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Table of Contents

Philippine Geographical Journal
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EDITORIAL

Happy 50-Year Anniversary PGJ!

Meliton B. Juanico

The *Philippine Geographical Journal* is 50 years old!

It was in early 1953 when the first issue of the PGJ came out of the press under the auspices of the founders of the Philippine Geographical Society. The journal rapidly gained recognition in the Philippines and abroad by regularly publishing two to four issues yearly with only an interruption between 1958 and 1963 when its first editor, Prof. Dominador Rosell, left for a foreign consultancy assignment. The PGJ eventually reached its zenith in the 1970s and 1980s when it rivaled some of the prestigious Asian journals interested in tropical geography. At that time, the influence of the PGJ spread far from the shores of the Philippine archipelago and attracted papers from all over the world. The Journal then had over 100 foreign subscribers and over 50 local subscribers. Then as now, the Journal is the only geographical journal from the Philippines which is included in the *Annotated World List of Selected Current Geographical Serials* of the University of Chicago.

Today, with the revival of interest in geography brought about by the electronic media as well as the participation of young and energetic members of the Philippine Geographical Society, the journal is again gaining attention from both readers and writers. The broad scope of the Journal is further underlined by the wide array of interests of the papers submitted, ranging from geomorphology and biogeography to behavioral and medical geography as well as geographical tools such as the Geographic Information Systems and Remote Sensing. Another significant trend in PGJ's existence is the predominance of papers interested in resource use and management. This should be seen as a reflection of the continuous attention local and foreign geographers have been giving to the state of the Philippine environment.

To mark the 50-year anniversary of the PGJ, the editorial team has decided to come up with a special anniversary issue which compiles a selection of nine papers. These papers reflect the wide span of interests of the discipline of geography and the broad scope of the Journal. We deliberately selected papers dealing exclusively with Philippine concerns. They should give insights on the way the PGJ has been following and reflecting the changing physical and human local environments.

Mabuhay ang PGJ!

Meliton B. Juanico

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Climactic Study of the Philippines: 1. Negros Island

Frederick L. Wernstedt

Published in the Philippine Geograpical Journal, 1953, 1(1), p. 24

Analyses of areal distributions of soil types, soil-forming processes and agriculture are dependent largely upon prevailing climatic conditions. There has been a noticeable lack of detailed climatic studies of the Philippine Islands. Coronas, Selga, Algue and Maso have furnished us with several excellent pioneer studies, however, of necessity, their work was based upon sketchy, incomplete and often misleading data. In the period since World War II only one rainfall study has been completed and that was accomplished totally within the framework of the older system. Most of the modern Philippine literature requiring climatic analyses must utilize these out-dated rainfall summaries.

In an attempt to utilize more recent and greatly expanded data sources, the author has embarked upon a new detailed analysis and synthesis of Philippine climatology. It is hoped that this study will serve the needs of agriculturists, pedologists, geographers, and others. As a preliminary step, a detailed survey of Negros Island was completed first and herewith included.

Negros Island Climatology

The atmospheric conditions influencing the climate of the Philippine Archipelago, as a whole, are the same conditions operative in supplying climatic elements for the Negros Island. Dominant among these atmospheric conditions are the two major air currents of the Asiatic content, air mass movements, which are controlled by the continental pressure systems of Asia, and those of the adjacent parts of the Pacific and Indian Oceans.

As the Southern parts of the Asiatic continent begin to be warmed more rapidly than the sea, owing to the apparent northward migration of the sun in the spring, a natural pressure gradient develops from the sea to the land. Thus, during the high-sun half of the year from April to October, an air stream is directed from the south over the Philippines, and onto the continent. Since this air current follows a counterclockwise path as it approaches the low pressure center of the continent, it reaches the Philippines from a southwestern direction. This is referred to as the *southwestern monsoon.* Whether this is a misnomer or not, the fact remains that the Philippines, including Negros Island, are under the influence of a southwestern air drift during this period.

