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GEOGRAPHICAL VIEWPOINT

"MULTIPLE CROPPING IS ESSENTIALLY CROP DIVERSIFICATION"

by

DIVINA E. CABANTAC[1]

Multiple cropping is essentially crop diversification according to Johnny C. Bunoan, Jr., Chief, Soil Fertility Division, Bureau of Soils, Manila. Consequently, Bunoan continues, "increased food production is the answer to present high prices which is among the primary causes of social unrest. The utilization of our vast rainfed rice areas for crop diversification will be truly meaningful in terms of increased production for food and industry, improving the nutrition of the Filipino people, raising the living standard of our rice farmers by increasing their farm income and eventually stabilizing the economy of the country."

The potential of introducing multiple cropping program in the country has been determined by a wide range of socio-economic consideration and available technology to the farmers. Multiple cropping, hence, leads to a new approach of farming technique by increased crop production thru maximum land utilization. Hand in hand with this, it aims to build and maintain the soil fertility as the matrix of agricultural production.

Delving into the country's statistics, the Philippines has a total cultivated land area of about 9 million hectares. One-third of this area is devoted to rice production. While one-third of the rice area is considered irrigated, the bigger fractional 2/3 portion, is under rainfed condition.

Again, Bunoan observes, that for an ordinary Filipino farmer, one crop of rice is made possible only under the rainfed condition. Throughout the rest of the crop year, his riceland remains idle.

To sum up, therefore, the number of rice farmers under the rainfed condition, by simple mathematics accrues to a vast hectarage of riceland

[1] Soil Technologist, Bureau of Soils, Manila.

remaining idle in each year. It, of course, follows that when a limited area is devoted to a mono-crop culture, an eventual low production in agriculture becomes an obvious equivalence.

As such, multiple cropping refers to the raising of more than one crop in an area of land during the period of one year.

In July 1971 the government, thru the National Food and Agriculture Council (NFAC) and the Bureau of Soils (BS) as the implementing agencies, entered into a memorandum of agreement with the Asian Pacific Council and the Food and Fertilizer Technology Center (ASPAC/FFTC) based in Taiwan, Nationalist China to launch a multiple cropping program in the country. By September of same year, the province of Nueva Ecija became the pilot site of the first multiple cropping project.

The project became a nationwide activity of the Bureau of Soils. Under various agro-climatic conditions, specialized techniques of crop intensification were tried out on the farmers' fields.

Among these specialized techniques were sequential cropping, intercropping, relay intercropping and the adaptability of different crop varieties to specific local conditions.

By simple definition of terms, sequential cropping means the growing of two or more crops in sequence with a base crop in one year. Crop intensification is based on time dimension under certain rainfall pattern and the succeeding crop is planted after the first crop has been harvested. Relay intercropping on the other hand is the planting of two or more crops simultaneously during part of each crop's cycle. A second crop is planted after the first crop has reached its production stage and before it is ready for harvest. Intercropping is the simultaneous growing of two or more crops on the same piece of land with due consideration of time and space in a year.

In all the above techniques, no crop competition is elicited, so that a farmer can manage to raise more than one crop at a time on the same field. At the same time the techniques can minimize crop damage due to insect infestations and increase utilization of plant nutrients efficiently.

Having gained a success at its initial first year of the experiment, the project was then extended to Pangasinan, Tarlac, Ilocos Norte, Cagayan and Bohol. Later, it was introduced in Ilocos Sur, Laguna, Bulacan, Iloilo, Davao and Misamis Oriental during the crop year 1973-1975. One barrio site was selected as a representative study of each province.

METHODOLOGY

For each of the selected pilot sites, an area of one hectare was divided into four parts after the main rice crop (CP-1) has been harvested.

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Thus, for CP-1, high yielding variety (HYV) rice was used in the experiment as a base crop. Rice planted during the wet season was closely supervised using the "Masagana 99 (M-99) package of technology."

The CP-2, CP-3, CP-4 and CP-5 correspond to the subsequent cropping patterns assigned for the secondary crops. Primary considerations for these, were given to legumes and field crops such as sorghum, sweet potato and other drought tolerant crops.

In the conduct of the experiment, the lands were either thoroughly prepared for the secondary crops after the harvest of the rice crops or there was no land preparation using minimum tillage. Mulching with rice straw was practiced to conserve soil moisture at the same time suppress the intercession of weeds. Fertilizers were applied based on the Bureau of Soils recommendations. Compost was used for vegetables. Some techniques of crop culture were introduced from Taiwan. Labor requirements and other farm inputs were partially subsidized by the Bureau. And to serve the purpose of a demonstration farm on the feasibility of adapting multiple cropping technique in the locality (technology transfer), farmers' field days were held.

SOME INTERESTING RESULTS

To cite an example of an early result of the experiment, was the one conducted at Bgy. Cabaritan, Sto. Domingo, Ilocos Sur with five cropping patterns tried out. The following results were obtained: CP-1 (Rice alone) gave a net income of ₱320.00 per hectare. CP-2 (Rice-Mungo-Corn) gave an income of ₱8,478.00. CP-3 with alternate vegetables such as watermelon, melon, kundol, squash, upo and cucumber gave a net total of ₱27,557.12. CP-4 (Rice-Sweet Potato) and CP-5 (Rice-Sorghum-Ratooned) gave ₱3,334.20 and ₱1,733.20 net incomes, respectively.

It becomes obvious from the above result, that with proper crop sequence, a farmer can increase his income to as much as 26 times than that of growing rice alone.

Another experiment worth mentioning also was that conducted at Barangay Anolid, Mangaldan, Pangasinan.

In the experiment, 10 cropping patterns were tried. The traditional one rice crop a year attained a net income of ₱949.00 per hectare only. Cropping pattern (CP-2) with three rice cropping using very early maturing varieties with irrigation gave an income of ₱4,799.00 per hectare. In CP-3 Rice-Cabbage (Chinese Cabbage) gave ₱11,831.00; CP-4 (Rice-Watermelon) gave ₱5,223.50; CP-5 (Rice-Sweet Melon) gave ₱6,667.00. CP-7 (Rice-Cauliflower) gave ₱1,052.00; CP-9 (Rice-Sweet pepper-Camote) gave ₱11,702.00 and CP-10 (Rice-Cabbage) had a net income of ₱22,378.60. Evidently, a significant increase was exhibited by CP-10 by 23 times than that from the traditional one crop system. But for CP-6

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(Rice-Cucumber) which did not have a good market for the product in the locality gave a very low profit. Also for CP-8 (Rice-Eggplant) gave a low market value due to a corresponding low quality of the product.

CONTINUING MULTIPLE CROPPING PROJECT

Assessing the success of the several experiments conducted country-wide with the government campaign of increasing food production, Manuel Sta. Ana, Chief, Soil Fertility Management and Multiple Cropping Section, Soil Fertility Division of the Bureau of Soils, recommends multiple cropping and its many advantages to the farmers in the country. He stressed that the technique could offer the best advantage to a farmer because he can fully utilize his land resources to improve his income and nutrition and finally his total being in the community. By this, Sta. Ana adds, the Bureau of Soils is making appreciable advances towards increasing crop production thru its continuing multiple cropping project for the country.

CONSTRAINTS AND REMEDIES

Meanwhile, as the project finds its advent in these crises-laden seventies, several constraints and their remedies are presented as follows:

1. *Availability of soil moisture.* — To meet the water requirement of crops the following must be considered: (a) soils with high retention of soil moisture preferably coarse and medium texture and high organic matter, (b) proper time of planting correlated with the rainfall distribution in the locality, (c) relay planting of intercropping with rice, (d) planting of early maturing variety and drought tolerant crops, (e) supplementary irrigation from groundwater, and (f) improved technique in the culture of upland crops such as non-tillage, mulching, deep furrow planting, as a way of concerning soil moisture.

2. *Availability of quality seeds and other planting materials.* — The establishment of quality seeds/ planting materials production centers or farms must be distributed in regions favorable for its production. Government regulations must be imposed to regulate the production and sale of these agriculture necessities.

3. *High cost of farm inputs.* — There must be a government price support for farm produce to overcome high cost of production. Other possible means or cost reductions are: planting with minimum tillage or zero tillage, use of resistant varieties, planting of legumes and use of crop residues, manures and compost to supplement chemical fertilizers.

4. *Technical know-how in crop productions.* — Extension work on improved farming techniques must be intensified thru the use of media, farmers, organization, schools, youth organizations, etc.

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5. *Marketability of farm produce.* — Government should stabilize the price of farm products and to develop domestic and foreign markets. Food processors must be encouraged and supported. Crop zonifications must be established to bring the desired market right on the farm.

6. *Availability of credit.* — Organization of farmers' cooperatives where credits are supervised. Government and private banking institutions shall extend operations to include upland crop or vegetables aside from the M-99 credit systems.

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REGIONAL DISPARITIES IN THE PHILIPPINES ASPECTS OF REGIONAL PLANNING II

by

DIRK BRONGER*

I. INTRODUCTION: SIGNIFICANCE OF REGIONAL DISPARITIES AS A PROBLEM OF REGIONAL PLANNING IN DEVELOPING COUNTRIES

The starting point of the reflections made below is the already mentioned[1] fact that out of the large number of criteria for characteriz.ng the very heterogenious group of the developing countries a spatial aspect should be considered as very essential: the existence of pronounced regional disparities in economic as well as in social and cultural respect within those countries leading to the co-existence of quite a number of different stages or levels of development. Precisely the consequences of the phenomena of these sectoral and regional dualisms and their combined effect are making this aspect the most significant criterion of the developing countries: the steadily increasing internal rural-urban migration mainly into the capital region, the emergence and expansion of slum and squatter areas with the following threat to mainly social unrest up to the endangered existence of the concerned state as a political unit.

The existence of these pronounced regional disparities together with their consequences inevitably reveal the special need for regional planning which counteracts those processes. Any such regional planning must aim at reducing (and in the sense of long-term planning overcoming) the existing regional disparities by means of a more evenly-spread development in both spatial and functional terms.[2]

In short, a fundamental task of developing country-research is considered to be the necessity to acquire regional differentiated analyses of the stage of development concerning the individual regions within those countries. Only the detailed knowledge of the stage and the potential of development of the single regions, verified as much as possible by quantitative data, and, finally, including the causal connections of the so much different level of development will enable the regional planner and

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[1] BRONGER, D. (1980), p.

[2] BRONGER, D. (1977a), p. 17.

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politician to derive concrete measures from the results and realize them in practice. To put it more precisely: any development planning which aims first and foremost in reducing the regional disparities is not conceivable without such analyses. They form the indispensable precondition for any such regional planning and policy.

So far there is an inexplicable discrepancy between the evidence of this statement on one side and the very limited number of such analyses on the other. The pioneer study of Venezuela by FRIEDMANN (1966) and the careful but apparently so far often disregarded study of Kenya by SOJA (1968) in which the stage of development of the, before 1963 existing, 36 districts is analyzed by 25 key indicators using the principal components analysis[3] are to be named primarily in this context. This gap leads us to the question regarding the reasons for this in the last analysis inconceivable discrepancy. At least partly they are caused by conceptual as well as methodological problems which are next to be discussed. They can be summarized into the following four topics.

II. DETERMINATION OF REGIONAL DISPARITIES: CONCEPTUAL AND METHODOLOGICAL PROBLEMS

1. First of all our basic criterion "stage (level) of development" is undoubtedly a very complex term. Its meaning is already controversial from the beginning because up to now there is no agreement about the central concept of "development": so far no comprehensive definition of the basic term "development" exists, i.e., a definition acceptable to all the disciplines involved in this function of research.[4]

As there is no comprehensive definition existing, so far the only possibility I can see to give the concept of "stage (level) of development" practical application is by means of a combination of quantitative and, as ever possible, qualitative indicators.[5] Although, when compared with the often very abstract discussion of development theories as well as the reduction of the entire problem to the utilization of a single factor indicating only quantitative changes practised by the economists even recently[6] this research into indicators seems to be the more pragmatic method. Yet, especially since in the last analysis any such result constitutes only a catalogue of indicators of underdevelopment this method can be taken solely as an additional although essential device.

2. This complex interpretation of our central term "stage of development" leads us to the next basic problem: Out of the large number of

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[3] SOJA, E. (1968), pp. 68 ff.

[4] See more in detail: BRONGER, D. (1977a), pp. 15 f. and the literature cited there.

[5] Comparable to the catalogues of indicators for "development" worked out by social scientists (see: McGRANAHAN, D. (1974), pp. 208 ff., MORRISON/MITCHELL/PADEN/STEVENSON (1972); SEERS, D. (1974a,b) et al.) and international institutions (UNRISD, ECOSOC, CEPAL). See the compilation in: NOHLEN, D./NUSCHELER, Fr. (1974), pp. 325 ff.

[6] KLAGES, D. (1975), p. 27.

indicators (see: note 5): which are the most important ones and should be selected? This question involves the further problem of weighting the determinants.

To find an acceptable procedure for this determination is quite problematic because of the following two reasons: Firstly, a considerable number of these indicators vary in their significance from country to country. To cite an example: the indicator "Enrolment in the Elementary and Secondary School Level" is of very much less importance in countries with a high level of education and a high literacy rate too than in the majority of those countries in which there is a great demand in this sector in general and a considerable deficit of such institutions in most of the rural areas in particular. Secondly, one of the most significant, if not decisive, indicator for characterizing the previous and current level of development, the population's willingness to develop resp. the population's willingness to accept innovations is not measurable at all directly.

3. Another additional principal difficulty regarding the determination and measurement of the stage of development and, at the same time a main reason for the discrepancy mentioned above lies in the fact that the theoretically often well founded indicator-catalogues (see Note 5) for characterizing the level of development of the single regions within these countries are often not at all applicable. The necessary extensive data as a basis to work out a solid quantitative regional analysis are, apart from being frequently not sufficiently accurate,

— in the majority of these countries to a large extent not available at all or hardly accessible. This is particularly with respect to just essential indicators like underemployment or data regarding sectoral investments. In addition to this,

— such essential data like GNP, GDP or per-capita income are not available in a form showing the regional differentiation or broken down in line with the recipients and so these data provide no or only a little information regarding the actual distribution of the national income, especially since supporting surveys on the socio-economic strata of the population are entirely lacking.[7] Furthermore,

— they are because not adequately prepared usable often only to a limited extent. This is particularly with respect to necessary qualitative information (hospital and hospital is by no means the same!) But above all a particularly disadvantageous fact is to be seen in the

[7] This fact has been generally acknowledged for sometime (see: RINGER, K. (1966), pp. 6 f.). And this makes such investigations, even nowadays all the more incomprehensible.

— non-existence of data series for a longer period in the vast majority of these countries. Such data are necessary to characterize the process of development as an essential causal factor for understanding the present level of development. In case of availability they are quite often not comparable to each other because the methods of investigation and/or classification changed from census to census.

4. Finally, a basic difficulty is to be seen in the next to "development" central term "region". "Region" as well as "space" are abstract-relative terms for which no scientific definition is possible by oneself.[8] Not until there is an additional determination like economic region or administrative region, etc., it becomes concrete and comprehensible.[9]

But with this statement we come into a direct conflict with our central concept of "development" which is not limited to economic growth but also incorporate the anthropological, sociological and psychological dimensions.[10] In short, "development" is a "totality,"[11] it is to be understood as a multidimensional process.

III. METHODOLOGY AND TARGET OF THE STUDY

A regional analysis which aims at the undoubtedly pretentions objective of an as much as possible solid investigation of the level of development of the single regions as a decision basis for a regional planning and policy which pursues the strategic target to reduce the existing regional disparities should, to sum up the former arguments, bear in mind the following basic criteria:

1. Because of the complex interpretation of our central term "stage of development" as far as possible all fundamental vital functions (in the following named as "dimensions") should be covered by indicators.
2. Development potential as well as development process are to be considered as essential causal factors for the understanding of the present level of development of a region[12] the indicators to be used should be diversified as much as possible.
3. The same should be valid concerning the spatial units: the regional breakdown of the country should be as much differentiated as justifiable. Since the regions naturally differs very much in size as well as in population the figures should not be taken absolutely but counted by area or by capita, respectively.

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[8] ROMUS, p. (1964), p. 234; LANGE, K. (1970), pp. 2705 f.
[9] OTREMBA, E. (1970), p. 2566.
[10] BEHRENDT, R.F. (1968), p. 101.
[11] BROOKFIELD, H. (1975), p. IX.
[12] See more in detail: BEHRENDT, R.F. (1968), pp. 103 f.

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4. In this connection, we have to state also the necessity to take qualitative data as a basis for such a solid study wherever possible. For the vast majority of the developing countries it is characteristic that their economic as well as social and cultural institutions vary very much in size, quality, etc.

Out of the total number of more than 350 presented indicators[13] for characterizing the level of development, only the most important, i.e., 27 single (total 25) indicators could be taken into consideration within the frame of this study. Their hierarchical classification into 7 dimensions, summarized in the overall complex "stage of development" is shown in Figure I.

It has to be mentioned in this connection that some important indicators for our target of this study are not available in regional differentiation. In this respect, we have to mention particularly the gross domestic product, underemployment and investment data especially in the industrial sector.

On the other hand two particularly in the theoretically based literature quite often cited indicators namely "degree of urbanization" and "literacy rate" are of less importance or applicable only to a limited extent so that we had to eliminate them. Last named is valid to the indicator "degree of urbanization" which is not accurately defined (to cite an example: the area of Davao City is 8-times bigger than the area of Cebu City and even amounts to 58-times of Manila City!)[14] In addition to this it has to be mentioned here that the always postulated correlation "high degree of urbanization," "high level of willingness to adopt innovations" at least for the large number of small and medium-sized towns hasn't been proven empirically yet. Also in this connection we have to state a considerable lack regarding profound investigation with respect to this subject. As far as the "literacy rate" (1970: 83.4%) and the "enrolment" (1975/76: 7.7 Mill. in the elementary and 2.2 Mill. in the secondary level[15]) is concerned and, in addition to this, the existence of very limited regional differences the Philippines is no more to be considered as a developing country regarding this sphere of the educational sector. As the colleges differ to a large extent in respect of the standard and equipment, out

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[13] To a large extent the sources are originated from unpublished data (see: Bibliography). The majority of the single indicators are compiled in: ENGELBRECHT, K. (1975), Vol. II. As far as the indicators regarding the secondary (manufacturing) sector are concerned they are published in: BRONGER, D. (1979).

