etc). This implies that wagons carrying bulky raw materials have to return empty due to lack of suitable goods to carry. This imbalance of incoming and outgoing traffic is difficult to avoid because the State's location is terminal.

The density of goods traffic on the broad gauge line is significantly high. It is almost three to four times that on the metre gauge line. The chief contributory factor to this high density is that this line carries bulky goods for distribution to the industrial centres such as Vellore, Salem, Erode, Coimbatore, etc. The metre gauge line, on the other hand, serves the agricultural areas where density of traffic is low due to the movement of lighter goods, such as foodgrains and other agricultural commodities. The highest density of inward traffic is on the broad gauge line between Madras and Arkonam; 6,445 net ton miles per route mile per day (See Inset Map A). From Arkonam the west-bound traffic decreases in density from 6,445 to 3,442 net ton miles at Coimbatore, because of the diversion of traffic on metre and broad gauge lines at Katpadi, Jalarpet, Salem, Erode, etc.

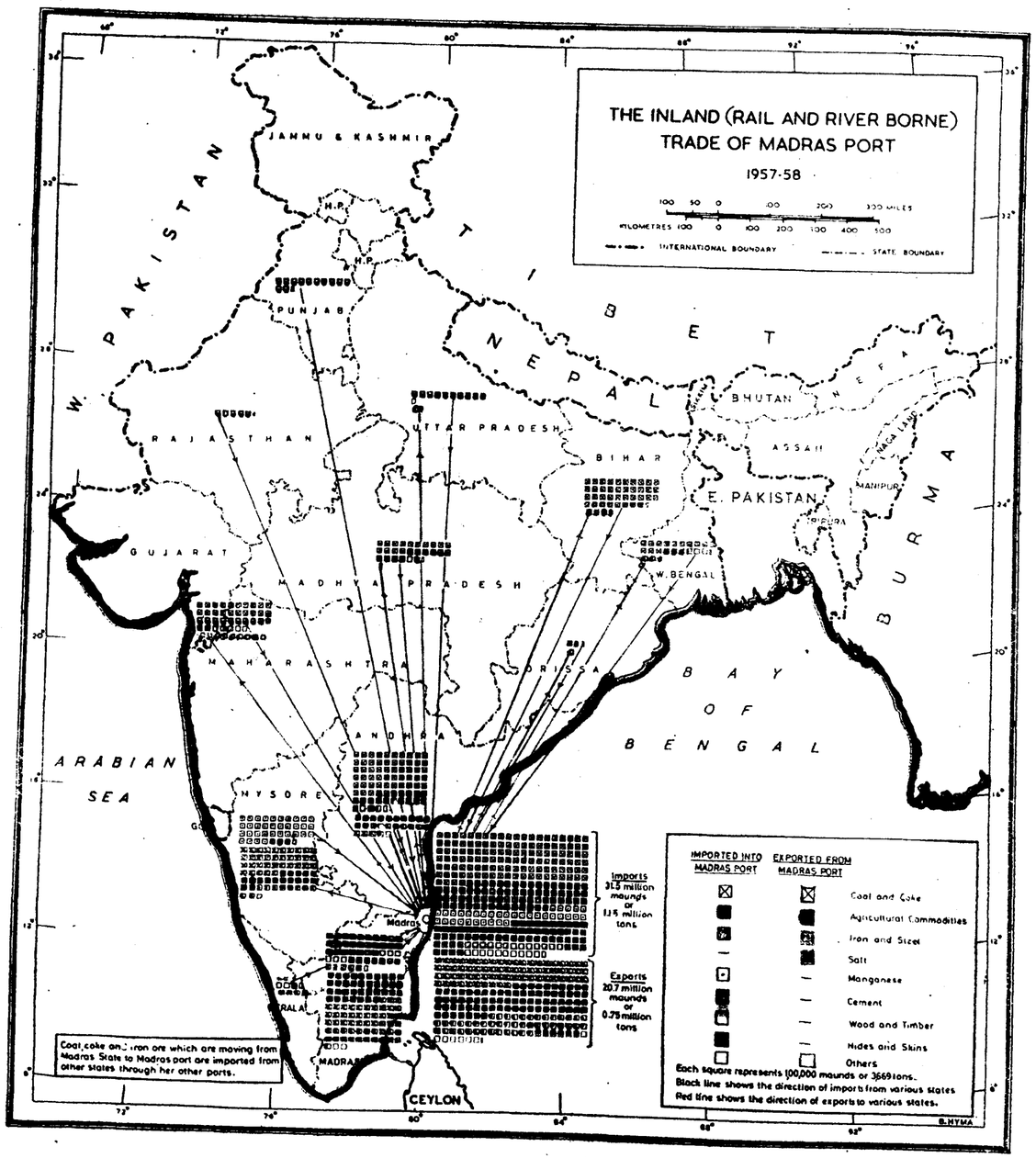
The maximum density of traffic on the metre gauge line is between Chingleput and Villupuram. This section of the line carries the traffic diverted from Madras Beach station and Arkonam. From Villupuram the density decreases gradually southward from 1900 tons to 93 tons (between Manamadurai and Rameswaram) because of the dispersal of traffic towards west and east at Vriddhachalam and Tiruchirapalli. Another section of the metre gauge line, where incoming traffic flow is relatively high (1230 ton miles), is between Tuticorin and Madurai. Tuticorin imports coal, copra, scrap iron, etc., which travel through this line north-ward for distribution.