As if in opposition to the southwestern air movement, during the period from November to January, the Asiatic continent cools more rapidly than the surrounding seas, and extremely high-pressure centers are established over the continent. As a result of these high-pressure centers general outblowing air-movements take place. Since these winds are deflected in a clockwise direction, they reach the Philippines from a northeasterly direction. This is the period of the *northeastern monsoon.*

By early spring, March to April, the high pressure center in Asia is exhausted and a period follows in which the Philippines come under the domination of the normal *northeastern trade wind system.*

Inseparably connected to these air movements, particularly the first two, are the destructive *baguios* or typhoons which visit the islands during the months of June to January, but particularly during November and December on Negros. During each of the seven or eight months two or three such storms occur. On the average seventeen typhoons per year pass close enough to the Philippine Islands to affect the weather pronouncedly. Most of these are felt on Negros Island. This figure includes both the storms, which pass directly through the islands and those, which pass by in the open sea, in either the Pacific Ocean or the China Sea. About seven percent of the typhoons striking the Philippines actually pass over Negros. These typhoons, of course, can wreak havoc, particularly to buildingsand to crops that are nearing maturity or are awaiting harvest.

Temperature:

Annual temperature ranges on Negros Island are very slight, for this region has a tropical isothermal climate. It is only with an increase in elevation, e.g., the ascent of a mountain slope, are significantly lower temperatures encountered.

Several factors act to maintain high temperature averages and to minimize temperature ranges. Negros Island lies between latitudes nine and eleven degrees north of the equator. This latitudinal position places the island very near the zone of maximum heat reception. Twice during the course of each year, the sun appears directly overhead, and the vertical rays of the sun strike the island. Since the island is completely surrounded by large bodies of water the maximum and minimum temperatures are greatly ameliorated. In addition, the normal period of maximum heat reception is also the period of maximum cloudiness. A cloud layer can and does materially cut down on the amount of heat received on the land. Also, since all of the air masses affecting the weather of the Philippines come from great distances entirely over water bodies, they arrive with many of the moderating characteristics imparted to them by the water surfaces over which they have passed.

In general, the period of the southwestern monsoon during November is a season of a heavy precipitation and constant cloudiness. This is a period of oppressively high sensible temperature and absolute temperatures are somewhat cooler owing to the extreme cloudiness.

The period from December through March is the so-called "cold" season. During this time the prevailing air drifts are influenced by the high pressure centers of Asia, the out blowing monsoon. In addition, the sun is furthest removed from the island. Occasionally during this season greatly modified "polar outbursts" from continental Asia affect the weather of the Philippines.

It is during the period from the latter part of March through June that highest temperatures prevail. The sun, on its apparent northward migration into the Northern Hemisphere, passes over Negros. Cloudiness is not as pronounced as later during the southward migration in August, and maximum heating of the land occurs.

The latitudinal position of Negros Island is largely responsible for the general tropical temperature conditions. The proximity of the sea, the prevalence of cloudiness and the trajectories of the air masses exert strong moderating influences.

Precipitation

It is not with the variability in the climatic element of temperature with which man must contend in his occupancy of Negros, but much more with the variabilities in precipitation. Not only is the total amount of yearly rainfall of importance, but also of even greater importance is the regime of that rainfall. One must answer the question as to whether there are seasons of drought or seasons of superabundance of such severity that crops will suffer.

Again in the study of precipitation, as in the study of temperature, one must return to an analysis of the general atmospheric conditions, those of the major air drifts. Here one is concerned with the directions, source regions and characteristics of these air masses.

Southwestern Monsoon

During the period of dominance of the southwestern monsoon from May to November, air is derived from more southernly regions over broad water areas and blows across the Philippines. Thus, these air masses are moisture-laden. As they strike the mountainous landmasses they are forced to rise, the air is cooled, and precipita-

tion results. Often this orographic precipitation, coupled with conventional monsoonal precipitation, occurs in enormous quantities, Since the air masses are moving of the islands with their full strength. On Negros, the southern, southwestern, western and northwestern parts receive abundant rains during the period of the southwestern air drifts. Other parts of the island, particularly along the eastern shorelines of Negros Oriental, receive only a small fraction in total amount of precipitation when compared to the amounts received on the more exposed western and southern sides. Dumaguete, on the eastern coast of Negros Oriental, receives only 33.1 inches during the period of southwestern monsoon, while in Cauayan, on the southwestern peninsula of Negros Occidental, receives 142 inches during the same period. Both La Carlota and La Castellana, on the western plain of Negros Occidental, receive in excess of 80 inches during this season.