[14] See more in detail: BRONGER, D. (1979), pp. 22 ff.

[15] NEDA (1978), pp. 585 f.

of this sector only the universities had been taken into account (Indicator No. 51).[16]

As far as the regional unit is concerned, we are referring in this analysis to the intermediate administrative level: the province. Their total number of 73 (1975) seems to be sufficient for the purpose of this study. An interpretation of the data with regard to the down next administrative level, i.e., the 1975 existing 1.438 municipalities would be beyond the scope of this study.

The same is valid with respect to the interpretation of the data by factor analysis. As such method seems to be impossible within the framework of this study however it causes the already mentioned fundamental methodological problem of weighting the determinants. To find an as much as possible satisfactory solution here, the dimension III-VII are represented each with the same (3) number of indicators where as the most important dimension II appears with the double (6) number. In order to get a quantitative measure of the 25 development factors as well as the possibility to compare the levels of development of particular provinces, the data where transformed into a scoring system: the maximum obtainable score for a development factor will be 100 points and the score for the lower data has been proportionately computed. With all in all 25 development factors, the maximum possible score is 2,500 for an individual region (province).

FIGURE 1. INDICATORS DETERMINING THE SPATIAL STRUCTURE OF THE STAGE OF DEVELOPMENT WITHIN THE PHILIPPINES
(Draft: D. Bronger)

Complex	Dimension	Indicators
Stage of Development	I Area and Population	— 1 : Population Density (persons/sqkm) 1975
		— 2 : Population Growth 1948-1975
		— 3 : Arable Land/Capita 1970
		— 4a : Internal Migration 1939-1960
		— 4b : Internal Migration 1960-1970

[16] The two indicators "percentage of urban population" and "number of college students per 10,000 population" have been included in a study "Population Trends and Existing Growth Areas" done within the frame of the already cited (BRONGER, D. (1980), p.) study "Physical Planning Strategy for the Philippines" jointly undertaken by the DEPARTMENT OF PUBLIC WORKS AND COMMUNICATIONS, INSTITUTE OF PLANNING, U.P. and the PRESIDENTIAL ADVISORY COUNCIL OF PUBLIC WORKS AND COMMUNITY DEVELOPMENT, assisted by the UNDP in the beginning of the 70's covering then 62 existing provinces. The study, with the aim "to determine the fastest growing areas on the basis of leading development factors" (DPWC/IP-UP/PAC-PWCD/UNDP (Ed.) (1971), Vol. III, p. 1) considers all in all 15 indicators divided into two major groups: A: Socio-Economic Factors (8 indicators) and B: Transportation (7 indicators). A great number of dimensions as well as the aspect of the development process regrettably remained unconsidered.

II Economic Characteristics	—11a	: Income/Capita 1966
	—11b	: Income/Household 1975
	—12	: Income Distribution: Proportion of Low Income Families to Household Population 1971
	—13	: Government Revenue/Capita 1970
	—14	: Power Consumption/Capita 1970
	—15	: Secondary & Tertiary Sector Employment (%) 1975
	—16	: Number of Banking Institutions/Capita 1974
III Manufacturing	—21	: Employment in Cottage Industries/Capita 1975
	—22	: Industrial Employment/Capita 1975
	—23	: Total Receipts (Industry)/ Capita 1975
IV Agriculture	—31	: Area Irrigated/Capita 1970
	—32	: Fertilizers Used/ha 1970
	—33	: Value of Crops Produced/ha 1970
V Transport & Communication	—41	: Hard-Surfaced Road Kilometerages/sqkm 1971
	—42	: Number of Registered Cars & Trucks/Capita 1977
	—43	: Telephone Connections/ Capita 1974
VI Education & Living	—51	: University Students/Capita 1971/72
	—52	: Hospital Bed Capacity/Capita 1976
	—53	: TV Sets/Capita 1970
VIII Housing	—61	: Percentage of Households with Pipe Water Supply 1970
	—62	: Percentage of Households with Flush/Water Sealed Toilet 1970
	—63	: Percentage of Households with Electricity 1970

Sources: see Note 17

It should be emphasized at this point that such a structural based analysis alone must always be incomplete. Simultaneous empirical investigations together with a detailed knowledge of as far as possible all regions of the country are essential to reach the above mentioned target. In our interpretation of the results we will come back to this point in the next chapter.

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IV. REGIONAL DISPARITIES IN THE PHILIPPINES (Table 1; Maps 1-8)

The findings of this structural analysis showing the regional disparities of the 73 single regions within the Philippines based on the 27 indicators (Figure 1) are compiled in Table 1[17] and spatially presented in Maps 1-8.

A detailed interpretation of the total material including the simultaneously empirical investigations will be reserved for a special study.

The following 6 topics sum up the results:

1. The overall result, first of all, illustrates the very big gap between the capital region on one side and all the remaining 72 regions on the other. In other words: compared to the "core region" all other parts of the whole country are to be characterized as "underdeveloped". This first statement has to be differentiated in respect of two aspects:

1.1 In view of the vast majority of the single indicators, the regional disparities became even more drastic. First and foremost, this is five with regard to the entire dimensions "Traffic and Communication" (V), "Education and Living" (VI) and, partly, "Housing" (VII; Maps 6-8) especially indicator No. 63 as well as the industrial sector (No. 22 & 23). In comparison to the last named sector the regional disparities of the branch "cottage industries" (No. 21) show much

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[17] 1 : NCSO, 1978, pp. 24 ff.
2 : *Ibid.*, (own calculation).
3 : NCSO, 1974, Vol. 2, pp. 1 ff. (own calculation).
4a : WERNSTEDT/SPENCER, 1967, pp. 637 f. (own calculation; see: BOUSTEDT, 1977, p. 141).
4b : BCS/NCSO, 1947 ff., Vol. 23, No. 2 (1972), pp. XXV ff. (own calculation; s.o.).
11a : DPWC/IP-UP/PAC-PWCD/UNDP, 1971, Vol. III, pp. 79 ff.
11b : BCS/NCSO, 1947 ff., Vol. 29, No. 3 (1978), pp. 101 f.
12 : TFHS/DAP, 1975, Social Equity in the Philippines, pp. 58 ff. (own calculation).
13 : DPWC/IP-UP/PAC-PWCD/UNDP, 1971, Vol. III, pp. 79 ff.
14 : *Ibid.*, pp. 82 ff.
15 : NCSO, 1977, Vol. 1-73 (own calculation).
16 : CORPUZ, 1975, Vol. 1, p. 175 (own calculation).
21 : BCS/NCSO, 1947 ff., Vol. 27, No. 4 (1976), pp. XV ff. (own calculation).
22 : NCSO, 1975 (own calculation).
23 : *ibid.*, (own calculation).
31 : NCSO, 1974, Vol. 2, pp. 84 f. (own calculation).
32 : *Ibid.*, pp. 86 f. (own calculation).
33 : *Ibid.*, pp. 13 f. (own calculation).
41 : BCS/NCSO, 1947 ff., Vol. 24, No. 3 (1973), pp. 55 f. (own calculation).
42 : *Ibid.*, Vol. 29, No. 3 (1978), pp. 68 ff. (own calculation).
43 : TFHS/DAP, 1975, Part IV, pp. 62 ff. (own calculation).
51 : YAMBOT, 1975, pp. 291 ff. (own calculation).
52 : BCS/NCSO, 1947 ff. Vol. 28, No. 2 (1977), pp. 21 f. (own calculation).
53 : NEDA/NCSO, 1975, pp. 32 f.
61 : *Ibid.*, pp. 12 f.
62 : *Ibid.*, pp. 19 f.
63 : *Ibid.*, pp. 16 f.

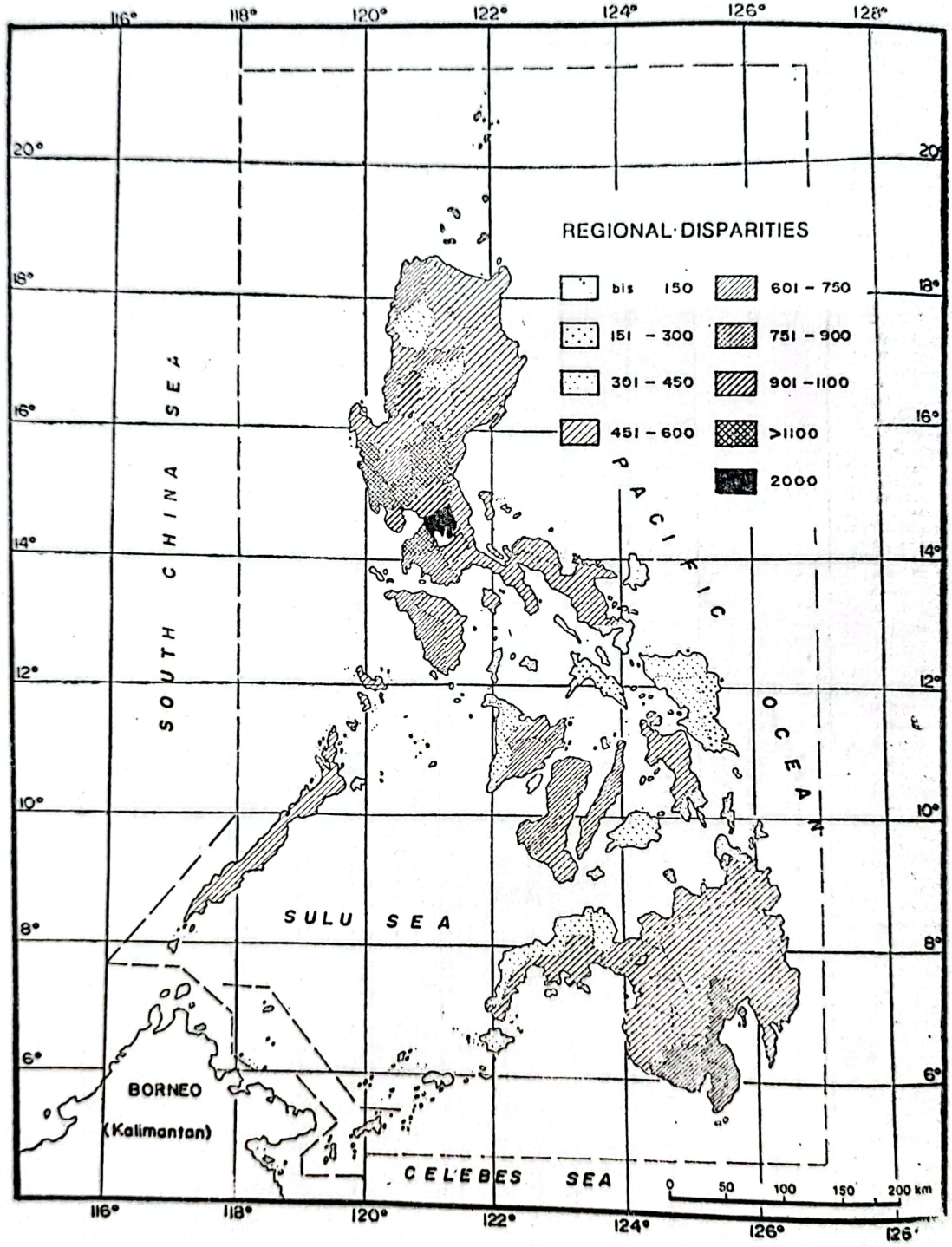
CamScanner

Tab. 1 : Indikatoren zum Entwicklungsstand der Einzelregionen der Philippinen

Dimension →	I					II							III			IV		
No. Region/Province Indicator→	1	2	3	4a	4b	11a	11b	12	13	14	15	16	21	22	23	31	32	33
1 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
REGION I																		
1 Ilocos Norte	4	18	22	15	35	26	16	23	26	2	36	68	30	1	0	59	33	51
2 Ilocos Sur	6	18	20	16	34	32	21	29	23	1	38	33	68	2	0	21	36	46
3 Abra	1	20	25	17	37	16	8	19	25	0	23	14	48	-	-	28	5	23
4 La Union	10	21	18	20	36	26	12	70	33	4	44	61	54	14	10	19	29	38
5 Pangasinan	10	20	25	22	34	22	17	28	21	3	47	45	26	2	2	36	36	44
REGION II																		
6 Kalinga-Apayo	1	34	56	21	36	29	18	82	29	0	15	6	1	-	-	100	1	32
7 Mt. Provinz	2	18	44	21	36	27	18	22	27	0	13	11	92	8	1	99	39	61
8 Ifugao	2	25	42	21	36	19	18	18	21	0	10	20	30	-	-	64	2	34
9 Benguet	4	32	16	21	36	32	18	60	100	19	56	52	6	5	1	20	62	60
REGION III																		
10 Batanes	2	13	50	10	31	26	20	31	51	0	22	88	33	-	-	0	0	100
11 Cagayan	3	25	54	22	36	28	8	31	21	0	28	28	9	7	2	29	2	23
12 Isabela	2	33	67	31	39	26	9	22	23	0	26	35	7	6	2	85	10	34
13 Nueva Viscayas	2	40	40	27	43	27	23	29	23	0	33	30	2	5	2	75	13	45
14 Quirino	1	40	40	27	43	23	23	29	23	0	20	30	1	20	23	76	13	45
REGION IV																		
15 Zambales	4	35	17	31	44	31	31	96	61	20	75	63	14	4	4	14	43	44
16 Tarlac	8	24	42	24	36	27	24	62	24	5	49	46	23	8	8	65	94	53
17 Nueva Ecija	6	24	49	21	38	19	21	94	23	3	41	56	21	1	1	94	89	51
18 Pampanga	17	29	23	25	39	33	25	76	24	21	71	51	53	8	4	42	56	54
19 Bataan	7	33	25	26	40	15	22	79	49	7	63	56	29	21	100	62	38	57
20 Bulacan	12	27	19	25	42	26	23	75	28	22	75	61	66	57	49	34	80	58
REGION V																		
23 Laguna	15	28	13	26	41	32	24	60	23	9	66	72	100	22	21	36	61	49
24 Cavite	12	27	14	24	39	29	29	63	25	4	72	52	23	4	12	13	31	32
25 Batangas	12	24	24	23	39	23	20	48	31	2	54	44	52	6	42	6	100	29
26 Quezon	3	32	19	28	41	22	25	39	24	1	36	43	14	9	7	20	3	22
27 Mindoro Occ.	1	51	77	34	44	35	26	81	29	1	26	57	54	2	1	42	9	29
28 Mindoro Or.	3	36	41	37	38	22	13	45	18	1	30	11	81	1	0	77	8	26
29 Marinduque	6	22	20	20	34	18	25	40	22	1	41	32	53	-	-	9	1	13
30 Romblon	4	20	18	18	34	21	11	34	19	1	37	23	76	-	-	7	2	21
REGION VI																		
31 Camarines Norte	5	33	20	30	36	25	18	48	27	3	39	37	15	4	0	21	1	23
32 Camarines Sur	7	21	33	33	30	21	17	35	22	32	33	35	17	3	1	42	4	20
33 Albay	10	21	18	23	35	24	19	36	20	3	48	38	57	3	2	33	3	27
34 Sorsogon	8	18	13	20	32	20	15	12	19	2	33	26	43	0	0	27	2	22
35 Catanduanes	4	18	28	24	27	15	14	35	67	1	31	18	13	2	0	14	0	17
36 Masbate	5	29	49	29	38	13	20	21	16	0	20	8	2	0	0	4	0	13
REGION VII																		
37 Palawan	1	33	76	27	38	19	16	65	33	0	22	18	21	2	0	13	1	19
REGION VIII																		
38 Ilo Ilo	9	19	38	17	34	28	12	49	26	6	40	39	39	7	5	24	28	41
39 Capiz	6	21	45	19	34	37	15	42	22	1	29	43	14	5	5	7	16	39
40 Aklan	6	18	21	17	32	15	13	9	22	0	37	50	23	2	1	17	5	20
41 Antique	7	15	43	14	34	24	21	8	22	0	30	21	14	1	0	36	26	23
42 Negros Occ.	8	20	37	24	30	31	20	54	34	55	39	43	9	25	28	16	55	63
REGION IX																		
43 Negros Or.	5	22	40	23	33	15	14	40	26	1	24	21	12	9	7	7	13	30
44 Siquijor	7	14	40	19	28	12	14	40	26	0	24	15	12	-	-	7	13	30
45 Cebu	13	19	13	16	35	35	12	35	35	2	49	46	62	14	17	2	4	16
46 Bohol	7	16	25	14	33	18	17	39	19	1	36	18	22	1	1	20	11	25
REGION X																		
47 N. Samar	4	19	33	24	31	20	19	35	23	1	24	12	1	-	-	2	0	23
48 E. Samar	2	18	26	24	31	13	19	36	24	1	24	4	1	1	0	1	0	24
49 W. Samar	3	16	29	24	31	24	19	19	15	1	24	22	55	1	0	1	0	24
50 Leyte	7	18	26	17	31	32	14	24	21	2	30	20	37	3	3	27	5	29
51 S. Leyte	6	18	12	17	31	15	15	32	21	2	26	8	21	-	-	18	4	23
REGION XI																		
52 Zamboanga d.N.	3	34	45	32	38	29	21	13	25	1	22	11	7	7	2	7	1	17
53 Zamboanga d.S.	4	48	43	50	40	26	15	44	24	1	28	25	11	10	6	13	1	18
54 Basilan	5	19	43	50	22	15	15	44	24	1	26	12	11	3	2	13	1	18
55 Sulu	5	15	11	18	35	13	13	73	18	2	30	13	14	0	0	1	0	26
56 Tawi Tawi	5	28	11	19	35	46	13	73	18	0	23	7	14	-	-	1	0	26
57 Misamis Occ.	7	20	14	14	35	20	28	27	30	2	35	30	11	10	5	15	4	29
REGION XII																		
58 Misamis Or.	6	22	23	30	37	20	24	43	35	6	45	55	32	14	10	3	2	25
59 Camiguin	8	9	5	20	30	38	24	43	35	6	26	20	20	-	-	5	2	31
60 Surigao d.N.	4	22	22	24	37	19	13	4	41	0	29	28	10	3	1	16	6	18
61 Agusan d.N.	4	40	21	40	43	20	16	67	29	1	46	32	8	34	22	7	0	26
62 Agusan d.S.	1	66	76	40	43	19	16	45	29	1	14	15	63	3	0	8	0	21
63 Bukidnon	2	100	100	46	50	14	17	23	22	10	17	10	8	4	3	10	4	30
64 Surigao d.S.	2	32	37	24	37	24	12	35	30	0	30	31	9	75	35	12	3	19
65 Lanao d.N.	4	34	34	40	34	18	25	57	33	4	42	30	20	15	24	4	0	24
REGION XIII																		
66 Davao d.N.	3	76	49	43	43	24	19	58	31	14	19	13	2	10	5	14	3	19
67 Davao Or.	2	52	33	43	43	15	19	75	31	14	20	25	3	18	6	3	2	20
68 Davao d.S.	5	54	27	43	43	35	19	54	31	14	43	52	32	21	12	8	5	33
69 South Cotabato	3	67	64	46	41	36	18	54	30	1	30	38	4	19	14	48		
REGION XIV																		
70 Lanao d.S.	5	28	44	39	30	37	10	67	11	0	43	25	46	7	2	24	6	43
71 Maguindanao	3	41	76	46	41	17	18	60	24	2	22	35	23	15	9	46	2	27
72 Sultan Kudarat	2	41	76	46	41	32	18	60	24	2	23	13	1	6	3	46	2	27
73 North Cotabato	3	41	76	46	41	32	18	60	24	2	19	11	1	9	5	46	2	27
REGION XV																		
21/22 NCR/Rizal	100	38	1	97	45	80	50	100	79	100	100	100	58	100	96	1	19	42