The density of goods traffic is significantly low on the metre gauge line crossing through the Cauvery delta linear with the coast, the lower Vaigai basin, and between Tiruchendur and Tirunelveli, between Madurai and Bodinayakkunur, and between Salem and Vriddhachalam. This is mainly because the area served by these lines is purely agricultural.

The chief bottleneck in the railway transport of Madras State is at Madras from where traffic moves west on the broad gauge line and south after transhipment to the metre gauge line. Congestion of traffic is quite marked at Madras railway station due to the inability of its marshalling yard to handle the traffic. Hence improvement of the line capacity is one of the measures to be taken for relieving the congestion of traffic at the Madras station.

SOURCE: Southern Railway, *Narrative Report by the General Manager*, 1958-59.

Map 52



Map 52

The Inland (Rail and River-borne) Trade of Madras Port, 1957-58

Method

THIS MAP SHOWS the bulk of inland trade (rail and river-borne) of Madras port. The quantities of export and import, expressed in net weight, are shown by proportionate number of squares. Red and black colours are used for differentiating export and import respectively.

Analysis

Coal and coke, agricultural commodities, and iron and steel represent the major portion of the trade carried by rail and riverways to Madras port.

Of the total 1.15 million tons of goods imported into Madras port in 1957-58, coal and coke accounted for 39.3 per cent, agricultural commodities 22.4 per cent, manganese ore 11.3 per cent, iron and steel 8.7 per cent. The other commodities accounted for about 19.3 per cent.

Of the total 0.75 million tons of exports from Madras port, 37.2 per cent was accounted for by agricultural commodities, 34.2 per cent by coal and coke, 22.1 per cent by iron and steel, and 6.5 per cent by other goods.

Madras port has the biggest share of trade with its immediate hinterland, i.e., Madras State. In 1957-58, about 45.0 per cent of its total export was meant for this State and its import on the other hand was 14.5 per cent of the total. Agricultural commodities, coal and coke, iron and steel were the major items of export from the port to this State, while hides and skins, agricultural commodities and cement were the principal items imported into the port from this State. Since the State is deficient in industrial fuels and metals, the import of coal and coke and iron and steel is significantly high. The result is that the net weight of inward traffic exceeds that of outward traffic in the State.

Mysore ranks second among the States in sharing trade with the Madras port. In 1957-58, about 30 per cent of the total export from Madras port was bound for this State, while 12 per cent of the total import to this port was from this State. Coal and coke, agricultural commodities and iron and steel were the main articles of export from the port to this State. Among the articles imported into the port, manganese ore was most significant. It alone accounted for 81 per cent of the total export from the State. In all, the net weight of outgoing commodities from the port to the State exceeded that of incoming commodities from the State to the port.