During the period of the southwest monsoon, day after day is characterized by some rain, very often torrential showers, and frequent cloudiness. La Carlota records an average of twenty-four rainy days during the month of July and twenty-one days during each of both August and September.

Northeastern Monsoon

Finally, around the first of November, the southwestern monsoon is gradually replaced by the opposing northeastern monsoon. Since this air mass originates over continental Asia one would expect it to reach the islands as a dry air but, on its passage to the Philippines, it must cross large areas of the ocean and, thus, it is able to assume humid characteristics. It reaches the Philippines, as a moisture-laden air body, and substantial rainfall occurs on the "stuck" or northeastern side of Negros as a result of its action. During this period, the eastern coast of Negros receives rain while the southwestern and western regions are comparatively dry. The northeastern monsoon is not as humid as the southwestern monsoon, and it does not bring as much rainfall to the island. Unfortunately for Negros, the large mountainous island of Cebu stands off the northeastern coast and interposes an obstruction to the northeastern monsoon winds, so that much of their moisture is removed prior to reaching southeastern Negros. The northern end, however, is not blocked by a topographic obstruction, and only the northernmost parts of the island receive precipitation from both the southwestern and northeastern monsoon.

Northeastern Trade Winds

When the third air movement, that of the northeastern trades, invades the islands, months of much less rainfall parts result. From a source region far to the north, over the North Pacific Ocean, these winds blow southward, constantly being warmed and, consequently, their capacity or ability to contain moisture is increased. They normally reach the islands as a much drier air current than the southwestern air masses. This is the season of drought, varying in duration and severity from place, for much of Negros Island, and indeed for much of the remaining islands of the Philippine group.

Typhoons (Baguios)

Another factor in the climatic picture, entering as a casual agent of precipitation, is that of the typhoon. Most of the storm tracks affecting the Philippines directly pass far to the north of Negros through the northern or central parts of Luzon. However, the weather of Negros is greatly affected by the passage of each storm during a two-to-three day rainy period. The rainfall is often quite widespread. This phenomenon occurs several times during the year, most often during the period June to December. Occasionally a storm track will pass directly over, or very near to, northern Negros. Such a condition existed in December 1951, causing tremendous damage

resulted from the very heavy rainfall and the exceptionally strong winds. Much of the rainfall caused by the passage of these storms is the result of the turbulence set up by the moving low pressure centers into which the southwestern air stream is directed with an increasing velocity.

Precipitation Distributions

The total yearly rainfall amounts received on Negros seem adequate, by American standards, for all kinds of agriculture. What is often overlooked, however, is that: (1) the total yearly rainfall is often too low for the characteristic oriental crop, i.e., lowland rice; (2) total yearly rainfall is often very unevenly distributed areally (see Plate II) and seasonally (see Plate III); and (3) the ratio of precipitation to evaporation is much different in the tropics than in temperate regions, i.e., it requires much greater quantities of rainfall to balance the excessively high potential evaporation rate of the tropics.

Total yearly rainfall amounts received on Negros vary greatly, ranging from 37.4 inches at Hacienda San Jose, Manjuyod (9) on the eastern coast of Negros to 166.2 inches at Hacienda Asia, Cauayan (51) in southwestern Negros. These variations have given rise to two distinct rainfall areas: an excessively-wet western and northern zone and a much-drier east coast. Topography, together with seasonal air mass movements, are the greatest factors influencing the areal distributions of rainfall.

However, seasonal variations in rainfall occurrences are of greater importance to agriculture than the distributions of yearly totals since they have strongly influenced the times of field preparation, planting, growing, harvesting, and even the actual selection of particular crops. For this reason a climactic summary of Negros Island must, of necessity, be largely an analysis of the precipitation regimes of different parts of the island.