Tab. 1: Fortsetzung

		V			VI			VII										
		41	42	43	51	52	53	61	62	63	I	II	III	IV	V	VI	VII	TOTAL
		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
	REGION I																	
1	Ilocos Norte	8	14	8	4	34	1	19	56	9	94	197	31	143	30	39	84	618
2	Ilocos Sur	10	11	6	-	14	2	13	85	5	94	177	70	103	27	16	103	590
3	Abra	3	12	3	-	29	0	25	10	6	101	105	48	59	19	29	41	401
4	La Union	15	17	5	-	20	6	12	30	17	105	250	78	86	37	28	59	643
5	Pangasinan	11	11	4	9	14	5	7	29	17	111	183	30	116	26	28	53	547
	REGION II																	
6	Kalinga-Apayo	0	5	-	-	34	0	22	2	1	148	178	1	133	5	34	25	524
7	Mt. Province	2	6	-	-	45	0	80	3	3	131	118	21	199	8	45	86	668
8	Ifugao	1	3	-	-	24	0	15	1	0	125	106	30	100	4	24	16	406
9	Benguet	20	42	43	85	51	14	61	39	45	109	337	12	142	105	150	151	1006
	REGION III																	
10	Batanes	10	6	-	-	100	-	100	42	8	106	239	33	100	16	100	150	783
11	Cagayan	3	9	2	-	13	0	3	66	4	140	142	18	53	14	13	73	453
12	Isabela	1	14	3	-	10	0	2	11	5	172	141	15	129	18	10	19	503
13	Nueva Vizcaya	1	17	4	-	29	1	5	15	7	157	165	9	134	22	30	27	539
14	Quirino	1	12	-	-	43	1	5	15	-	151	152	31	134	13	44	20	545
	REGION IV																	
15	Zambales	10	47	-	-	22	19	38	53	44	131	377	22	101	57	41	135	864
16	Tarlac	13	19	7	-	14	10	7	28	25	136	237	39	212	39	24	60	744
17	Nueva Ecija	5	23	4	4	16	7	7	30	21	139	257	23	224	32	27	58	759
18	Pampanga	16	57	15	5	21	32	15	33	48	133	301	70	152	88	58	95	898
19	Bataan	25	26	4	-	14	24	18	27	47	131	261	150	175	55	38	92	932
20	Bulacan	24	19	5	-	26	37	26	47	60	125	310	172	172	48	63	133	1023
	REGION V																	
23	Laguna	30	34	9	-	21	27	45	33	62	123	285	143	146	73	48	140	959
24	Cavite	30	33	7	-	13	50	34	45	50	116	274	39	76	70	63	133	775
25	Batangas	17	19	4	-	24	10	24	17	21	122	222	100	135	39	36	62	714
26	Quezon	3	9	5	7	14	4	28	19	17	123	193	30	45	16	25	64	493
27	Mindoro Occ.	1	8	5	-	14	1	2	22	7	207	255	57	80	14	15	31	559
28	Mindoro Or.	2	9	3	-	11	1	14	13	7	155	140	83	111	14	12	34	548
29	Marinduque	0	9	5	-	16	2	37	13	6	102	179	53	23	22	18	59	455
30	Romblon	4	2	-	-	19	0	19	7	2	94	146	76	30	6	19	29	399
	REGION VI																	
31	Camarines N.	15	7	6	-	19	1	7	5	7	124	197	27	45	28	18	19	458
32	Camarines Sur	10	8	5	10	19	0	14	30	11	124	195	21	66	23	28	55	512
33	Albay	19	12	2	12	21	0	32	14	12	107	183	62	63	34	33	59	545
34	Sorsogon	14	4	3	-	10	0	41	16	7	91	126	43	51	21	10	64	405
35	Catanduanes	4	2	7	-	35	0	32	20	8	101	181	15	31	13	35	50	436
36	Masbate	2	2	1	-	8	0	13	4	3	150	99	2	17	5	8	20	300
	REGION VII																	
37	Palawan	0	5	2	-	11	0	9	10	6	175	173	23	39	7	11	25	452
	REGION VIII																	
38	Ilo Ilo	9	18	12	20	27	3	25	17	11	117	200	51	93	38	59	52	610
39	Capiz	5	11	1	-	19	0	7	7	6	125	189	24	64	17	19	20	457
40	Aklan	3	5	4	-	14	0	3	15	6	94	146	26	43	12	14	23	358
41	Antique	3	4	2	-	16	0	18	8	2	113	126	15	85	9	16	29	392
42	Negros Occ.	9	29	13	5	18	5	26	13	18	119	276	62	135	50	29	57	727
	REGION IX																	
43	Negros Or.	6	12	6	15	13	1	23	38	9	123	141	29	53	24	20	69	467
44	Siquijor	7	12	-	-	22	1	23	30	-	109	131	12	40	19	23	61	394
45	Cebu	9	26	22	51	32	10	28	22	10	96	214	93	22	57	93	69	644
46	Bohol	7	5	4	16	11	1	26	36	6	95	148	24	58	18	29	65	435
	REGION X																	
47	N. Samar	1	1	-	9	13	0	8	11	9	111	134	1	25	2	21	21	315
48	E. Samar	2	2	-	-	14	0	3	17	1	101	121	2	21	4	14	21	284
49	W. Samar	1	2	4	-	11	0	27	9	6	103	124	56	25	7	11	30	365
50	Leyte	4	10	3	9	16	0	33	36	7	99	143	43	60	17	24	76	462
51	S. Leyte	3	5	6	-	18	0	50	40	4	84	119	21	45	14	18	94	395
	REGION XI																	
52	Zamboanga d.N.	2	6	3	-	11	0	9	24	4	152	122	16	25	11	11	37	374
53	Zamboanga d.S.	3	12	6	-	10	1	22	12	11	105	163	27	32	21	19	45	492
54	Basilan	3	6	4	-	10	0	22	12	11	139	137	16	32	13	10	45	392
55	Sulu	6	2	3	-	21	0	23	4	7	84	162	14	27	11	21	34	353
56	Tawi Tawi	0	1	-	-	5	0	9	4	7	97	180	14	27	1	5	20	344
57	Misamis Occ.	10	17	7	-	27	1	14	25	13	90	172	26	48	34	29	52	450
	REGION XII																	
58	Misamis Or.	9	21	3	10	22	5	37	23	15	119	228	56	30	33	37	75	577
59	Camiguin	29	13	-	-	38	0	90	29	3	72	192	20	42	42	38	122	528
60	Surigao d.N.	2	6	4	-	27	0	57	23	9	108	134	14	39	12	27	89	423
61	Agusan d.N.	6	16	11	-	30	0	18	39	20	148	205	64	35	33	30	77	590
62	Agusan d.S.	1	4	-	-	13	0	3	17	9	226	138	66	29	7	13	26	503
63	Bukidnon	1	8	1	5	9	0	9	7	5	208	119	15	44	10	13	21	520
64	Surigao d.S.	1	6	2	-	19	0	21	15	6	132	162	110	34	9	19	42	517
65	Lanao d. N.	5	14	3	-	26	0	22	33	18	146	219	59	29	20	26	71	569
	REGION XIII																	
66	Davao d.N.	1	9	1	-	10	1	4	19	11	214	179	17	35	10	10	33	497
67	Davao Or.	0	5	3	-	10	0	3	8	7	173	199	27	25	9	10	18	459
68	Davao d.S.	7	45	20	27	24	6	6	19	27	172	249	65	31	75	57	53	701
69	South Cotabato	0	20	2	-	13	1	3	10	10	221	207	37	66	22	14	23	610
	REGION XIV																	
70	Lanao d.S.	1	4	1	5	3	1	22	6	4	146	193	55	72	5	9	32	518
71	Maguindanao	1	11	5	8	22	1	7	8	7	207	179	47	75	17	31	22	577
72	Sultan Kudarat	0	4	-	-	10	0	7	8	7	206	172	10	75	5	10	22	500
73	North Cotabato	1	7	1	-	6	0	7	8	7	207	166	15	75	9	6	22	500
	REGION XV																	
21/22	NMA/Rizal	100	100	100	100	96	100	80	100	100	221	979	284	62	309	296	288	2000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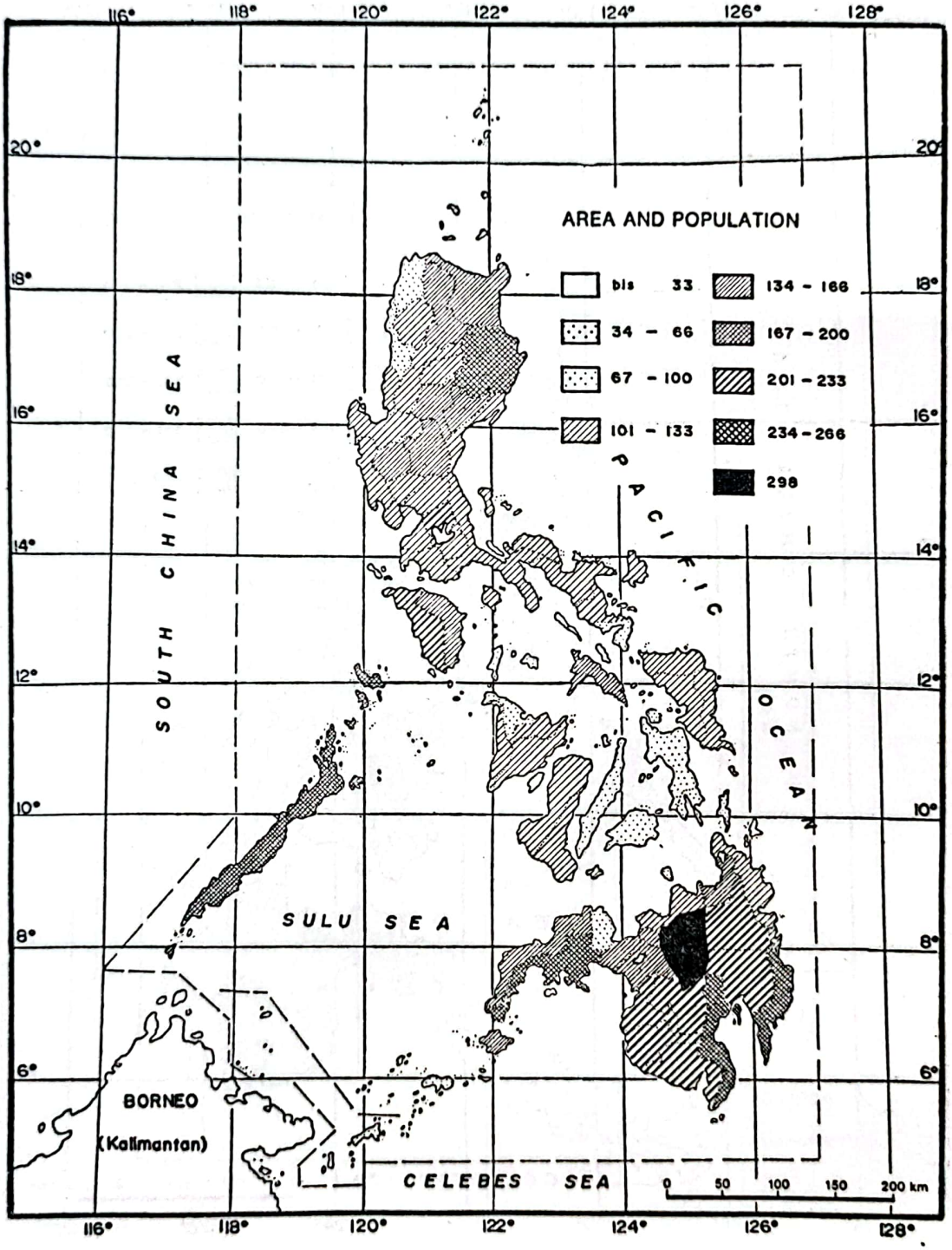
122°
124°
126°
20°
18°
16°
14°
12°
10°
8°
6°
REGIONAL DISPARITIES
bls 150
151 – 300
301 – 450
451 – 600
601 – 750
751 – 900
901 –1100
>1100
2000
SOUTH CHINA SEA
PACIFIC OCEAN
SULU SEA
CELEBES SEA
BORNEO
(Kalimantan)
0 50 100 150 200 km

Map 1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122°
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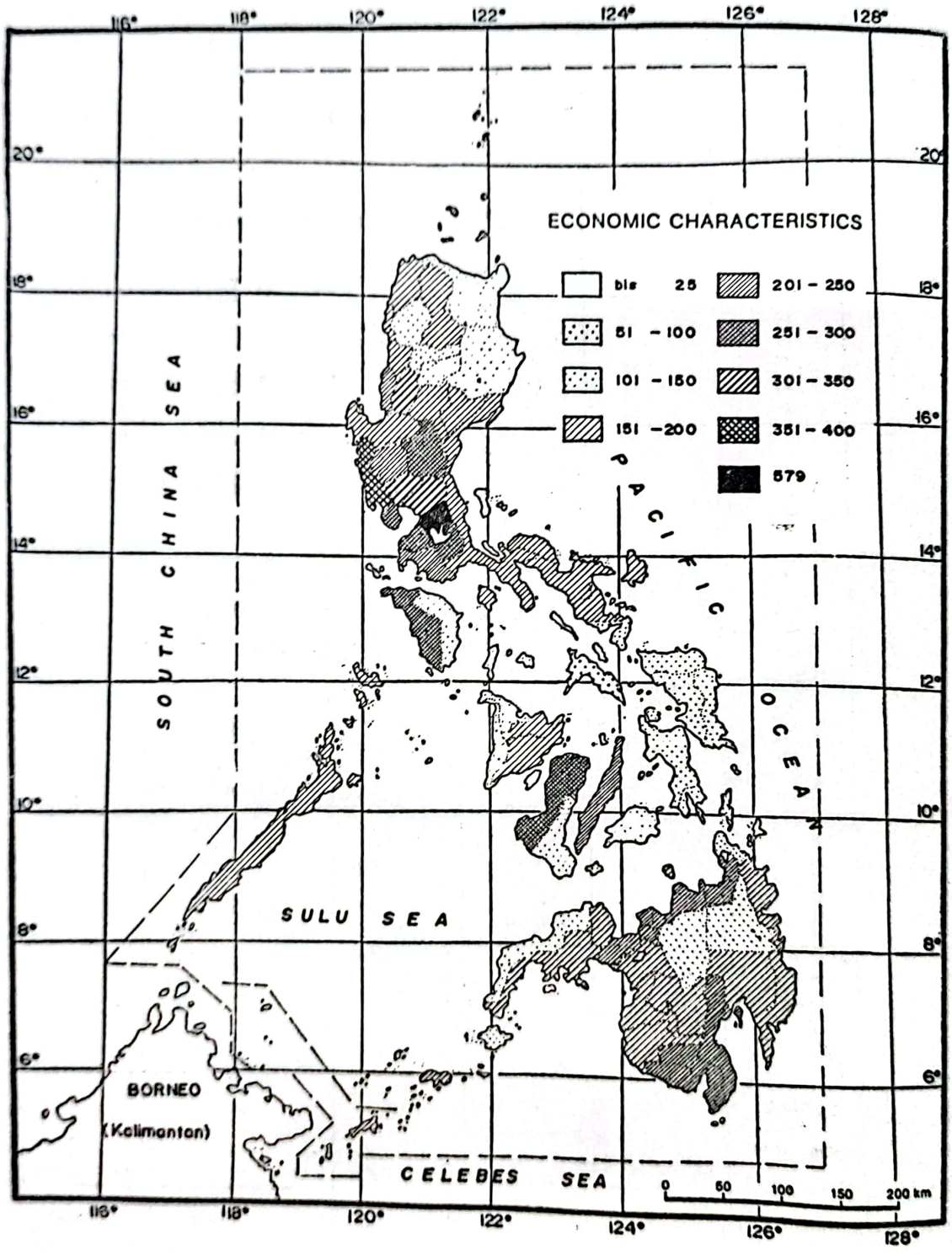
18°
16°
14°
12°
10°
8°
6°
AREA AND POPULATION
bls 33
34 - 66
67 - 100
101 - 133
134 - 166
167 - 200
201 - 233
234 - 266
298
SOUTH CHINA SEA
PACIFIC OCEAN
SULU SEA
BORNEO
(Kalimantan)
CELEBES SEA
0 50 100 150 200 km