Andhra is the third important State with a significant trade relationship with Madras port. But unlike Madras and Mysore States, Andhra took less and gave more to the Madras port. Its net weight of export to the Madras port was about three times that of import. Coal and coke was the biggest item of export accounting for 70 per cent of the total, followed by agricultural commodities accounting for 22.7 per cent of the total. The other items of export were wood and timber, hides and skins, manganese, iron ore, etc. Among the imported articles, agricultural commodities led in net weight accounting for 52 per cent of the total imports. Iron and steel, coal and coke and other miscellaneous articles accounted for the

Madras port carries on trade with other States as well. Among these States, Bombay, Bihar, Madhya Pradesh and West Bengal are significant.

In each of these States, the net tonnage of exports to Madras port exceeded that of imports. Bombay State, for example, exported 0.14 million tons of goods to Madras port and imported back only 0.03 million tons of goods in 1957-58. Coal and coke, agricultural commodities, iron and steel, hides and skins, and wood and timber were the principal items of export from Bombay to Madras port; while agricultural commodities formed the main item imported from Madras port to this State.

Bihar's net weight of export to Madras port was almost ten-fold that of import, mainly because its export commodity was principally coal and coke, which is much heavier than salt, the main item of import.

West Bengal exported to Madras port iron and steel, coal and coke, hides and skins and other items, and imported in return agricultural commodities. Obviously the net weight of export exceeded that of import.

Madhya Pradesh shows a tremendous imbalance of trade with Madras port. The net weight of export from this State to the port is about 30 times that of import. Coal and coke, and agricultural commodities went out of the State, while sugar and salt entered into the State.

Madras port also has some commercial ties with the distant States like Rajasthan, Uttar Pradesh and Punjab. It is, however, interesting to note that Kerala State, in spite of its location next to the Madras State, does not have enough trade with the port. This is probably due to the State's greater dependence upon coastal trade than on rail and river-borne trade. Nevertheless, Kerala's net weight of import, such as iron and steel, sugar and salt from this port exceeded that of export comprising agricultural commodities and wood and timber.

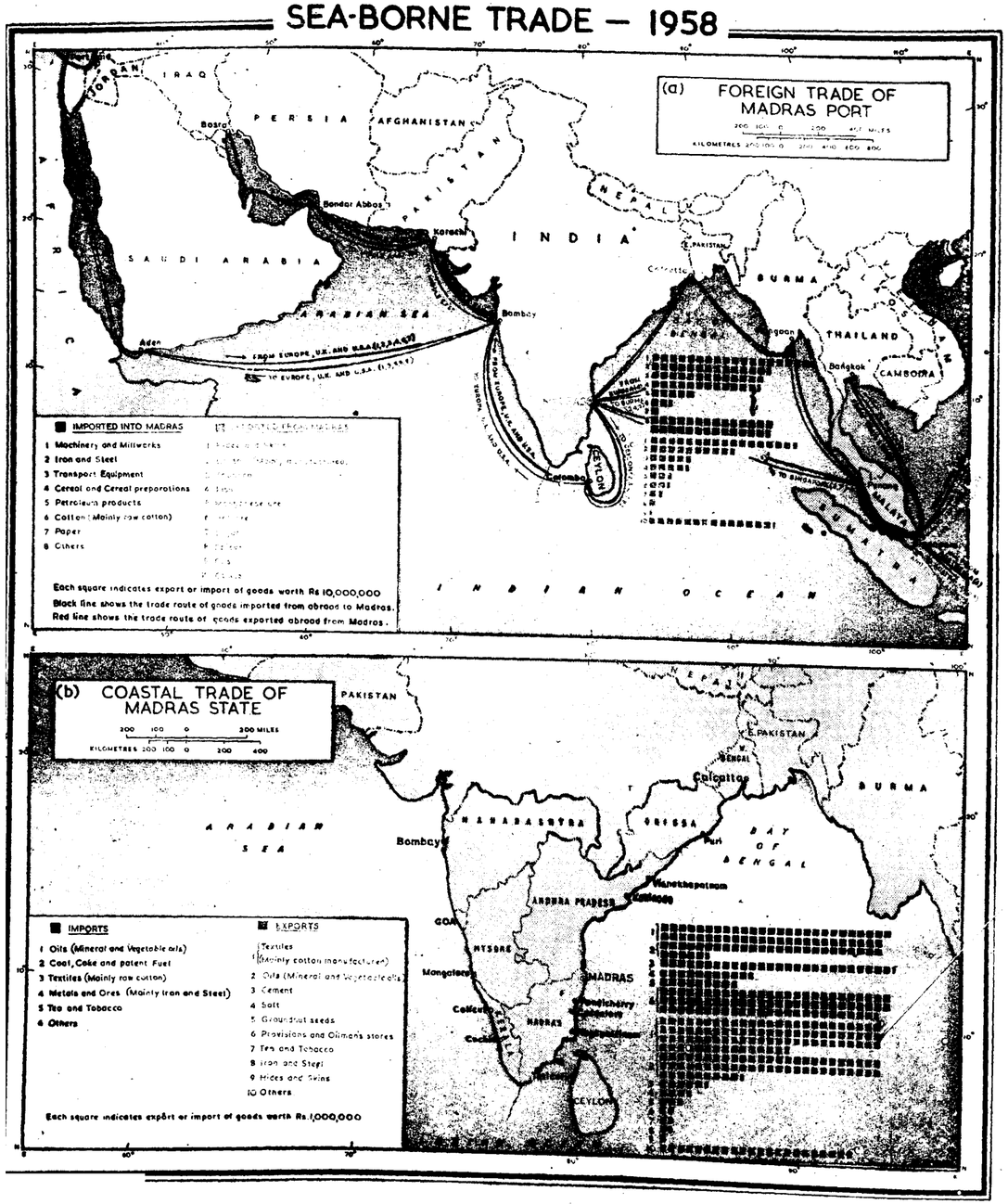
The above analysis may be summarized as follows:

(*i*) The incoming goods to Madras port by rail and river boats exceeded the outgoing goods in net weight. It is true of all categories of commodities except agricultural products, iron and steel, and salt.

(*ii*) For all States other than Madras, Mysore and Kerala, the incoming traffic to the port exceeded the outgoing traffic from the port.

Since the incoming traffic is largely of bulky goods like coal and coke, iron and steel, manganese ore, etc., many of the wagons carrying these goods return empty. From the point of view of transport economy, a balance between incoming and outgoing traffic is desirable. To some extent, this imbalance can be reduced by producing specialized engineering goods for export to other States.

SOURCE: *Accounts Relating to the Inland (Rail and River-borne) Trade of India for Twelve Months ending March* 1958; Department of Commercial Intelligence and Statistics, Ministry of Commerce and Industry, Government of India.



Sea-borne Trade, 1958

Method

THIS MAP COMPRISES of two sections. The upper section shows the foreign trade of Madras port and the lower section shows the coastal trade of Madras State.

The value of articles exported to and imported from abroad is shown by graphical methods, each square representing export or import of goods worth Rs. 10,000,000.

In the case of coastal trade of Madras State, each square represents goods worth Rs. 1,000,000. Two colours are used; black for imports and red for exports. For both foreign and coastwise trade the country-wise share to the total export and import is not shown due to the absence of reliable data.

In case of foreign trade, however, the trade routes with specific mention of the countries participating in trade transactions and the commodities of export and import are shown.

Analysis

Foreign Trade : In 1958, Madras showed an adverse balance of trade. Her imports exceeded exports. She imported Rs. 942.3 million worth of goods and exported Rs. 585.3 million worth of commodities.

Of the total import, capital goods such as machineries, iron and steel, transport equipment, etc., accounted for 47.3 per cent, cereals and cereal products 13.0 per cent, other consumer goods such as paper, raw cotton and yarn, petroleum products, glassware, manures, etc., accounted for another 40 per cent. The chief suppliers of capital goods to Madras port are the U.K., the U.S.A., West Germany and Japan. Cereals and cereal products are imported from Burma, Thailand, Australia and the U.S.A. Among the other consumer goods paper is imported from the U.K. and Sweden; cotton yarn from the U.K. and Japan; petroleum products from the Middle East; glassware from the U.K., Belgium and Japan; and manures mainly from Belgium, West Germany, France and Italy.