In an attempt to place Philippine climactic patterns within a framework of present world climactic patterns, the more commonly utilized Koeppen climactic classification system furnishes the broad bases for the present study. It is upon the basis of this climactic system, plus an evaluation of relief factors, that this present study rests.

Accordingly, the application of the Koeppen system subdivides Negros Island into three climactic-vegetation zones, namely:

(1) Tropical rainy climates with no drought months. Each month must receive at least 2.4 inches of rainfall (sixty millimeters). This type of climate has been assigned the symbols *Af.*

(2) Tropical monsoon climates with a pronounced drought season lasting from one to six months. However, enough moisture falls during the rainy season by compensate for the drought period. This type of climate is known by the symbols *Am.*

(3) Tropical savanna climates with a pronounced drought season lasting from one to six months. Contrary to the monsoon climates, the rain-season precipitation is insufficient to compensate for the drought period. This climatic type has been symbolized *Aw.*

For practical applications in the Philippines, such a broad generalized climatic type regions serve a purpose only to establish broad regional patterns. In order to present a more detailed climatic data, each of the three climatic

zones is further divided into several subtypes, each subtype having the characteristic of the parent type but at the same time exhibiting greater or lesser degree of rainfall concentration within the rainy six months. For example, tropical monsoon climates can have a six-month rainfall concentration varying from less than seventy percent to more than ninety percent of the total annual rainfall. Each major climatic type has been divided into three subtypes (see Plate III); namely, a *mild phase* with less than seventy percent rainfall concentration, a *moderate phase* with between seventy and eighty percent concentration, and an *extreme phase* with greater than an eighty percent rainfall concentration in the six-month rainy season. However, not all of these subtypes are found on Negros Islanf. An equally valid subdivision might be made on the basis of variations in the duration of the drought periods.

There has been a total of fifty-one weather recording stations on Negros Island. One can plot a reasonably accurate map of the distributions of rainfall on the lowlands where these stations are located, but unfortunately, there are no stations in the interior of the island. In lieu of this missing data, the interior rainfall boundaries are plotted based on island relief, as portrayed by the accompanying physiographic diagram, and its influence on seasonal air mass movements. It must be remembered that rainfall boundaries, whereas appearing as definite lines on the maps, actually represent broad transitional zones.

Several rainfall zones can be generalized from Plate II and III. The northern end of Negros and the Bais lowland (5,6) are areas of adequate and evenly distributed rainfall. The southwestern air masses are able to penetrate to Bais through a river corridor opening to the southwestern coast. The western and southwestern coasts are regions of strongly monsoon precipitation. Blocked off by the central highlands from the northeastern trade and monsoon air mass movements, at least seventy percent of the annual precipitation falls during the six-month southwestern monsoon period. In general, eastern Negros, although receiving less rainfall than the western parts during the southwestern monsoon, nevertheless receives more than the western parts during northeastern air mass movements, and hence has a more evenly distributed rainfall. Two areas in eastern Negros, San Carlos (14) and Manjuyod (7,8,9), coastal southeastern Negros (1,2) and Ilog in negros Occidental (49) are areas suffering under insufficient rainfall during part of the year.

Thus, from this detailed climatic study one can draw several valid conclusions concerning agricultural crop distributions on Negros Island. Eastern Negros, except at Bais and San Carlos, specializes in more drought tolerant crops, e.g., corn. Bais, because of heavy and evenly distributed rainfall, and San Carlos, because of evenly distributed rainfall amounts and readily available irrigation waters, specialize in sugar cane production with high yields. Northern Negros, also devoted sugar cane (Victorias, Lopez, and Danao Sugar Districts), can mill almost twelve months of the year because of their abundant and evenly distributed rainfall. Western Negros, experiencing a heavy but extremely concentrated rainfall, can grow rice or sugar cane only during a restricted season. Western Negros sugar processing facilities operate only six months of the year.

Geography and Philippine Schools: A SUGGESTED PROGRAM

Charles O. Houston, Jr.