Map 2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126°
128°
20°
18°
16°
14°
12°
10°
8°
6°
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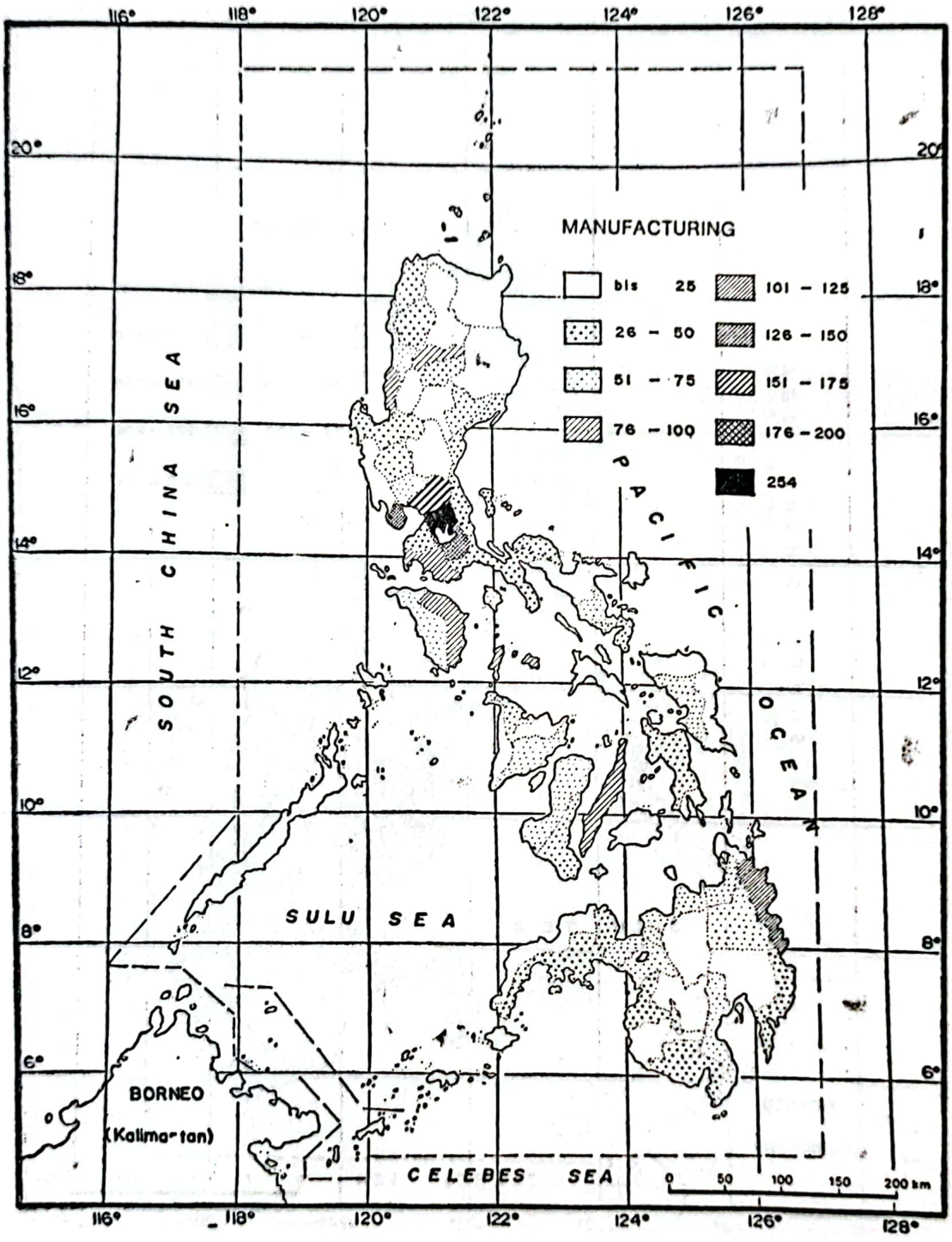
bls 25
51 - 100
101 - 150
151 - 200
201 - 250
251 - 300
301 - 350
351 - 400
579
SOUTH CHINA SEA
PACIFIC OCEAN
SULU SEA
CELEBES SEA
BORNEO
(Kalimantan)
0 50 100 150 200 km

Map 3


MANUFACTURING
bls 25
26 - 50
51 - 75
76 - 100
101 - 125
126 - 150
151 - 175
176 - 200
254
SOUTH CHINA SEA
PACIFIC OCEAN
SULU SEA
CELEBES SEA
BORNEO
(Kalimantan)
0 50 100 150 200 km
116°
118°
120°
122°
124°
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20°
18°
16°
14°
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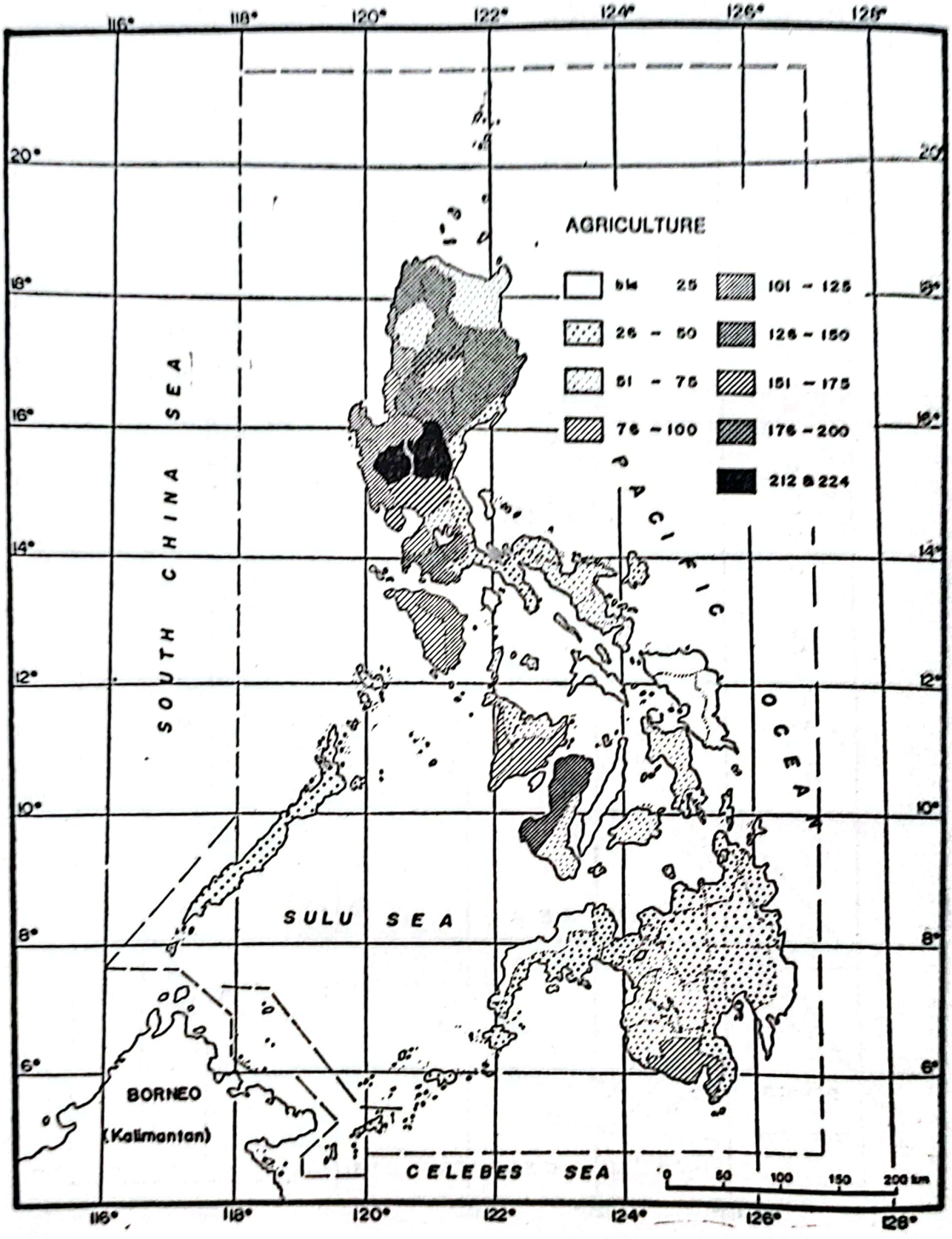
10°
8°
6°

Map 4


AGRICULTURE
SOUTH CHINA SEA
SULU SEA
CELEBES SEA
PACIFIC OCEAN
BORNEO
(Kalimantan)
116°
118°
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122°
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20°
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16°
14°
12°
10°
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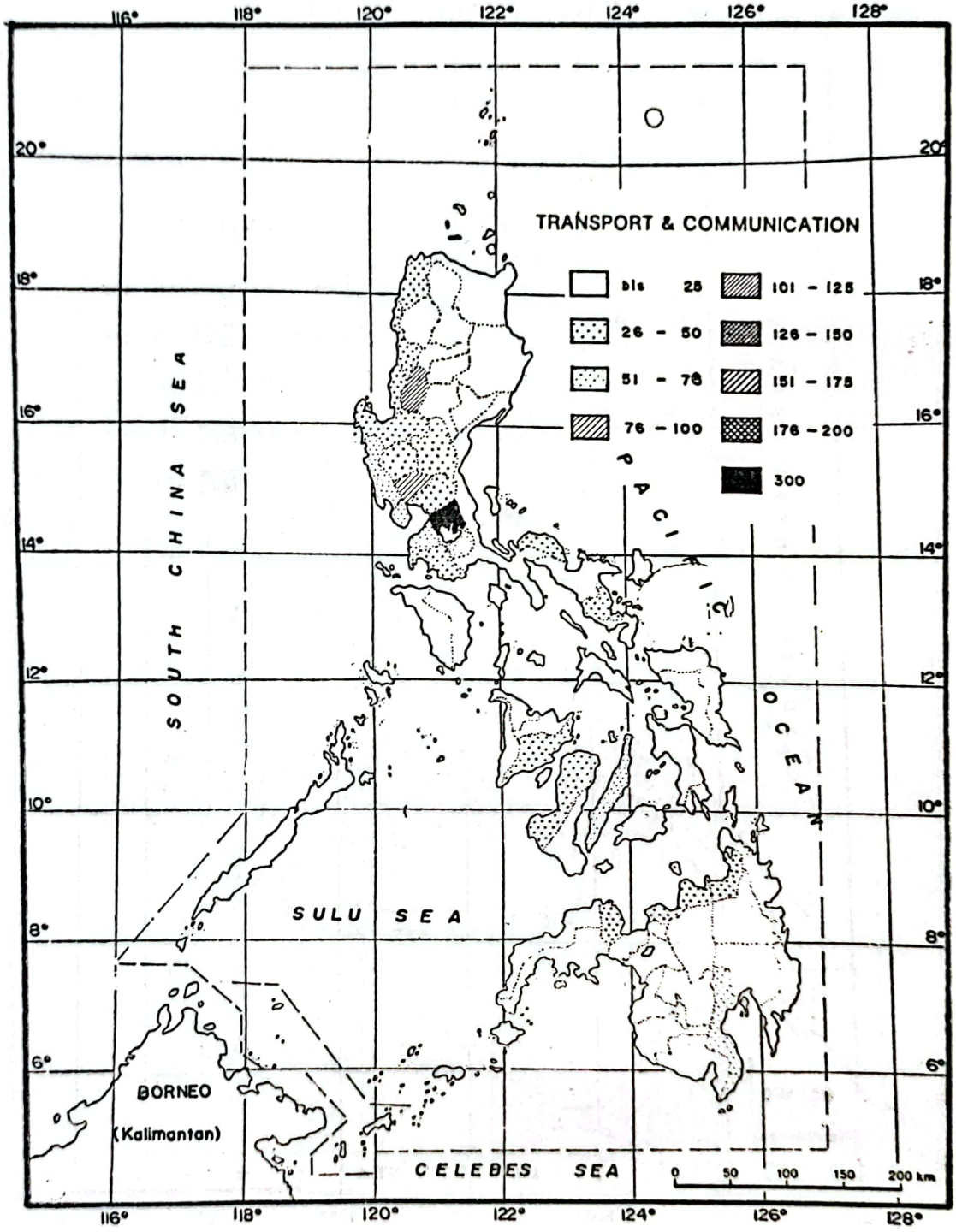
6°
0 50 100 150 200 km

Map 5


TRANSPORT & COMMUNICATION
bls 25
26 - 50
51 - 75
76 - 100
101 - 125
126 - 150
151 - 175
176 - 200
300
SOUTH CHINA SEA
PACIFIC OCEAN
SULU SEA
CELEBES SEA
BORNEO
(Kalimantan)
0 50 100 150 200 km
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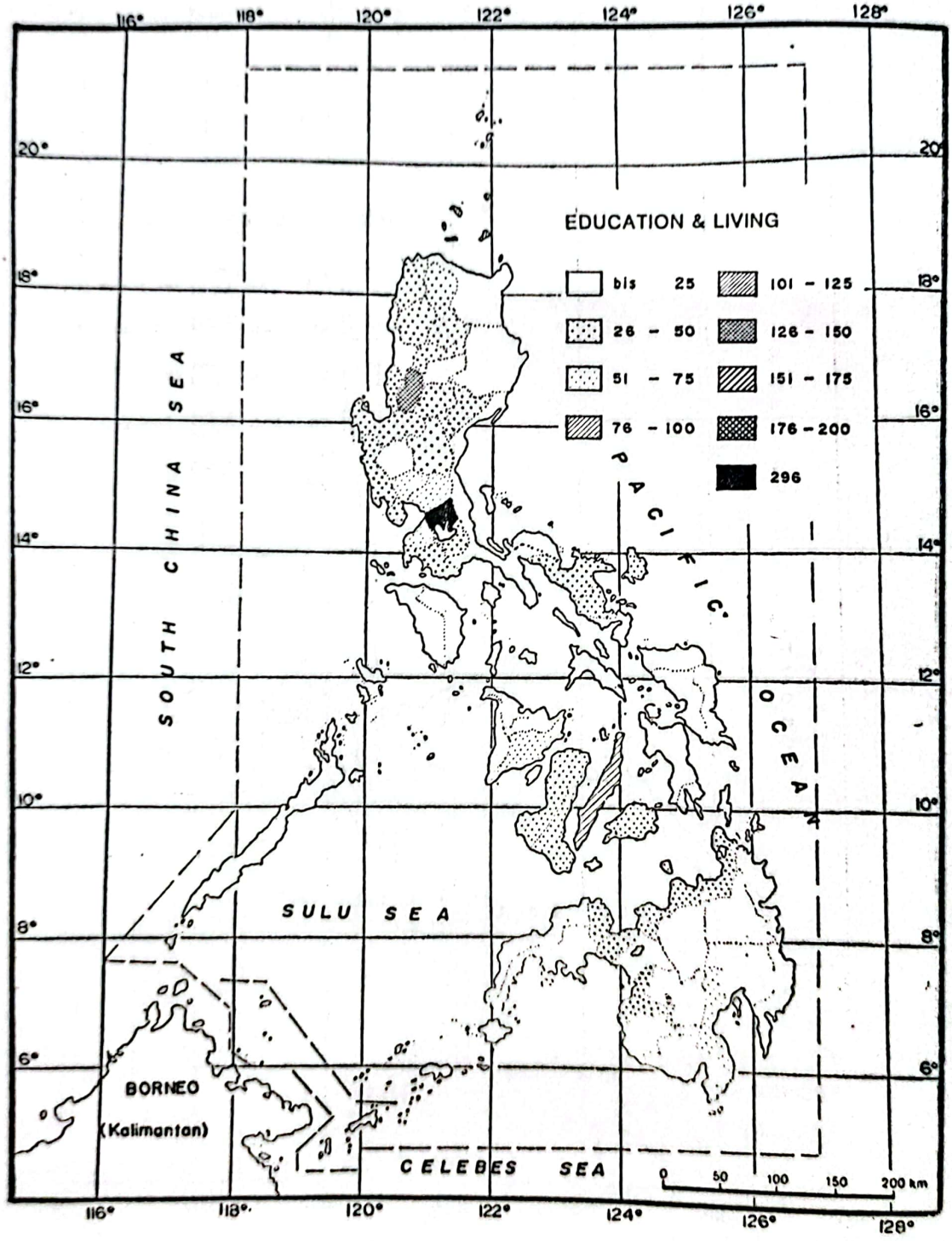
20° 18° 16° 14° 12° 10° 8° 6°