The export commodities, except cotton piece goods, are all unfinished products. Hides and skins, cotton goods, tobacco, cured fish, manganese and iron ore, onions and spices, sugar and oils are the principal items of export, the respective percentages to the total export are 29, 17, 9, 8, 8, 4, 1.7 and 1. The U.K., the U.S.A., Italy, West Germany, and Australia are the principal importing countries of hides and skins. South-eastern Asiatic countries of Burma, Ceylon, Malaya, Thailand, Hongkong, Fiji Island, and Australia are the principal customers for cotton piece goods. Fish is sent to Burma and Ceylon, spices to the U.K., the U.S.A., the U.S.S.R., Italy, etc.; sugar to Hongkong, Malaya and Pakistan; tobacco to the U.K., Ceylon and Australia.

Coastal Trade: Like the foreign trade, the coastal trade also showed some imbalance, though on a smaller scale.

In 1958, the State showed Rs. 204.6 million worth of imports against Rs. 190.1 million worth of exports. Oils (mainly mineral), coal and coke, textiles, iron and steel and other metallic ores, were the main items of import, the respective percentages to the total import being 25.0, 15.0, 13.0, and 5.1.

As regards export, textiles, vegetable oils, cement, salt, groundnut seeds were the principal commodities, while their respective shares to the total were 47.2 per cent, 28.3 per cent, 2.8 per cent, 1.9 per cent and 1.5 per cent.

From the above analysis the following findings emerge:

(*i*) The State showed an adverse balance of coastal and foreign trade in 1958.

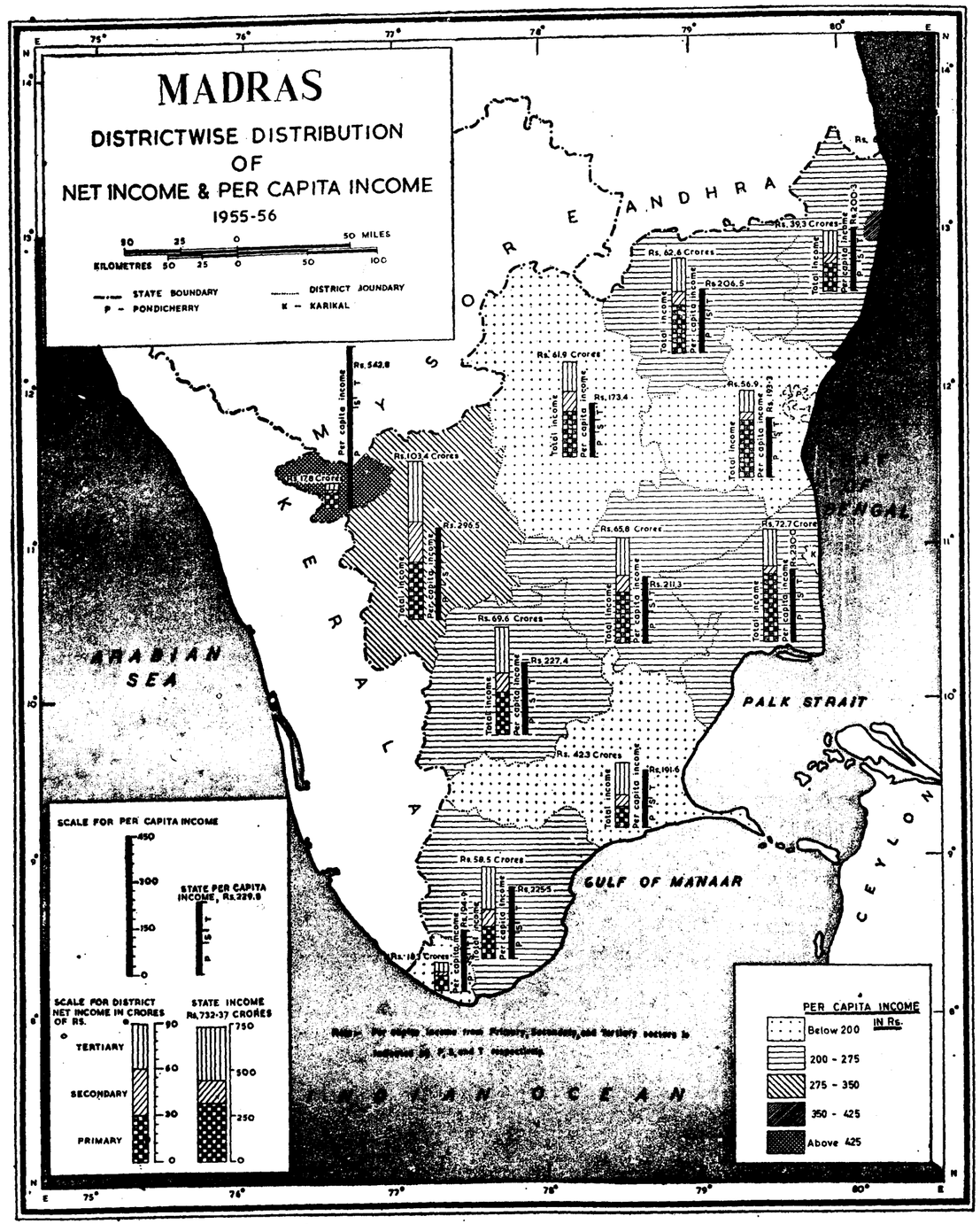
(*ii*) Finished products, mainly capital goods were the major items of foreign import, while unfinished products, except cotton piece-goods were the principal items of export.