Published in the Philippine Geograpical Journal, 1953, 1(2-4), p. 127

If one were faced with the problem of removing from the curriculum of an educational system all subjects but one, which would best be retained? One would perforce to select a subject, which in its compass would so mold the mind of a child that the loss of others would be more easily sustained. It would, of necessity, have to be a course whose plan and program would embody the all-important cultural background of the social sciences, and require the training of the mind for solution of the world's problems resulting from a study of the pure sciences, and the preparing of the child for participation in society which is the function of vocational training.

With these qualifications, there can be no dispute. What course then, would fulfill all these prerequisites? Upon a thorough and judicious examination of the components of the curricula of the world's courses of study, only one would qualify: Geography.

A whole curriculum may be erected from the stuff of geography from astronomy to zoology and from primary to man's estate. Can History be taught without Geography- either physical, political, historical, demographic or economic? Those who make attempt leave their students sadder but not wiser.

Economics cannot be taught without geography. What would the theories of Cantillon, Turgot, Adam Smith, Say, Rau, Ricardo, Mill, Senior, Malthus, Ruskin, Muller, de Sismondi, List, Unwin, Marshall and Keynes mean if they were developed by induction and philosophy alone? What would the theories of the economists be if it were not for the existence of alluvials, planosol, lithosols, sand, podzol, chernozem, lateritic soils? For the uneven distribution of minerals, metallic and nonmetallic, of forests and tundras, of grasses and bogs? We cannot visualize the potential importance of Saudi Arabia without waters and its oil or the actual importance of Belgium without its population. Australia is as large as the United States yet it contains a population only as great as that of the City of New York and has a future wholly different from that of the United States. To the unwary, this last statement would have little significance, for to him geography is but a word, and he would compare America to Australia and deduce conclusions wholly unwarranted by a comparison of size, history, and population. Australia unlike America does not possess rich black soil and unlimited sources of water. A soil map of the world shows the weakness of Australia as a continent and the strength of America as a nation.

We may practically exhaust the list of disciplines in our educational systems without encountering one, which cannot be included in one way or another in the many facets of a study of Geography.

One may ask how geography can be utilized so that pupils will gain mastery of it, themselves and other subjects? It would be presumptuous, perhaps, for the writer to tell how others should teach each particular detail, but it might not be amiss here if we examine a possible program for Philippine Schools.

Since it is well known that an overwhelming percentage of our school children never advance further than the fourth grade, it is essential that the elements of geography be explained to them as early as possible. This can be done. The study of Geography is not any more difficult than the others, but the success in teaching depends first, upon the choice of text, and, secondly, upon the training of the teacher. The great textbook publishers of the United States provide excellent texts for children in primary grades in Geography. These texts are so arranged, and teaching aids for the teachers are so easily utilized that any teacher with a good B.S.E. degree can teach geography successfully to the child in the primary grades. For the purposes with which the writer is concerned, he will illustrate a possible program with the texts with which he is most familiar, and which he believes are the best that can be used in Philippine schools.

The subject matter of geography deals with ways of living in relation to the environment, and with one environmental factor in relation to another. The writer has long been enthusiastic about the McConnell-Hugley-Harter geographies (published by Rand McNally & Co.) since the content of these books emphasizes these important geographic relationships. For that reason, he uses them to illustrate a possible social studies program in the important early years of a child's education.

In America the child would, start in the third grade, with McConnell & Hugley's *Geography Around the Home*. This book deals primarily with food, shelter, and clothing, and with interdependence among individuals and communities. Young children naturally take for granted the essentials of living. They do not usually think of the work that is done to supply their simplest needs, nor that the work is generally done by many people near and far. It is the purpose of this book to encourage pupils to think about these things, to show them how people work together at home and in the community to produce needed things, and how communities like individuals are interdependent. The book is narrative in style; it is a story of Big Farm, Little Town, Big City—wherever children live. It carries the reader from one new experience to another, and pupils are guided, by the teacher, to compare their own situations with those of other children elsewhere. The teaching of the language of geography and the use of symbols are reserved for later years and the stories are about the things behind the formal content of geography. The workbook that accompanies the text provides clear and exciting adventures in new things for the young mind. Since this book presupposes a fairly good acquaintance with the English language, it is perhaps unsuitable for the public schools in the Philippines, but could possibly be used in those private schools which draw their students from families more or less ready in the use of that language. There is no reason, however, why this book could not be translated into the language of the particular region from which the pupil comes—into Tagalog, Ilocano, any of the Visayan languages, or any other. In fact, the simplicity of language and treatment would lend itself readily to translation and would prove of great value in the problem of meeting the educational needs of the elementary child in the tongue of his people.