Map 6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128°
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18°
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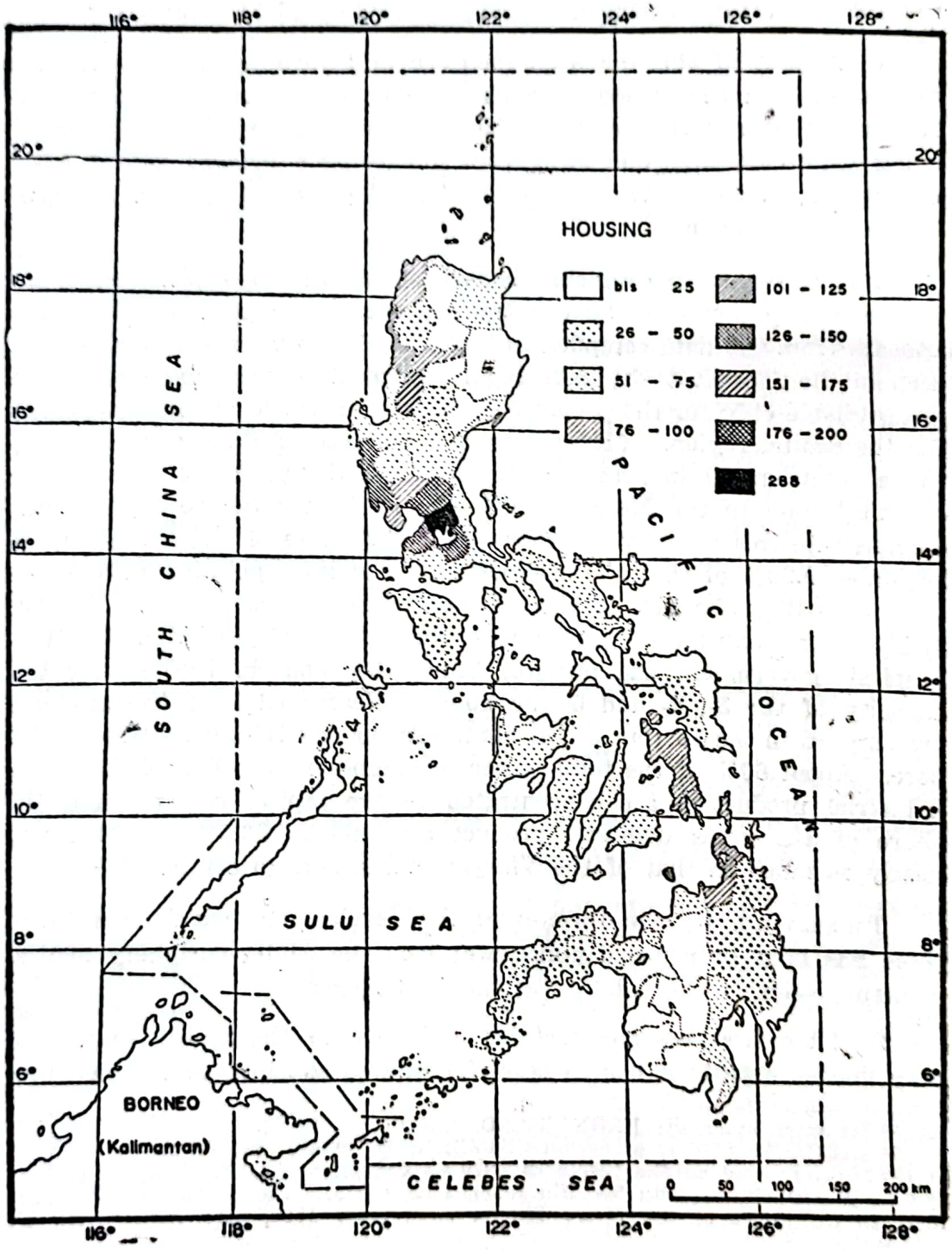
8°
6°
EDUCATION & LIVING
bls 25
26 - 50
51 - 75
76 - 100
101 - 125
126 - 150
151 - 175
176 - 200
296
SOUTH CHINA SEA
PACIFIC OCEAN
SULU SEA
BORNEO
(Kalimantan)
CELEBES SEA
0 50 100 150 200 km

Map 7


116°
118°
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20°
18°
16°
14°
12°
10°
8°
6°
HOUSING
bls 25
26 - 50
51 - 75
76 - 100
101 - 125
126 - 150
151 - 175
176 - 200
288
SOUTH CHINA SEA
PACIFIC OCEAN
SULU SEA
BORNEO
(Kalimantan)
CELEBES SEA
0 50 100 150 200 km

Map 8

less significance although there is a heavy concentration regarding the number of factories, the capitalization as well as the employment in Central Luzon and Southern Tagalog (including Metro Manila).[18]

In respect of this general result, several authors argue that there also exist underdeveloped regions in so-called developed countries.[19] However, the most characteristic fact for the vast majority of the developing countries, and our first view makes this evident also for the Philippines, is the restriction of the "development" first and foremost to the capital region.

1.2 In reality, the regional disparities between the capital region and the remaining parts of the country are even more pronounced than it appears from the data compiled in Table 1. The reason for this is to be seen in the fact that the data regarding most of the single indicators are available only for the province of Rizal as a whole but not separately for the capital region. That means the province of Rizal has inevitably to be incorporated into the capital region although most of its parts doesn't belong to the Metro Manila Area. Some absolute figures may demonstrate this actually enormous gap: the share of the actual capital region — 0.28% of the total area with 13% of its population (1975)[20] — amounts with reference to the number of registered cars and trucks: 46.5% (cars, only: 55%), telephone connection: 68%, TV sets: 72%, hospital (government and private) beds: 41% and ca. 75% of the bed capacity of the 3-, 4- and 5-star hotels. Nearly 62% of the students are enrolled in the 15 (out of the total number of 44) universities located here. About 60% of the total power consumption as well as 65% of the industrial production are concentrated in the capital region[21] and the share of the gross domestic product amounts to 33.5% (1974); i.e., nearly as much as that of the Visayas and Mindanao combined.[22]

To sum up, we can formulate: the development which has taken place has been pronounced punctuate; i..e., the center-periphery spatial structure seems to be valid — at the first glance.

2. This first resume however is justice to the reality only to a very limited extent; it has to be differentiated substantially. The over-

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[18] See more in detail: BRONGER, D. (1979), pp. 81-96.

[19] SALIN, E. (1968), p. 63; JOCHIMSEN, R. (1968), pp. 66 f.

[20] Figures based on the CENSUS 1970 — definition; i.e., 832.0 skm (4 cities and 23 municipalities) with 5.5 Mill inhabitants (1975). Compilation of the more than 20 definitions of the Metro Manila Area since 1960, see: BRONGER, D. (1980), Tab. 6.

[21] The share of MERALCO which is responsible for the energy supply of the capital region and its surroundings amounts to 70.1% during the years 1976 and 1977 combined (NEDA (1978a), p. X); sources for industrial production see: BRONGER, D. (1979), p. 82 (Tab. 20).

[22] Data compiled from a personal note of Dr. Tito A. Mijares, Executive Director of NCSO, to the author (March 1980), for which I want to express my kindest thanks to him. The data for the capital region are based on the CENSUS 1975 — definition i.e., 4 cities and 13 municipalities.

all result (Table 1, column 37; Map 1) shows aggravating regional disparities; there are existing pronounced differences with regard to the level of development within the so-called peripheral regions. Strictly speaking, in relative terms the regional disparities in respect of the two poles — Eastern Samar with the lowest and the province of Bulacan with the highest stage of development — are more distinct than between Bulacan and the capital region.

A more detailed analysis discloses that these differences regarding the level of development within the peripheral regions become even more significant in view of the majority of the 7 dimensions (No. III, IV, V, VI, VII; Table 1, columns 32-36; see also Maps 4-8). And even more pronounced are the regional disparities in respect of the vast majority of the single indicators (see Table 1). This means: the center-periphery model has again to be thought over more closely and surely to be modified — an essential task of the future developing country-research.

3. Apart from this pronounced heterogeneity regarding the stage of development of the individual regions a fact which is supposed to be similarly characteristic for the majority of the developing countries, we can recognize a from inside (center) to outside proceeding spatial pattern in respect of the regional disparities: deriving from the capital region the level of development of the regions is decreasing by increasing distance from the center. The only three exceptions can be considered as special cases: the island group of the Batanes in the far north, the province of Benguet in which the proved level of development is almost solely concentrated in Baguio City as the "summer capital" and next to Manila by far the most important center of Tourism and, finally, the province of Negros Occidental as the "sugar bowl" of the country, from where 50% of the value of sugarcane production is obtained.

Apart from these three cases, the 9 provinces adjoining the capital region (Nr. 15-20, 23-25: Table 1) show the highest level of development among all individual regions (see: Map 1). Generally speaking this downward trend regarding the stage of development proceeds to the North (with the two already mentioned exceptions) as well as to the Southwest (via Mindoro up to Palawan), South (via Marinduque, Romblon, Panay, Zamboanga del Norte up to the Sulu archipelago) and Southeast (via Bicol up to Samar). Without going into details, we can assume that the main causes for this spatial pattern are considered to be the "spread effects" of MYRDAL[23] as well as the particularly favorable ecological preconditions of the core region surrounding provinces.

Exceptions from this spatial pattern came in to being first and foremost in those regions which consist of a self-reliant urban center, located in most of the cases also within a fertile hinterland. Such centers,

[23] MYRDAL, G. (1957), pp. 27 f.

however, could emerge only at a great distance of the overshadowing capital of Manila. Therefore, we have to count in the first instance the historically grown centers, particularly the old cultural center of the Visayas, Cebu City, apart from Manila the only one which could obtain at least a party supraregional centrality. Next important to Cebu, in this connection, we have to name Iloilo and Zamboanga. In recent times Davao and Cagayan de Oro in Mindanao, Bacolod in the Visayas and Baguio in the North could grow as independent centers with correrspond-ing infrastructural facilities.

4. Coincidently with this fact we come to an additional character-istic feature which can be observed first and foremost in the last named regions. Here, a partly already aggravating urban-rural downward trend came into being within the individual regions in respect of the level of development, visible and measurable most prominently in the dimensions V, VI and VII (Table 1, columns 22-29; Maps 6-8) and partly also in II and III. As far as the two last named sectors are concerned, this urban-rural gap can be observed particularly regarding the indicators income per household (No. 11a and 11b),[24] energy consumption (No. 14), in-dustrial employment as well as production (22 and 23).[25]

Also the spatially effective impacts resulting from this urban-rural trend, i.e., the rural exodus is already visible in form of extensive slum and squatter areas on the outskirts of these centers, to be seen particu-larly in Cebu and Davao City, but also in Bacolod and even in Baguio. In connection with the emergence of these negative-effects, the growth pole-strategy has to be reflected upon very carefully.

5. Most intensely pronounced, however, are these differences regard-ing the level of development within the capital region itself. In this con-nection the figures of the CENSUS 1975, published by city/municipality level, showing already pronounced differences regarding the indicator "income per household" (Malabon: 5.782 P — Makati: 20.488 P[26]) are still offering a very incomplete picture. Here the economic and social disparities are to be seen — spatially extremely — close together most drastically. On one side the "villages" in Makati, on the other the slum

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[24] Already in one fifth of the provinces the income per household in urban areas is more than double those of rural households in 1975 (see: BCS/NCSO (1947 ff.), Vol. 29, No. 3 (1978), pp. 101 ff.).

[25] UP to the present most of the rural areas especially in the Visayas as well as in Mindanao are still without electricity supply: the fact that in 1977 12.9% of the total households in the Visayas and 15.2% of those in Mindanao are elec-trified (MINISTRY OF ENERGY (fEd.) (1978), p. 64) disguises only the aggra-vating rural-urban disparities: in these two main regions only each 30th (!) rural family is supplied with electricity. But above all — and this to be seen as a decisive factor regarding the future industrialization of the rural areas — these areas are supplied with electricity only a few hours per day and in addition, they have to pay much higher rates than in Manila.

[26] BCS/NCSO (1947 ff.), Vol. 29, No. 3 (1978), p. 102.

and squatter areas of Tondo where in 1975 57,745 people/sqkm are living squeezed together — mostly in one- and two-storeyed buildings! Here the rate of unemployment is several times higher than the country's average, to say nothing of the more than one million underemployed.

6. As far as the essential aspect of the development process is concerned, quite a number of indicators are pointing to the fact that the already serious gap in respect of the stage of development between the capital region and all the other parts of the country is even steadily aggravating. So the very pronounced lead of the capital region concerning the industrial sector (Indicator 22 and 23) could by no means be reduced in the last 15 years (1961-1975)[27] despite counter-measures from the governmental side. Similarly, it is valid with respect to the dimensions V (indicator 42 and 43), VI (51 and 53) and VII (63). As an essential single indicator concerning this process, we can state the private capital investments in the construction sector: during the last three years (1976-1978) about 80% of the total investments had been concentrated in the capital region — clearly visible through its fast growing number of multi-storeyed buildings, five-star hotels and a huge congress-center along the seashore, probably unique throughout the world.

Other clear indicators are the growing share of the gross domestic product allotted to the capital region: 1948: 23%, 1961: 27%,[27a] 1971: 30.2%, 1974: 33.5% (see: Note 22) and the promotion of the road system mainly in the core region and its hinterland: the enlargement of the expressway system up to Dau in the North as well as beyond Calamba in the South, respectively, new roads around Laguna de Bay, to Infanta, Tagay ay, Bataan, etc. The consequence of this promotion program on one side and the coincident lack of infrastructural facilities comparable to Manila in the other parts of the country on the other is to be viewed in the increasing concentration of the fast growing stream of tourists (arriving anyhow in Manila only) in this area.

This dynamics precipitates in its fast growing share of the total population: in the year 1918 the share of Metro Manila amounted to only 4.7%,[28] after World War II, it rose to 9% (1948) and according to the last census (1975) it reached already 13%.[29] Remarkable is the fact that this enormous population increase which came to more than double the country's average was due mainly to the internal migration surplus especially in the 60's and 70's.

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[27] BRONGER, D. (1979), pp. 81 ff.

[27a] Government of the Republic of the Philippines, TREEMAN Fox and Associates, 1976, p. 109.

[28] Computed from: NEDA (Ed.), (1978), pp. 26-27.

[29] Most probably this share is sufficiently higher: a semi-official (barangay) census estimated the population of Metro Manila already to 7.1 Mill. in 1975. This figure includes the definitely more than one million permanent and temporary workers from the surrounding Luzonian provinces, especially from Ilocos, working and living most of the time in Manila.

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V. PROBLEMS OF PRACTICAL APPLICATION — CONSIDERATIONS FOR FUTURE RESEARCH

The target of this study had been the attempt to determine the stage of development of the individual regions within the Philippines based on 25 main indicators. With reference to the function of regional planning, the leading results are twofold. Firstly: The highly pronounced and in the course of the time continuously aggravating regional disparities between the capital region and the remaining country as well as among the so-called peripheral regions. Secondly: It should be the prime task and duty of any regional planning and policy to reduce these regional disparities — disparities, as I mentioned in the beginning, which could be a futural treat to the existence of the concerned state as a political unit.

As far as the problem of the application of our division of the peripheral regions into 6 categories (see: Map 1) is concerned, the spatial picture of the stage of development offers us important understandings: as it is impossible to develop all peripheral regions to the same extent and intensity at the same time, these findings give us the possibility to determine out of the total number of the "objective region" ("Zielregionen"[30]) the definitive selection of the "action regions" ("Aktionsregionen"). "Action regions" are defined as those regions which should have the top priority for development and in which the instruments of regional planning are actually applied and realized.[31]

With reference to the Philippines, the results of the determination of the regional disparities show clearly that first and foremost the individual regions within the main (functional) regions VI[32] (Bicol), X (Eastern Visayas), XI (Western Mindanao) and XIV (Central Mindanao) should be selected as "action regions". In connection with this general conclusion it is further necessary to reflect upon a long-term strategy how the concept of establishing and/or developing regional centers could be applied as efficiently as possible in order to reduce the overwhelming dominance of Metro Manila. A precondition to solve this problem and consequently an essential task for future research is the determination of the spatial hierarchical structure of the main urban centers in order to answer the questions: which of these centers could possibly act in the above mentioned sense as a regional center? These problems are to be discussed in a separate study.

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[30] THELEN, P. (1972), p. 243.
[31] *Ibid.*, p. 243.
[32] For details regarding the regionalization see: BRONGER, D. (1980), Map. 1

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NOISE AS A FACTOR IN ENVIRONMENTAL POLLUTION OF KANPUR CITY

by

DR. S.L. KAYASTHA and DR. V.K. KUMRA*

Noise is also an important aspect of urban environmental pollution. It is the most subjective pollutant. It may be soothing music to one ear and uncomfortable to another. With developing technology and mode of living, it has penetrated almost every aspect of modern human life. 'Although many cities are in a process of redevelopment, the proplem of noise is generally relegated to a minor item in the budget.[1]

'Noise' may be defined as 'unwanted sound' which interferes with human comfort, health and efficiency. Motion of a sound wave through air is most conveniently described as the physical replacement of air molecules adjacent to the vibrating surface which in other words is the variation of air pressure at any given point.[2] Noise emanating from any source becomes a pollutant when it is intolerable.

There is ample evidence that exposure to loud sounds is harmful in various ways and most people do not want to be harmed, therefore, the louder sound is the more likely to be considered noise.[3]

Geographical studies are becoming more concerned to the problems arising from noise pollution. The studies involve the geographical distribution of sources of noise and spatial pattern of noise level in different parts of the city. Therefore, in the present study, the author has also tried to evaluate the level of noise in the city and its effect on human health. For this purpose, monitoring of noise has been done at congested road crossings, near railway stations and near industries. For analyzing the pattern of noise, cartographic techniques have been used and noise pollution zones have been demarcated. Thus, noise pollution becomes an important aspect in the present study of Kanpur city.

SOURCES OF NOISE POLLUTION

The major sources of noise pollution can be grouped into two categories: (i) stationary sources and (ii) corridor sources. Stationary sources include noise from industries, construction and demolition, noise as well as domestic noise originating from air conditioners, radios, and

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lawn mowers, etc., and corridor noise involves all moving vehicles including automobiles and air crafts. In Indian context, main sources of noise pollution in cities are the industries, automobiles and the loudspeakers.

The most common noise in cities are the automobile noise, and different types of motor vehicles produce different intensity of noise (Table 1).

Table 1 reveals that buses produce maximum level of noise in the city (83 dBA), while motor cycles produce only 77 dBA of noise, but the motor cycle which has no silencer generates a noise of more than 80 dBA which is intolerable. Bolt Beranek and Newman's studies show that in the urban noise environment, different traffic volumes produce different noise levels.