(*iii*) Unlike the foreign trade, the coastal trade showed finished products as the major items of export, while unfinished products were the main items of import.

(*iv*) The western countries exchanged capital goods with agricultural products and mineral ores, while southeastern Asiatic countries exchanged cereals and cereal products with cotton piece-goods, fish, tobacco, and sugar at Madras port.

SOURCES: (1) *Abstract of Statistics for Madras State*, Volume III—No. 1-4, 1958;
(2) *Monthly Statistics of the Foreign Trade of India*, December, 1958.

Map 54



Map 54

Districtwise Distribution of Net Income and Per Capita Income, 1955-56

Method

THIS MAP SHOWS the districtwise distribution of net output and per capita income. The net output is shown by proportionate rectangles divided into primary, secondary and tertiary sectors. The per capita income is shown by solid bars.

Analysis

The State income of Madras State was estimated at Rs. 732.4 crores (at current prices). To this net value primary sector contributed 43 per cent, tertiary sector 40 per cent, and secondary sector 17 per cent. The State's per capita income was Rs. 229.4 against India's average of Rs. 261.0[1].

State Income: Coimbatore district had made the largest contribution to the State income (14%) followed by Tanjore (9.9%), Madurai (9.5%) and Tiruchirapalli (9.0%). The districts of Nilgiri (3.5%) and Kanyakumari (2.41%) had made, on the other hand, the smallest contributions to the State income because they were significantly small in size.

Per Capita Income: Nilgiri district exhibited the highest per capita income (Rs. 542.8). The chief attributive factor to this very high per capita income is plantation farming. The per capita output of the district from agriculture was Rs. 338.3 against Rs. 99.2 for the State as a whole.

Madras district ranked next to Nilgiri district in high per capita income which was Rs. 418.4 against the State average of Rs. 229.4. Its industrial and commercial importance (functioning as the leading port of South India) is reflected in its very high per capita income from secondary and tertiary sectors. Its per capita income from industry was Rs. 111.9 compared to the State average of Rs. 38.5 and that from tertiary sector was Rs. 306 against the State average of Rs. 91.62.

The third area with a high per capita income is Coimbatore district. Its per capita output from the agriculture sector was Rs. 109.8 against the State average of Rs. 99.2, that from secondary sector was Rs. 72.30 against Rs. 38.5, and that from tertiary sector was Rs. 114.3 against Rs. 91.6 for the State as a whole.

The fourth area of relatively high per capita income is Tanjore district. Its income per person was Rs. 230 against the State average of Rs. 229.4. Its income from agricultural sector was outstandingly high. The income per person from this sector was Rs. 136.8 against the State average of Rs. 99.2.

Except in the above four districts, the per capita income in every part was lower than the State average. Nevertheless Madurai and Tirunelveli districts showed their per capita income from tertiary and secondary sectors as being higher than the State average.

The lowest per capita income was exhibited by Salem district (Rs. 173.4) followed by Ramanathapuram (Rs. 191.6), South Arcot (Rs. 193.3) and Chingleput (Rs. 200.3) districts.

1 C.S.O.'s Estimate.

Income from all sectors in Salem district was lower than the State average. Its per capita income from tertiary sector was significantly low—Rs. 51 against the State average of Rs. 91.