It is with the next book that we come to one easily used in the Philippines: McConnell's *Geography Around the World*. This book is generally used with a workbook, a beginner's globe, and 10 wall maps in the famous Rand McNally Beginners Map Series. The globe is 12 inches, in brown and blue, and the maps are 40 x 40 inches. The basic objectives of the book are threefold: (1) to study the social-global world in which people have the same fundamental needs and engage, generally, in the same basic activities to fill those needs; (2) to study how people live in different areas and how the natural environment influences people's activities in satisfying their needs; and (3) to study and master the development of map-reading skills. It is here that the pupil is first introduced to one of the greatest achievements of civilization—the map, upon which the physiognomy and the essence of the world is made visible and understandable to all who have eyes and intellect. This text expands the idea of community living presented in *Geography Around the Home* to include ways of living in communities throughout the world.

The following understandings are developed thru the skillful use by the teacher of the tools this book and its equipment provide:

1. The earth is round and large.
2. People live in most lands of the earth, have the same fundamental needs, and engage in the same kinds of activities to supply their needs.
3. Differences in their ways of living are due largely to differences in their natural environment—hot or cold, wet or dry, high or low. Their ways of living are naturals for them just as ours are for us.
4. Differences in seasons and in length of days and nights are related to distances from the equator, and are reversed north and south of the equator.
5. Globes and maps tell stories about the earth. They are read through an understanding of symbols.

The maps used as tools for this fourth grade course are eight simple studies containing a symbol chart, six perspective spherical maps showing different views of the globe, one simple world projection, and two simplified hemisphere physical-political maps introducing pupils to the use and meaning of color layers, scale, basic symbols, etc. The globe is sturdy and is set in a cradle permitting the pupils to handle it freely, turning it in any direction in the base or free in their hands; it is washable and may be marked with globe-marking crayons to trace journeys or carry out other projects suggested by the teacher.

Since so many of our children leave our hands after this fourth year, this course is both an excellent preparation and termination of formal geographic training. It prepares those children who proceed with their education for more advanced studies in geography and imparts *global* concepts to the child who of sad necessity ends his formal education. The advantages of a *global* treatment over the present local one should be obvious. Since so many of our people are parochial in outlook, the schools must emphasize to the child his existence in a world along with two billion others.

Undoubtedly, the Filipino child in the fifth grade, in those schools not now using a good text, must be introduced to his first course in Philippine Geography. Unfortunately, there is no text being used at present to suit the needs of this level. What is needed is a good text for Philippine schools which will describe the ways of living in different parts of the Philippines and in immediately contiguous areas as well as teach the basic geographic understanding and skills that are needed to explain where people live, why they live where they do, and how they work and live in their homes and communities. It should have as a broad purpose the development of such understandings and skills as the interrelation of growing season, altitude, latitude, rainfall, fertility of soil, and vegetation; the influence of these factors on distribution of population and ways of living; the interdependence of communities and regions of the Philippines and other symbols on maps and globes and to make use of various kinds of maps such as physical-political, rainfall, etc. To one who meet students, all of whom display practically no knowledge of Philippine Geography, the conclusion is inescapable that either the present text is unsatisfactory or that the level of teaching and use of the text is far from adequate.

The Philippine Geographic Society should establish as an objective the study and concrete recommendation of steps needed to improve the Filipino's knowledge and understanding of Geography as well as the preparation of a geography text that meets the requirements outlined above.