Looking more closely at these sources, we can visualize that the noise emanates from several sites, exhaust engines, gear boxes, tyres, and in some locations air turbulence caused by the movement of cars at high speeds. Driving habits also affect the level of noise because some drivers blow horn too frequently. Motor cycles are often becoming very noisy for the congested parts of the city. Air craft noise is not a serious problem in Kanpur city because there are very limited flights at Chakeri Airport. About 50,000 persons who live near the Airport are affected by the air craft noise for some hours.

Even though air craft noises bring the largest number of complaints from people but in Kanpur city, surface traffic is more noise-some to the majority of people. Although automobiles are typically 8 to 10

TABLE 1. MOTOR VEHICLES NOISE GENERATION (MINIMUM FLOW 120 VEHICLES PER HOUR)[4]

Vehicle type	Mean sound level dBA	Range for 80% of vehicles
1. Cars	70-72	67-77
2. Heavy commercial vehicles	81	76-86
3. Buses (London Transport)	83	80-85
4. Motor cycle	77	72-83

decibels quieter than gasoline powered engines and 12 to 18 decibels quieter than diesel trucks, the large number of cars makes them an important source of noise pollution, especially in peaceful area of the city where trucks do not ply. At free-way speeds, the noise of vehicles is mainly due to their tyres, while at city speeds the noise comes from engines, exhaust systems and the rattling of loose parts. Noise is also generated from trains which are the major transportation systems in the big cities especially during night hours. In Kanpur city, the railway

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station is located in the inner parts of the city. Railway lines also pass through most congested parts of the city. The noise produced by these trains is uncomfortable to those residing near railway lines. A train produces 80 decibels of noise.

Along with the above mentioned sources of noise, there are a few other sources of noise in public places. Human talks in gathering of friends generates 40 decibels of noise, while in offices talks among employees create a noise of 60 dBA. Talks on telephone produces 70 dB of noise while processions for demands produces a noise of 100 dB.[5] Industries and their machines produce very high levels of noise, i.e., 120 dB. These sources of pollution on which we have given very little attention are more harmful for human comfort.

PATTERN OF NOISE POLLUTION

It is essential to evaluate the pattern of noise level in the city. Noise levels vary substantially by location and time as well as density of population. If the density of population is high, the level of noise will be high. In previous studies it has been concluded that noise level varies from urban to rural areas. The table given below (Table 2) shows the level of noise in different localities:

TABLE 2. THE RANGE OF OUTDOOR NOISE FOR DIFFERENT RESIDENTIAL LOCALITIES

Description	Typical Range dB(A)	Average dB(A)
1. Quiet suburban residential	36-40	38
2. Normal suburban residential	41-45	43
3. Urban residential	46-50	48
4. Noisy urban residential	51-55	53
5. Very noisy urban residential	56-60	58

The above table reveals that in a quiet suburban locality, the level of noise is least, i.e., 38 dB(A), while it is 58 dB(A) in very noisy urban residential area. In a very noisy urban residential locality, traffic is more frequent, while in the suburban locality traffic flow per hour is rather low.

To know the pattern of noise in the city, monitoring of noise was conducted, with the help of noise-level meter. For this purpose, different parts of the city and busy road crossings have been selected for measuring noise level. The time selected for measuring noise are peak hours of the working day, because in the city the main source of noise are the automobiles. In addition to this, noise have also been monitored

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during night hours (12 to 3 A.M.), when most of the people asleep. Site should be also selected so that every part of the city may be covered for a detailed study of noise pollution with varying intensity. Along with these, noise is also measured near industries, suburban and rural areas of the city.

The average noise level at various monitoring stations for days hours and night hours have been measured (Fivure 1). Table 3 shows the average noise level in the city. It is evident from the table that average noise level varies from 40 decibels at H.B.T.I. West Campus to 29 decibels at Parade crossing. Along with Parade, noise level at Moolganj, LIC Crossing, Barachauraha, Meston Road Crossing, Medical College crossing, Gumti No. 5, Rawatpur crossing varies from 70 to 85 decibels which is intolerable to the residing population. The Figure 2 shows that these areas are very noisy and come under isopleth of noise of 80 decibels; while I.I.T. Campus, Kidwainager, Nawabganj, Civil line, Jajmau, Cantonment areas are less noisy and rural areas near these localities are the least noisy (Figure 2). At Chakeri Air Port, noise is emittel from aircrafts only. The average noise level is only 70 dB, while maximum level of noise is 105 decibels.

Similarly at Kanpur Railway Station level of noise is also with (81 decibels) due to high frequencies of trains. Even at night, noise level is more than 60 decibels. Automobiles also contribute to noise nuisance. Here each hour more than 1200 vehicles including motor cycles, scooters, tempos, cars and buses pass through the crossing situated outside the railway station. It has been observed that people residing near railway station suffer loss of sleep and hearing capacity.

In the industrial localities noise is mainly caused by the machines operating day and night and as well as by automobiles. Fazalganj, industrial estate, Armapur Estate, Civil lines, Jajmau, Prade anl Udyog Nagar, are the main industrial parts of the city where the residents are more affected by industrial noise. It is obvious from the Table 3 that Fazalganj and area near Panki Power Plant, has a noise level of 60-75 decibels, which is also harmful to human health.

In purely residential and rural parts of the city, noise level is low. In this zone noise level varies from 25 to 50 decibels (day time). The above analysis reveals that nearly every part of the main city is crowded but the city also enjoys very peaceful areas surrounding the main city.

For spatial analysis, the author has compared Delhi with Kanpur regarding level of noise. Delhi has a population of 5 million and 306,300 vehicles. Here the main sources of noise pollution are automobiles. The level of noise varies from 64 decibels at Teen Murti Marg to 92 decibels at Daryaganj (Table 4). Daryaganj is the noisiest area of Delhi, while in Kanpur, Parade is the noisiest. At Safdarganj airport, the average noise level is 87 decibels while in Kanpur at Chakeri airport the level of

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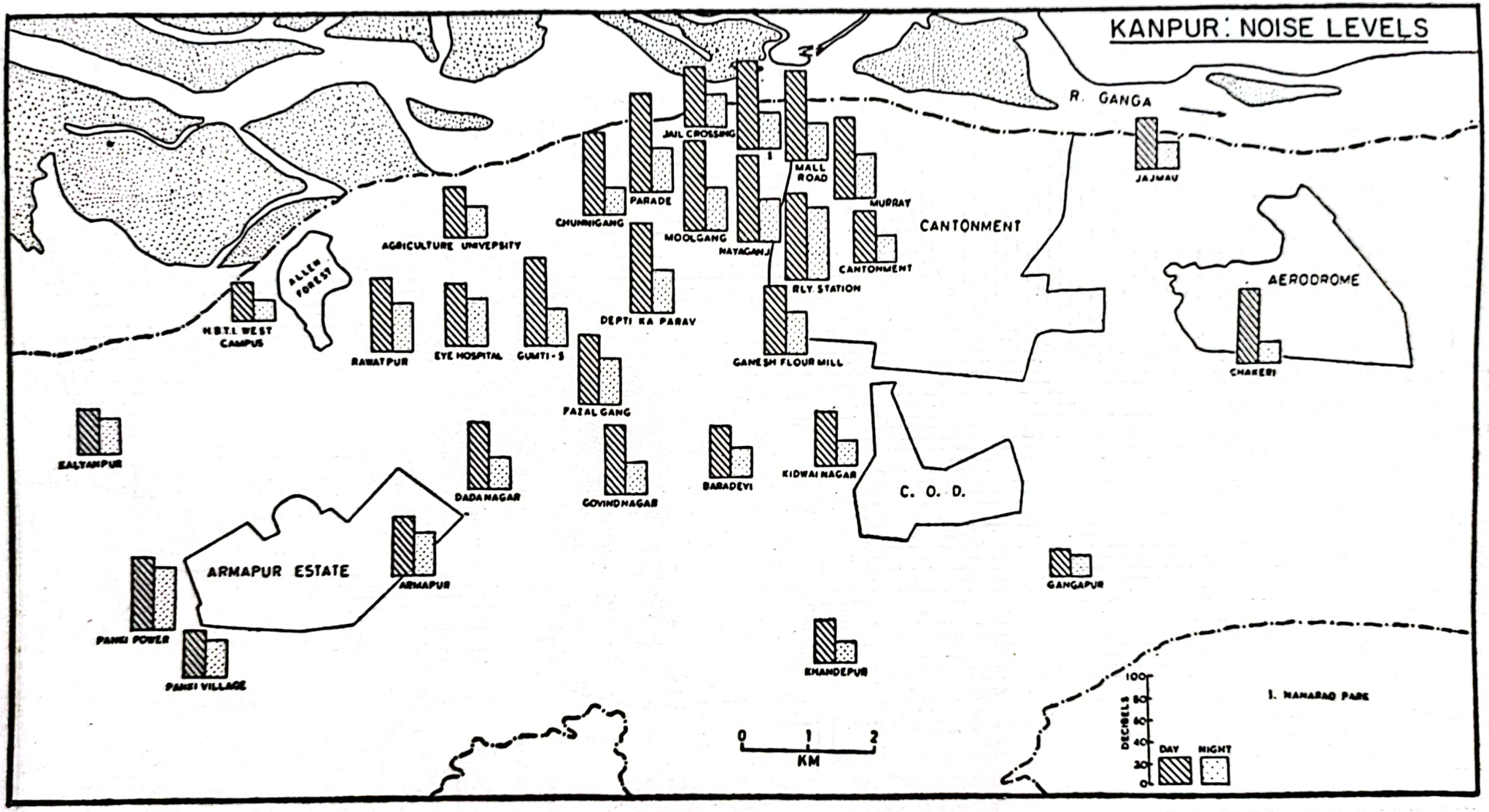
KANPUR: NOISE LEVELS
R. GANGA
JAIL CROSSING
MALL ROAD
MURRAY
PARADE
CHUNNIGANG
MOOLGANG
NAYAGANJ
CANTONMENT
CANTONMENT
RLY. STATION
AGRICULTURE UNIVERSITY
ALLEN FOREST
H.B.T.I. WEST CAMPUS
RAWATPUR
EYE HOSPITAL
GUMTI - 5
DEPTI KA PARAV
GANESH FLOUR MILL
JAJMAU
AERODROME
CHAKERI
PATAL GANG
KALYANPUR
DADANAGAR
GOVINDNAGAR
BARADEVI
KIDWAI NAGAR
C. O. D.
ARMAPUR ESTATE
ARMAPUR
GANGAPUR
PANKI POWER
PANKI VILLAGE
KHANDEPUR
I. NANARAO PARK
DECIBELS
100
80
60
40
20
0
DAY
NIGHT
0
1
2
KM

FIG. 1

KANPUR: NOISE LEVEL DURING DAY HOURS

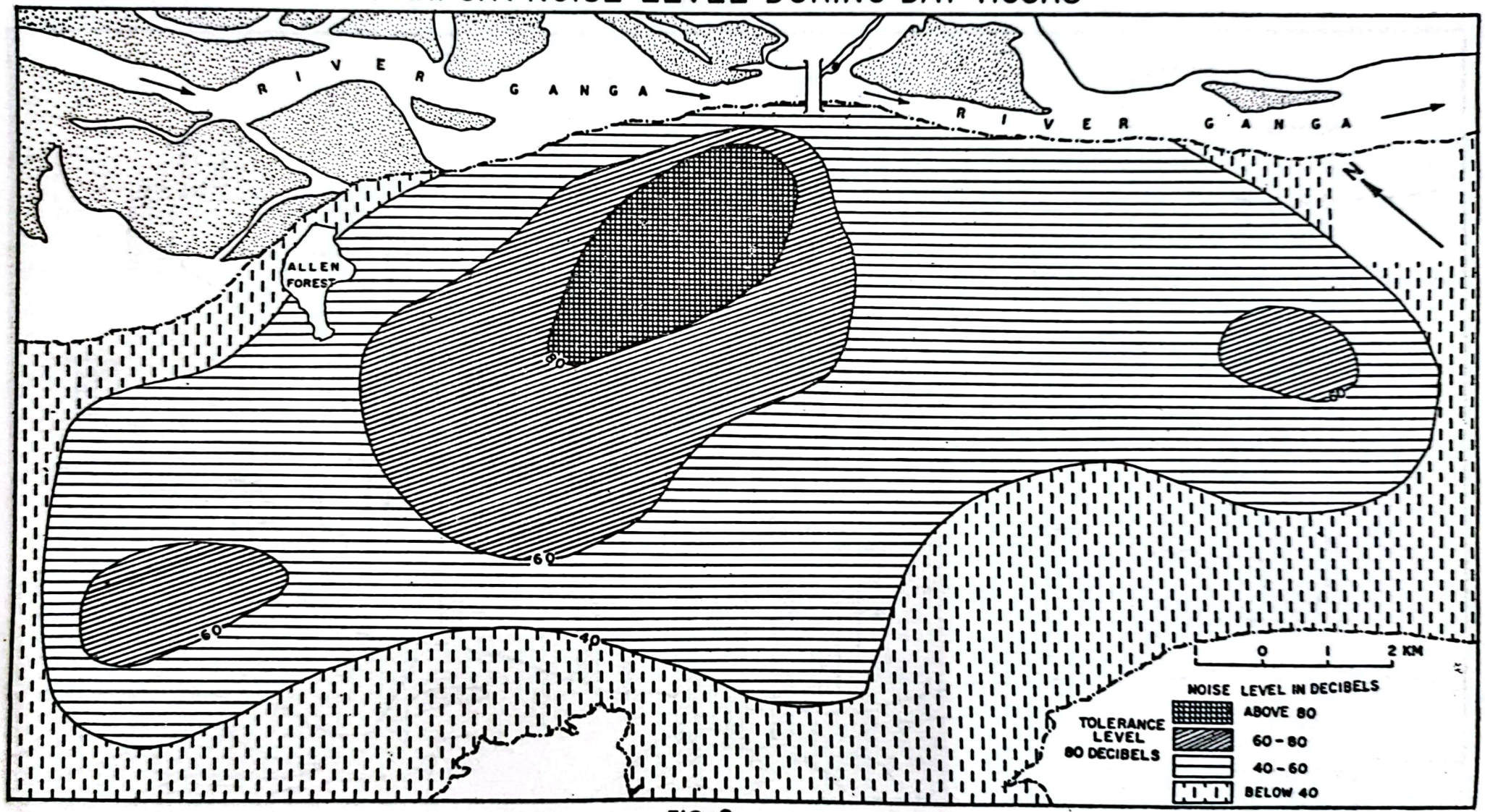

FIG. 2

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KANPUR : NOISE LEVELS DURING NIGHT

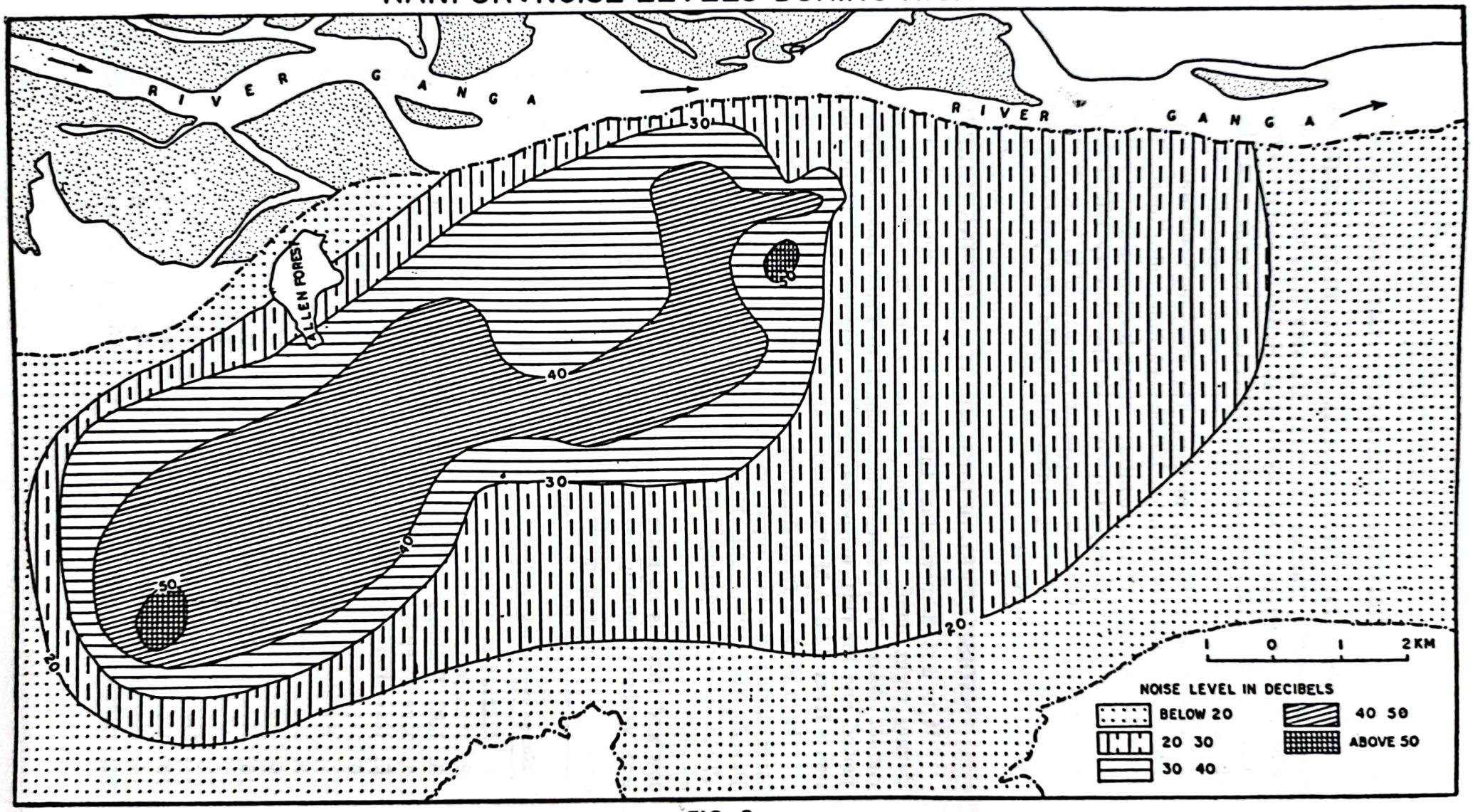

FIG. 3

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noise is only 70 dB. This is because of more flights at Safdarganj than Chakeri airport. Similarly at Lady Harding Hospital, the level of noise is 81 decibels which is higher than at Hallet in Kanpur (70 decibels). In both of the cities noise level is higher than desirable near the hospitals (Figure 2).