In Ramanathapuram district, the per capita income from all sectors other than tertiary sector was below the State average. Its income per person from agriculture (Rs. 66) was lowest in the State. In South Arcot district, the per capita income from agricultural sector (Rs. 127.2) was much higher than the State average (Rs. 99.2). Even so, its per capita income on the average was below the State level due to its very low income from secondary (Rs. 17.1) and tertiary (Rs. 48.8) sectors. It recorded the lowest per capita income for tertiary sector.

In Chingleput district the net output per person from each of the economic sectors was lower than the State average, though none of the per capita income figures was extraordinarily low.

Following are the salient features of the districtwise distribution of income:

1. The highest contribution to the State income from primary sector was done by Tanjore district (13%), that from secondary sector by Coimbatore district (20%), and that from tertiary sector by Madras district (16%).

2. With regard to per capita income the Nilgiri district recorded the highest figures (Rs. 338) in agricultural sector, Madras showed the highest per capita output in industrial (Rs. 111.9) and tertiary (Rs. 306.4) sectors.

3. Ramanathapuram district exhibited the lowest per capita output (Rs. 66.8) from agricultural sector, Tanjore district recorded the lowest per capita output from secondary (Rs. 15.0) sector, and South Arcot district recorded the lowest per capita output (Rs. 48.8) from tertiary sector.

SOURCE : *Techno-Economic Survey of Madras*, Report of NCAER, 1961, Table 15, p. 19.

Map 55

The Morphology of Madras City

Method

THIS MAP IS drawn to show the functional zones of Madras City. The various zones are differentiated by various shades of hatching.

Analysis

Madras is the fourth largest city, and the third largest port of India. It has a total area of 49 square miles supporting 1.7 million people according to the 1961 Census. In 1639, Madras City conformed to the Dutch factory established by Francis Day at the site of Fort St. George. In the eighteenth century the Dutch were weakened by the long and hard struggle with Louis XIV and gradually lost ground in India. After 1763, Madras City changed hands. Since then it had been under the British rule, till India became independent.

The City has grown along the east coast of Madras State to discharge the function of a port, though it has no natural advantage of deep sea harbour. There are probably two main local factors which might have influenced Francis Day in his choice of this site: the Cooum creek capable of taking ships up to 50 tons and the defensive value of the line of lagoons about two miles away from the coast.

The City area has remained unchanged from 1798 to 1923. After 1923, the City expanded to some extent. In 1941, it supported 25,600 persons per square mile within its total area of 30 square miles. In 1951, the size of the City increased to 49 square miles with a density of 28,900 persons per square mile. During the last decade (1951-61) there was no extension of the City area, but population density increased to 35,200 persons per square mile.

The nucleus of the City is Fort St. George and George town. The Fort is a fourteenth century construction by local craftsmen and contains the Secretariat barracks and other buildings.

George town is the commercial core of the City. Its layout is rectangular. On three sides, it is bounded by the National highways. All the important commercial banks and business centres face directly to the harbour. Both George town and Fort St. George are marked off from the rest of the City by the Buckingham Canal in the west and Cooum meander in the south.