Therefore, it is evident from the comparative study that Kanpur is also reaching the Delhi condition regarding noise level. Delhi is the third noisiest city of the country. Noise level in Kanpur is less in comparison to other metropolitan cities of the country but it suffers from acute noise problem. Its increasing population is also contributing to the rising level of noise, which will within few years become uncomfortable for human life.

NOISE LEVEL DURING NIGHT (SLEEPING HOURS)

It is a well-known fact that noise in day time is much more than during night hours. If noise is more than 30 decibels, people usually cannot sleep. Therefore, it is essential to know noise level during this period and for this, noise has been also measured at night and average noise from 12-3 A.M. has been tabulated.

It is evident from Figure 1 that there is great difference in noise level during day and night hours. In the busy streets of the city, like Parade, Bara Chauraha, Meston Road and Moolganj, noise is too high (70-90 decibels) during day time, while at night (12-3 A.M.), it varies from 30 to 45 decibels. At night after 12 o'clock, traffic density is very low and there is no noise from any other source except a few industries and vehicles running on roads. But the residential localities situated

TABLE 3. NOISE LEVEL IN KANPUR CITY

Noise monitoring stations	Noise level in decibels		
	at 9-12 A.M.	5-8 P.M.	Average
1. Murray crossing	78	76	77
2. Parade crossing	88	90	89
3. LIC Building crossing	84	80	82
4. Eye Hospital crossing	70	66	68
5. Rawatpur crossing	72	68	71
6. Near Panki Thermal Power Plant	66	70	68
7. Fazalganj crossing	64	68	66
8. Near Central Railway Station	84	78	81
9. Agriculture Univ. crossing	50	44	47
10. Bakarmandi crossing	65	65	65
11. Medical college	75	65	70
12. Collectorganj crossing	80	78	79
13. Gumti No. 5 crossing	80	84	82
14. Govind Nagar crossing	66	70	68
15. Ganges flour mill	70	64	67

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16.	Kidwai nagar	51	55	53
17.	Jajmau	50	44	47
18.	I.I.T. Kanpur gate	44	40	42
19.	Nayaganj crossing	80	76	78
20.	Near Panki Temple	50	40	45
21.	Moolganj crossing	80	70	75
22.	Civil line	54	50	52
23.	Cantonment	54	50	52
24.	Chakeri airport	90	50	70
25.	Lalbungalow (Baradevi)	54	50	52
26.	H.B.T.I. West Campus	40	36	38
27.	Armapur estate	60	58	59
28.	Depti-ka-Paraw crossing	84	80	82
29.	Chamanganj crossing	80	80	80
30.	Canal crossing	78	82	80
31.	Charles crossing	80	82	81
32.	Jail crossing	60	54	57
33.	Bara Chauraha	80	84	82
34.	Nana Rao Park crossing	88	80	84
35.	Gun factory crossing	70	60	65
36.	Village Gangapur	25	25	25

TABLE 4. NOISE LEVEL IN A FEW SELECTED AREAS OF DELHI*

Locality	Noise level (decibels)	Locality	Noise level (decibels)
Daryanganj	92	Dariba area	78
Subjimandi	79	Teen Murti Marg	64
Fatehpuri	84	Mintobridge	88
Sadarbazar	80	Regal	81
Chandichauk	88	Conaught place	80
West Patel Nagar	83	Safdarganj airport	81
Lady harding hospital	81		

* Source — *Statement*, 11th July 1976 (by a staff reporter).

along G.T. road suffer from noise at night; which varies from 35 to 60 decibels (Ganges flour mill, Eye hospital and fazalganj). It has also been observed from this survey that near Central Railway Station, Thermal Power Plant and IEL, the level of noise is high (40-60 decibels), which disturbs sleep. Figure 3 shows that there are certain localities in Kanpur where during night hours, noise level is higher than 40 decibels (tolerance level for night).

In the present study, deviation index have been calculated to know the noise level which is more than the tolerance limit. Composite deviation index has been also calculated to evaluate which place is suffering

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more from noise pollution hazard. Deviation index calculated for each sampling station showed that Parade is the noisiest place of the city (deviation index 1.112) during day hours, while H.B.T.I. West Campus (0.475) and village Gangapur are quieter places of the city. Along with this, Meston Road crossing and Bara Chauraha are also noisy crossings of the city. During night, area near to Central Railway Station and Thermal Power Station are very noisy (DB = 0.750). Composite deviation index calculated for every locality reveals that Central Railway Station is the noisiest place of the city while in village Gangapur noise level is least. At parade, composite deviation index is 1.612, which depicts that it is also a noisy place of the city but during night hours level of noise is less in comparison to Central Railway Station.

TRAFFIC DENSITY AND NOISE LEVEL

Traffic density at any crossing of the busy road governs the level of noise at that place. But it is not theoretically correct that as the number of vehicles passing through a crossing increases, noise level also rises. To know the relationship between noise level and traffic density, road traffic survey has been conducted at important road crossings of the city. Table 5 shows the level of noise pollution and traffic density per hour. It is obvious from the table that most of the crossings where traffic density per hour is more than 1000 vehicles, has a noise level varying between 70 to 80 decibels. At Parade crossing where the traffic density is 2331 vehicles per hour, having noise level of 89 dB, is the noisiest crossing of the city while at Kidwainagar traffic density is only 314 has lowest level of noise, i.e., 50 dB. But at Collectorganj noise level is high (79 dB) while traffic density is less in comparison to Parade. The reason behind this is that Collectorganj is near to the railway station and is situated in very congested part of the city. Therefore, it is clear from the above analysis that there is some relation in traffic density and noise level but this relation is not altogether true in every case.

TABLE 5. TRAFFIC DENSITY AND NOISE LEVEL*

Name of the crossing	Traffic density per hour	Noise level (decibels)
Murray crossing	1382	77
Parade crossing	2331	89
LIC Building crossing	1865	82
Eye Hospital crossing	1013	68
Rawatpur	480	71
Fazalganj	845	66
Agriculture Univ. crossing	542	47
Charles crossing	2065	81
Canal crossing	1831	80
Kidwainagar	314	53

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Govindnagar	586	68
Chamanganj	1985	65
Barachauraha	1858	84
Collectorganj	770	79
Gumti No. 5	907	82
Ganges flour mill	1122	67
Baradevi	446	52

* Source — Compiled from field study.

NOISE INSIDE AN INDUSTRY

In the present study, noise level inside the industry has also been given importance, because a large number of laborers are engaged in factories where machines operate day and night. For this purpose textile industry has been selected as a case study. In most of the textile mills, the noise levels are above the threshold of danger level with potential to cause permanent hearing loss. In India, about 8,000,000 workers engaged in textile mills working in weaving and spinning sections of mills, are worst affected. The noise level in a big textile mill like Lalimli, weaving section is in the range of 100-105 dB(A) and therein a large spinning and preparatory departments, between 80-95 dB(A). The table given below shows noise level in different sections of the mill.

TABLE 6. TEXTILE MACHINERY NOISE LEVEL IN DIFFERENT SECTIONS*

Noise level in dB(A)	Machinery section
Opening and blow room machinery	85-94
Card room	87-90
Card frames and spinning frames	89-96
Winding machines	85-89
Warping machines	85-87
Sizing machines	80
Large weaving shed	100-105
Shuttleless weaving	90-96
Shearing and cropping machine	75-85
Folding depths	69-75

* Purushotham, S. 'The Noise Nuissance', Science Today, Times of India Publication, Feb. 1978, p. 35.

The above table reveals that almost in every section of the mill, noise level is more than 80 decibels, which is harmful for those who handle machines in different sections of the mill. Noise pollution is not a problem only in textile mills but also in all the factories where heavy machines operate for production of goods. It has been observed that it is not possible for a person not working in the factory to stay

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for more than one hour in any machine section. Even noise level could not be measured in each type of mill of the city but personal survey reveals that in factories noise level is generally more than the tolerance limit.

EFFECT OF NOISE POLLUTION ON HUMAN HEALTH

The effects of noise vary from mild annoyance to inversible changes and permanent hearing loss. In addition to this noise interference with communication often causes accidents, for instance, at railroad crossings. One might think that it would be straight forward to work out how it is to be 4.9 million people in U.S.A. society with hearing damage caused by noisy jobs. Therefore, the three basic problems arising from noise pollution are psychological, physiological and interference with communication.

The annoyance of sound is the most general problem now-a-days and includes all people in every living and working condition. It requires detailed study by medical-psychiatrists and others to determine what accoustical environment, the human beings can tolerate or consider proper for well-being. Whether a given noise should be considered as dangerous or it will impose on the listness on human beings depends on the level of noise, how long it occurs daily, how long it lasts, over how many years daily exposure is repeated and individual susceptibility to this type of injury is possible. Besides the psychological and annoyance effects, there are real physiological effects of noise on human beings, which have been studied in several environmental studies.

Noise of high level affects the heart as well as decrease in oxygen supply to the brain. Interference with digestive processes has been also experienced (R.F. Christman, U.S.A.) due to sudden unexpected noise. But the most significant health problem caused by noise is interference with communication. The warning clang of a railroad crossing, the siren of emergency, emergency radio messages, are all the best examples of the situation, where noise may have lethal effects by interference with communication.

STANDARDS AND ACCEPTABLE NOISE

In India, presently there exists no perfect noise emission standards on a national level either for community noise levels or for source emission levels. However Environmental Protection Agency (EPA) has constituted noise level standards in 1974.

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TABLE 7. ACCEPTABLE NOISE LEVELS IN dB(A)*

Acceptable outdoor noise levels in residential areas		Acceptable indoor noise levels for various types of buildings	
Location	Noise level	Location	Noise level
Rural	25-35	Radio & TV studio	25-30
		Music room	30-35
Suburban	30-40	Hospitals, classroom and auditorium	35-40
Residential urban	35-45	Apartments, hotels, conference rooms, office	35-40
Urban (residential-commercial)	40-50	Court rooms, private office, libraries	40-45
City	45-50	Large public office bank stores	45-50
Industrial area	50-60	Restaurants	50-55

Noise standards do exist on the state or local level. These standards are for the most part directed towards regulations of noise from specific type of emitters. The most prevalent regulation should be for motor vehicles because in cities these are the main sources of noise pollution. These standards should be established according to type of vehicle and travel speed. The maximum noise level permitted for motor vehicle should not be more than 90 dB(A), because above this level, noise may cause severe effects on health of people residing along roads.

However, in India, Indian Standards Institution has established noise level standards for outdoor and indoor noise levels for residential and official buildings of the city and rural area. Table 7 shows the acceptable noise levels for planning purposes. Along with this, standards are also available for critical sound levels. At different noise levels, hearing loss is also different. At 105 dB(A), the noise level causes losses to all exposed individuals (Table 8).

TABLE 8. SHOWING CRITICAL SOUND EXPOSURE (DAMAGE RISK FOR PROLONGED EXPOSURE TO NOISE OVER A PERIOD OF SEVERAL YEARS)*

Sound level in dB(A)	Effects
70-80	Safe
85	Hearing losses begins
90	Serious loss begins
95	50% probability of hearing impairment
105	Losses to all exposed individuals

* Source — Indian Standards Institution.

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These prescribed standards are not sufficient for the country like India. Standards should be also prescribed at the local level, so that, noise pollution control may become easier for the city planner. Standards should also be prescribed for various sources like motor vehicles, trains, industries, so that techniques to control noise may be used.

NOISE CONTROL

Noise control is simply a technology of obtaining acceptable noise environment on the basis of economic and occupational considerations. Before proceeding to the problem it is essential to know the difference between noise reduction and control. In a specific problem noise reduction may be obtained by several techniques, which may be unnecessarily costly and wasteful and may also interact with the normal operations. Against this in noise control techniques, problem would be studied systematically and acceptable conditions may be achieved in the best economic way. Therefore, in controlling noise, economic aspects are very essential aspects.

Now-a-days with increasing noise pollution levels, several methods for controlling noise in city or a place like 'industry', have been developed and any of them can be chosen according to the situation of the problem. In general, the following measures are classified for controlling noise.

Noise control at source. — This is the best method to control noise but essentially it requires a more detailed knowledge and skill of the structure of engine or plant and as well as process by which sound is generated. This can be done while design sound is generated. Noise can be reduced by reducing the amplitude of the existing forces and by reducing the response of various components of the various systems to the existing force. In motor vehicles, silencer should be of that type, which produces low level of noise.

Control of the transmission path. — Another technique of noise reduction is that of controlling the transmission path so as to reduce the energy that is communicated to the receiver. This may be done by the following methods:

1. Siting — In this technique distance between source and receiver should be increased. Since number of noise sources do not radiate the energy uniformally in all directions, noise level may be reduced by altering the relative orientation of the source and receiver at a considerable reduction.

2. Building layout — The careful planning of the location of a room within a building with respect to the position of the noise source in suitable quiet area may reduce the level of noise to a certain extent.

3. By path deflection — Barriers in open air can be effective when they are large in size compared with the wave length of the sound generated from the source and may deflect the path of noise. Hence

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barriers should be constructed in between the source and receiver so that sound may be deflected in other directions so that it cannot reach the receiver.

4. Absorption — This is the most effective technique for transmitting the path of sound. Here an example of a machine situated in a room may be given to describe absorption technique. Most of the noise from these sources that reaches the workers on the opposite side of the room will have been reflected by the ceiling walls and floor by using absorption materials on walls and floor. Hence the use of sound absorption materials on the ceiling or carpet on ground, provide attenuation in between the source and the receiver.

5. Use of mufflers — The flow of the sound energy along with the path from the source to receiver can be impeded by discontinuities which reflect the energy in the same direction where source is situated. Mufflers is the best thing used by the receiver to break the sound energy reaching the workers. Therefore, every worker working in a machine room must use mufflers to avoid effects of noise pollution.

Control of noise at receiver. — Noise level can also be reduced at the receiver to some extent. Here, few techniques are suggested to control noise at the receiver.

1. Use of personal protective equipment — Ear-plugs, ear muffs, or noise halmets or a small booth in the machine room, can be used for protecting hearing power from ill affects of high level noise. In India these equipments are now easily available, so it is the duty of industries' administration to provide such equipment to their workers so that effects of noise may be countered. Mufflers can also be used as protective equipment by others.

2. By educating the people — In cities like Bombay, Delhi, Madras, Calcutta and Kanpur, where noise pollution is a serious problem, government and industries should take strong steps to control this problem by educating people with the help of T.V., radio, news reals in picture halls. In this connection, Regional Labor Institute, is doing a lot of work in the country mainly in industrial cities, to train workers to protect themselves from serious hazards of noise.

The railroads, highways and arterial roads should preferably be routed away from the residential and commercial areas. If the highway is to be connected with the residential areas, it is better to provide a linkroad and route the highway through by-pass.

Along with these, it is essential for town and country planning department to establish a research and noise monitoring center in the city, so that statistical data may be obtained regularly at a certain period of time. It must be the duty of scientists engaged in research work related to noise pollution to monitor noise in heavy industries and techniques should be suggested to avoid high level of noise. Corporation should not allow heavy vehicles to enter the main city and also through the purely

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residential areas. Public cooperation is also essential for controlling noise. New residential areas should be established away from highways and rail tracks.

NEED FOR NATIONAL EFFORT

In India very little attention is paid to control noise pollution. The government must take a serious view of the increasing noise nuisance, assess the correct condition and situation, in the country should take appropriate measures to protect workers mainly industrial, from hazardous effects of noise. One of the problems comes while assessing its hazard, which is due to the fact that it is difficult to distinguish clearly between hearing impairment on account of advancing age and hazard due to occupation.

In India until now, suitable instruments of measuring noise were not available. Therefore instruments required for it should be made available by the government to offices of concerned industries, so that noise level can be monitored after certain duration of time. Insurance companies can also play an important role for reduction or lowering working hazards, accidents and thus insurance costs. There must be regulations established by the government for noise, and these should be strictly followed by industries.

At last industrialists must take noise control with the same seriousness as control of toxic fumes in the atmosphere is taken. It is also important to educate the public and industrial management on how to control and save workers from nuisance of noise. Appropriate legislative measures must be evolved to punish the offenders and protect the public.

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POSSIBLE ROLE OF GEOTHERMAL ENERGY IN ALLEVIATING THE ENERGY CRISIS IN THE PHILIPPINES[1]

INTRODUCTION

Energy is an essential and indispensable element to progress. The Philippines, however, is energy deficient and has to import much of its raw energy in the form of oil. This constitutes a drain of valuable foreign exchange and makes the economy of the country vulnerable to rising oil prices. There is a need, therefore, to explore and develop indigeneous energy resources in order to minimize our dependence upon external source and be self-reliant as a nation.

PHILIPPINE GEOTHERMAL POTENTIALS

The Philippines is a volcanic country and, as such, it is richly endowed with geothermal resources, which is today one of the most promising energy sources. Scattered all over the archipelago are more than 70 known thermal areas and about 30 of these are considered with geothermal economic potentials.

The Tiwi Geothermal field in Albay, which has an estimated generating capability of 600 MW electrical power, is currently being developed by the Government. Meanwhile, the geothermal field in Leyte is undergoing detailed exploration work. The New Zealand assistance under the Colombo Plan, which entails drilling of seven exploratory wells in Leyte, is hoped to be finished by June of this year. The Philippine counterpart calls for the joint logistic and technical supports of the National power Corporation, the Commission on Volcanology, the National Science Development Board and the Provincial and City Government of Leyte and Ormoc, respectively.