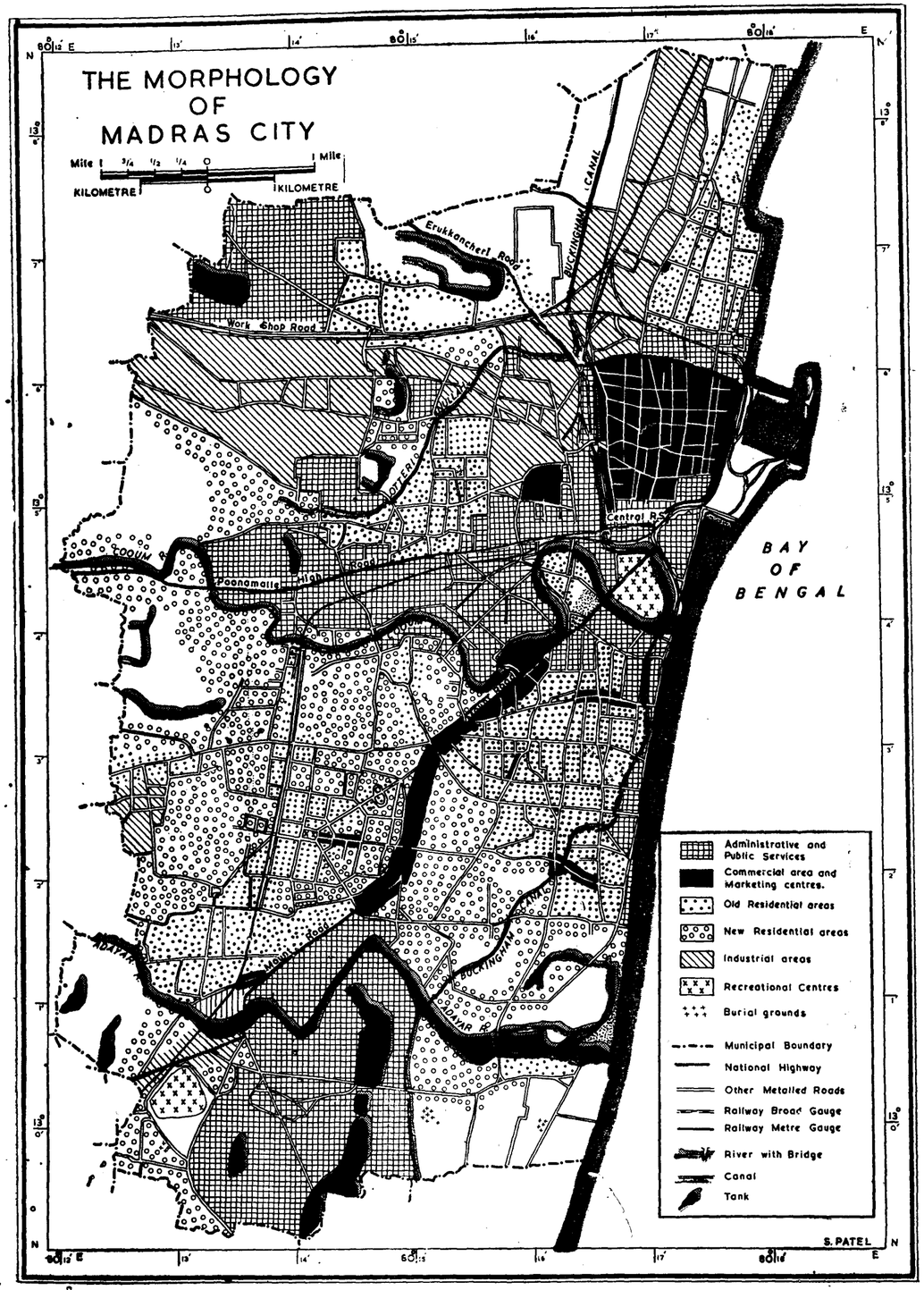
The City sprawled from this core more towards south than towards north and west. Between the rivers Cooum and Adyar there is a curious mixture of residential, administrative, business and industrial areas.

Chintadripet, occupying the Cooum meander, is a dirty slum area. It is more rural than urban.

To the south of this Cooum meander are the old residential areas—Triplicane, Royapettah, Mylapore (Map 55a).

The Mount Road, the main commercial artery of the City runs diagonally through this southern part and stretches from the Old Government House to St. Thomas Mount. The central part of this road

Map 55 (b)



is the main shopping, hotel and entertainment (cinema) area. New residential and administrative areas have sprung up on either side of this road. Thyagarayanagar, a well planned residential area, lies on the western side of the Mount Road.

Guindy, on the eastern side of the road, is a new area with Government office buildings, colleges, industrial estates, etc.

Except in Kodambakkam, settlements are thinner at the western end of the City.

Kodambakkam is an important centre of film-industry in the State.

In the northern part of the city, the Poonamalle Highway is the main centre of public administration. Schools, colleges, libraries, hospitals, broadcasting house throng on either side of this road. About half a mile to the north of this road is Pursavakam, an old residential area (Map 55a).

Further north lies the industrial part of the City with the famous Buckingham and Carnatic mills and the Perambur Coach-factory.

SOURCE: *Map of the Madras Town*, published under the direction of Mr. H. St. C. Gilby, Senior Deputy Director, Madras Survey of Land-Records.