The Los Baños thermal field in Laguna, which is close to the commercial center of the country, also indicates possible significant potential. In the Visayas, we have other promising thermal areas in Negros and Cebu aside from that in Leyte. Likewise, the Mindanao area down to Jolo is pockmarked with these geothermal resources — just idly waiting to be intensively explored and developed.

[1] Prepared by the Commission on Volcanology, National Science Development Board.

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GEOTHERMAL ENERGY AS DIRECT FUEL

The development of a large electric power station in Albay utilizing geothermal energy as a direct fuel could enhance the industrialization of the Bicol region. The excess electrical energy of this plant could also be supplied to and integrated with the Luzon Grid. With a power plant at Tiwi and possibly another at Los Baños and a third in Cagayan, the prospect of running an electric locomotive from the north down to the south of Luzon would be realized. This vision is not beyond reality as the Italians have shown that their geothermal power stations can supply cities and part of Italy's railroad system.

In the Visayas, where large hydro-power source is not available, geothermal resources present in most of the islands could be tapped instead. The power requirement of each island provinces could be supplied economically by this energy source. This will also minimize the trouble of transporting electricity from Luzon or Mindanao to the different Visayan islands through an expensive submarine cable. Geographically speaking, therefore, the Philippines favors the use of geothermal energy as a direct fuel.

ECONOMIC ASPECTS OF GEOTHERMAL POWER GENERATION

The characteristic features of established geothermal power plants, as summarized below, reveal its applicability to our developing country:

1. Geothermal installations are simple and easy to operate.

2. Capital cost of the plant is less than that of conventional power stations. This is an advantage for a country such as ours where capital resources are scarce.

3. The annual operating cost of the geothermal power plant is low.

4. Since geothermal power station operates on an indigenous energy course, no foreign exchange cost arises from the importation of fuel. This would mean considerable dollar savings. Taking the price of oil fuel at $20/ton, a 30 megawatt geothermal station at base load will represent a saving of around $1.5 million/year in oil imports.

5. Geothermal power station provided electricity at competitively low prices even during off-peak periods.

6. Geothermal exploitation lends itself to installation of power generating units of comparatively smaller sizes. With this, development could progress by stages as the demand for power increases. Capital investment, therefore, does not necessitate immediate large outlay.

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7. Since geothermal power stations do not burn fossil fuels they do not emit fuel gases containing sulfur dioxide or nitrous oxides, neither is their effluent radioactive. Difficulties can, however, arise from the disposal of hot geothermal brines containing variety of salts and mineral compounds.

OTHER USES OF GEOTHERMAL RESOURCES

Apart from its use for power production, geothermal energy has other commercial and industrial values, as shown below:

1.	Pulp and Paper Manufacturing	New Zealand
2.	Domestic Heating of Houses and Spas ..	Japan, Iceland, etc.
3.	Recovery of Boron and other by-products .	Italy
4.	Recovery of Valuable Minerals	California, USA*
5.	Salt Manufacturing	Albay, Philippines*
6.	Grain (Farm Crops) Drying	Albay, Philippines*
7.	Food Canning	Under study
8.	Refrigeration and Air-Conditioning	Under study
9.	Desalination of Sea Water for Agricultural and Industrial Uses	Under study

* Under research to semi-commercial stage.

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GEOGRAPHY OF METROPOLITAN MANILA
A Prologue

B. T. MIRANDA[1]

Any written piece on Metropolitan Manila (Metro Manila for short) must begin with its creation by executive fiat as well as the vision behind it — to the extent that this can be ascertained. For, important as Metro Manila's present may be, more so is its future which is the raison d'etre for its creation.

On November 7, 1975 the President of the Philippines, Ferdinand E. Marcos, signed Presidential Decree (PD) No. 824[2] creating Metropolitan Manila and its governing body, the Metropolitan Manila Commission. This was the necessary and ultimate formality. Previous to that, in February 27, 1975, a referendum among residents of the Greater Manila Area "authorized the President to restructure the local governments of the four cities and thirteen municipalities thereof into an integrated unit of the manager or commission form of government..." This was the desirable formality. There is little doubt in this writer's mind that, previously, the idea of a Metro Manila had been born to the person who, in November 1976, became its first Governor, the President's lady, Imelda Romualdez Marcos. The purposes for the creation of Metro Manila, embodied in PD 824, she summed up in..." to rebuild it into a city of man."[3] This could not have been a catch phrase composed on the spur of a moment. Rather, she must have been thinking for sometime of a dignified city worthy of dignified man. And, as Governor, she has been hot on the heels of this goal over nearly four years. It would not be exaggerated to believe that the future of Metro Manila is in her hands. If the Governor can continue on her course long enough, it may indeed be possible to write the future geography of this metropolis by simply consulting her.

Factually, PD 824 restructures the local government of the cities of Manila, Quezon, Pasay, and Caloocan, and the municipalities of Makati, Mandaluyong, San Juan, Las Piñas, Malabon, Navotas, Pasig, Pateros, Parañaque, Marikina, Muntinlupa, and Taguig in the province of Rizal, and Valenzuela in the province of Bulacan, and constitutes them into Metropolitan Manila. The purposes revolve around the people therein and their increasing number, including such considerations as integrating and harmonizing public services formerly dispensed separately and in varying quantities, and providing unified high professional standards for their administration and operation. The concluding stipulated purpose is to enchance the "safety and security of the State" through "maintenance of peace and order and eradication of social and economic ills."

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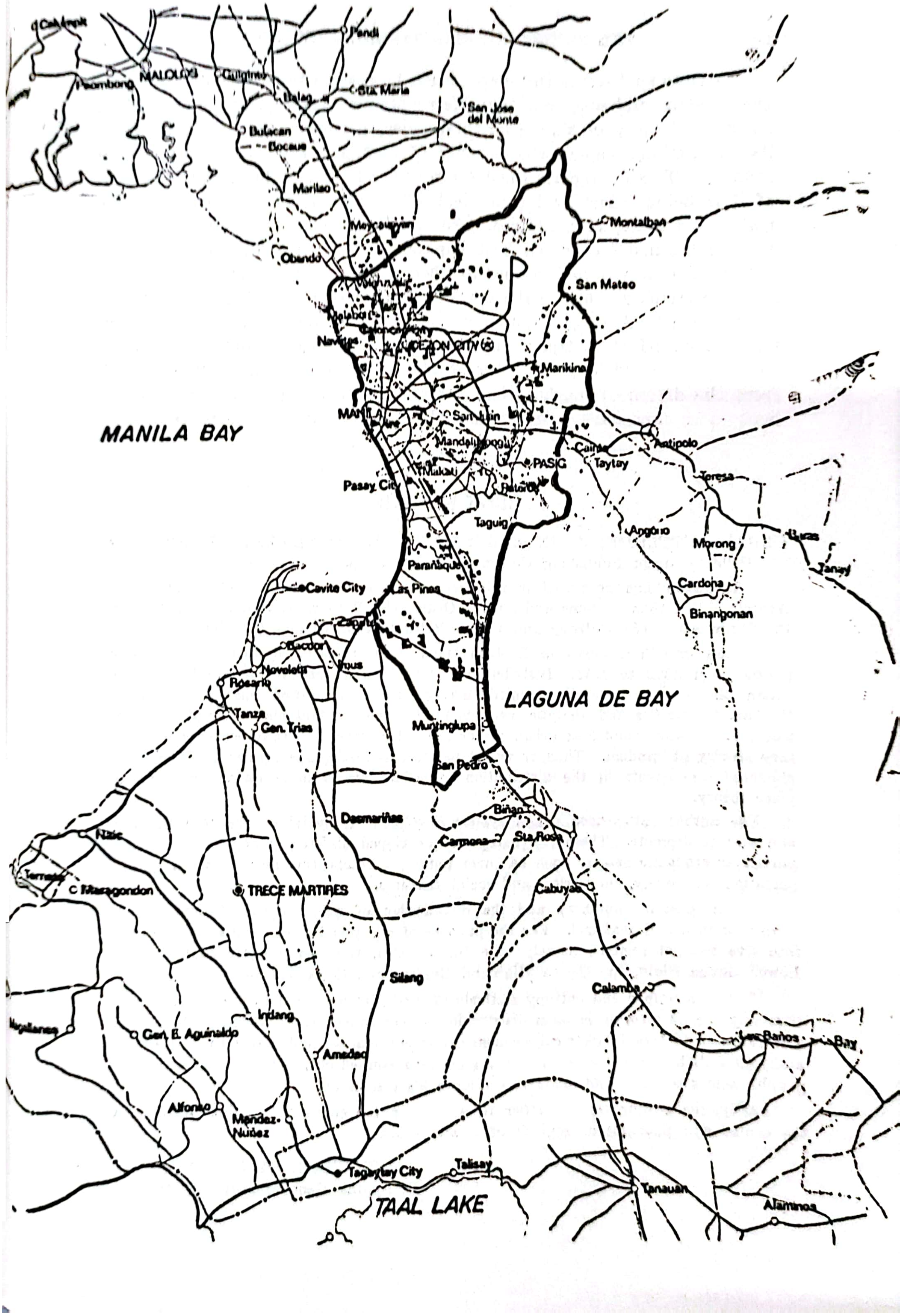
[1] Member, The Philippine Geographical Society, and the National Committee on Geographical Sciences, National Research Council of the Philippines.

[2] Under Martial Law a Presidential Decree has the force of law.

[3] Imelda Romualdez Marcos, Manila: A City of Man. National Media Production Center.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TAAL LAKE
Alaminos

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A cursory look at the map (Plate 1) reveals the last purpose to be the fundamental one, and that Metro Manila is a bigger region which cushions the city of Manila on three sides, the fourth being Manila Bay. As the national capital the security of Manila is crucial to that of the country. This is properly the concern of the President, but a large portion of it is being borne by his political, diplomatic, technical, and administrative helpmate, Mrs. Marcos, who is all these besides being what the President himself calls his best kapataz (foreman). But, Mrs. Marcos is first of all a wife and mother to whom such a momentous consideration as State security could be the occasion for creating a well-ordered metropolis like a well-ordered family home. It is no mean job; it will take tremendous effort to transform distressing features of Metro Manila to what they should be in a "City of Man". This city has just emerged from the dream stage, but the ultimate future could be a backdrop of hope to an exposition, geographic and whatever else, of the present.

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BOOK REVIEW

URBAN SETTLEMENTS IN EASTERN INDIA. By Baleshwar Thakur. New Delhi: Concept Publishing Company, 1980. 22 pp.

The author has presented in this book six chapters, namely: (1) Theoretical Aspects, (2) Urban Systems and Spatial Order, (3) Pattern Analysis, (4) Focus on the Study Area, (5) Entropy and Urban Pattern Analysis and (6) Conclusion.

Urban growth patterns in Eastern India were investigated during a 100-year period from 1872 to 1971. Distributional aspects and spatial interrelationship of urban places were carefully studied, taking into consideration past and present theories, hypotheses and analytic methods used. The "central place theory" pattern was one. It was found that urban places are not always uniformly spaced nor were they strictly at random. Thus, it would be more realistic to recognize uniform, and clustered components in the distribution of urban places in assessing the central place theory.

The author categorized urban system development involving time into the old and new settlements. These two categories developed differently according to each particular economic set-up, such as farm tenure, markets (mobile or fixed), transportation technology, industries, and social features.

Urban growth (number) and the distribution of urban places (towns/cities) were examined and analyzed. For the purpose of analysis Eastern India was divided into five natural regions, namely: the Bihar Plain, the Chotanagpur Plateau, the Lower Ganga Plain, the Orissa Highland Region, and the Utkal Coastal Plain.

Nearest neighbor and entropy methods of analysis were used to determine quantitatively the uniform or random distribution of component point within each region. The relevant factors — physical, economic, and cultural — underlying the observed/analyzed distribution patterns in each region were pointed out. The author presented graphs, tables of data and maps to elucidate his discussion.

Lastly, the author urges further researches on the changing location pattern in the center and pheripheral regions of urban areas.

FELICIANO M. LAPID
Philippine Geographical Society

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FORESTRY AND KAINGINING IN THE PHILIPPINES
A SELECTED BIBLIOGRAPHY

Prepared by
DR. GEOFFREY A. J. SCOTT
University of Winnipeg, Canada

The following bibliography lists references under specific environment use related topics for the Philippines. Most references are available in the library at the Forest Research Institute (FORI) and the College of Forestry, University of the Philippines at Los Baños, Laguna RP. In most cases when a reference is first used a short statement about the contents of the article follows. When the reference is referred to again under another topic the reader is informed to turn back to this first use of the reference for full information. Articles are listed under the following section headings:

For reference materials, encouragement and assistance in preparing this selected bibliography I am greatly indebted to: Prof. Dominador Z. Rosell, President of the Philippine Geographical Society; Dr. Romeo Bruce, Professor of Photogrammetry, UP, Diliman; Dr. Bernardo Jasmine, FORI; Dr. Romeo Raros, Dr. Percy Sajise and Dr. Anacleto Duldulao, College of Forestry UPLB; Gordon Hart, Hilda Koslowsky and Robert Moskal, Winnipeg, Canada.

Copies of this bibliography can be obtained from Dr. G. Scott, Department of Geography, University of Winnipeg, 515 Portage Avenue, Winnipeg, Manitoba, Canada. R3B 2E9. As with other bibliographies it is strongly recommended that the original article be checked rather than quoting information directly from this bibliography.

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SCHOLARS FORECAST EVENTS OF 1980s

Washington — Isaac Asimov thinks people will someday enter a "symbiotic relationship" with computers. Alvin Toffler believes the human race is "building a remarkable civilization from the ground up." And Herman Kahn expects "reasonably good" economic development during the next 20 years.

These scholars and scores of others present their views on the years ahead in a 434-page volume of papers prepared by some of the world's leading futurists for the First Global Conference on the future, the largest meeting of futurists ever held.

More than 4,000 futurists and others registered for the July 20-24 conference, held in Toronto, Canada, under the auspices of the World Future Society, a Washington-based group with 50,000 members in 80 countries, and the Canadian Association for Futures Studies.

In the book, entitled *Through the '80s*, Asimov takes a careful look at the possibility of computers replacing people and conclude optimistically: "It could be that human and computer might form a symbiotic intelligence that would be far greater than either could develop alone; a symbiotic intelligence that would open new horizons and make it possible to achieve new heights."

Alvin Toffler, in an excerpt from his new best seller, *The Third Wave*, claims that humanity "faces the deepest social upheaval and restructuring of all time. Without clearly recognizing it, we are engaged in building a remarkable civilization from the ground up."

On the economic front, Herman Kahn, director of the Hudson Institute, offers a view that "runs contrary to some relatively pessimistic, widely articulated intellectual fashions of the '70s, represented by aphorisms such as 'limits to growth' and 'small is beautiful'."

Kahn expects that from 1980 to 2000, there will be "reasonably good overall economic development in the world, particularly in the rapidly rising middle-income countries."

The papers range from optimistic to pessimistic, from immediate proposals for action to far-out visions, and are filled with imaginative solutions to pressing problems.

Norman Myers, author of *The Sinking Ark*, estimates in his article on "Vanishing Plants and Animals" that the earth is losing a species a day to extinction, and that by the end of the century 1 million of the existing 5 million species could disappear.

To illustrate the important benefits that people derive from the great variety of plants and animals, Myers says, "There is one chance in two that, when we take a medical prescription to the pharmacy, the drug we receive is derived from a wild species.

"Corporations and other organizations can actively support conservation campaigns," Myers adds. "It seems curious that leading pharmaceutical enterprises, for example, do not seek to protect their future resources by supporting efforts on the part of tropical nations to set aside protected areas in, e.g., tropical forests."

On a more optimistic note, Anton Schmalz, who was principal consultant to the 1978 White House Domestic Policy Review of Solar Energy, writes that oil imports could be virtually eliminated by 1990.

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"There is plenty of domestic energy available today. The equivalent of 8 to 12 million barrels of oil a day can be produced and conserved in the U.S. with resources and technologies available locally now," Schmalz says.

One way to avoid shortages of the earth's resources would be to look elsewhere for them, proposes Princeton University physicist Gerard O'Neill.

"By the end of the century, thousands of people could be working in space, and the first permanent communities could be ready for occupancy, giving humanity the capability of rapidly expanding its presence in space," says O'Neill.

In an unorthodox economic view, Swedish economist Gunnar Adler-Karlson argues that the concept of full employment has outlived its usefulness in the post-industrial society.

In a paper entitled "The Unimportance of Full Employment," Adler-Karlson writes, "Full employment policies demand a bondage-creating economic growth. Full employment, while once having been an excellent instruments for liberatng the poorest strata in the Western nations from hunger and misery, now is becoming an obstacle to the realization of the realm of material — and thus spiritual — freedom."

The volume's 61 papers cover a wide range of topics, including the future of energy, education, technology, values, population, communication, employment, religion, business, space, resources, and health, and conclude with a section on "turning dreams into action."

Through the '80s was edited by Frank Feather, chairman of the Toronto meeting, in collaboration with an editorial board headed by Howard F. Didsbury, Jr., professor of history and executive director of the Program for the Study of the Future at Kean College of New Jersey.

Edward Schreyer, governor-general of Canada, wrote the introduction; Maurice Strong, honorary chairman of the conference, contributed the preface; and Aurelio Peccei, founder of the Club of Rome, added a postcript urging the need for action to prevent world catastrophe.

Through the '80s: Thinking Globally, Acting Locally is available for $12.50 from: World Future Society, 4916 St. Elmo Avenue, Washington, D.C. 20014. Telephones: 301/656-8274.

To all Members:

The Philippine Geographical Society will celebrate the 30th Anniversary with an appropriate program on December 8, 1980. We will write to you for details.

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