The next year's text, McConnell's *Geography of Lands Overseas*, can easily be used in a well developed social sciences program in the Philippine schools. It is one of the most important in the series, as its subject matter is made to order for the present elementary program of six years. This sixth grade text has four basic objectives, which may be stated declaratively as follows:

1. All people everywhere live natural lives. They seek the necessities of life in ways that are influenced by their environment and by their past experiences and present activities. Ways that seem strange to some are natural and sensible to others.
2. All people everywhere are interdependent.
3. Maps are tools of general interpretation. The ability to find and use maps that are helpful should be developed.
4. The ability to perceive relationships and understand principles should be extended from the specific situation

under which they developed to general situations, wherever they are significant.

This fourth objective must be emphasized and reemphasized in all education, since it is the very basis for education – the very core of the mental equipment of an educated person. In this text, the lands of the world are divided into large areas in each of which natural conditions and ways of living are similar. As in other texts in this series, emphasis is on geographic relationships rather than *isolated facts*. The superiority of this method of teaching cannot be questioned. The relationship here is between ways of living and the natural conditions in a region, for instance, and between one part of the world and another. In addition to the text, there are other tools the teacher and pupils should use for optimum results: The Simplified 12-inch globe, now in more colors and keyed to the wall maps which are three in number, comprising the Simplified Ranally World, United States and Europe, and *Elementary School Atlas* (for pupils) and the indispensable *Goode's School Atlas* (for the teacher). Since the sixth grade is the present termination of elementary training, this course presents an excellent cap-stone to the student's early career.

The child's training should not stop at the end of the sixth year in public schools, for six years cannot give the average student the proper background for citizenship (if his education ceases there) or for advanced secondary and college work. Obviously, even six full years is not enough with the increasing complexity of our lives and problems, and the present system gives actually only the equivalent of three years of training which, unfortunately, fail to equal in quality a similar period of training in European schools. Thus in his suggested possible program for Philippine Schools, the writer must include two additional years of study, including two geography courses requisite to the understanding of and fruitful participation in society.

An optimum program would include a course in geography for each year of schooling until the fourth year of college – 13 years of Geography. For many reasons, it is still impossible to obtain such an excellent preparation for life provided by thirteen years of geography even in the most advanced schools in the United States and Europe. Therefore, we cannot expect that the Philippines, whose economy strains at carrying the present load, will be able to institute the best. The aim then, for the present, should only be the best possible program.

This discussion would be lengthened beyond all patience by analysis of all the books and teaching materials that can be used in making the study of geography the fascinating exciting and instructive subject it is. The writer hopes that he has indicated the importance of Geography in the mental equipment of each individual no matter at what level his formal educational training terminates.

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Land Utilization in Ilocos Norte

Telesforo W. Luna, Jr.

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The Ilocos Region has long been one of the areas in the Philippines from which notable and sustained migrations to other areas and overseas have originated. These population movements have been partially, if not totally, explained as the net effects of a restrictive environment. Restrictive as it may be, environment with very limited resources and prospects.

Ilocos Norte, the northernmost province of the Ilocos region, is no different from the other provinces. Physically and culturally, the provinces differ only in details. Nevertheless, a study of details is important as they present slightly different problems.

Some of the restrictions imposed by the physical environment can be overcome. With the modern advances in farming methods and techniques, it is possible that the present conditions of land utilization in Ilocos Norte can be greatly improved. Better farming schemes and increased irrigation facilities should result in a more efficient use of the limited agricultural land resources. Improvements likewise can be done in grazing and forestry.

Perhaps, a far more important aspect of this paper is the re-examination of the capability of an area where the maximum capacity of the land resources reportedly has already been reached. As all the empty, agriculturally feasible frontier areas of the Philippines are filled up attention will, by necessity, be directed towards a more intensive land development program and to a re-study of all agricultural areas.

Physical Aspects

The physical environment of Ilocos Norte presents a number of limitations on land utilization. Level, cultivable land, low in fertility, is limited to alluvial areas, which are not very extensive. Coastal lowland and an interior valley make up the largest areas available for agricultural development (Fig. 1).

Largely an elevated tract, which consists in part of raised coral and in part of alluvium overlying older sediments, the coastal lowland is long but narrow and irregular in width. The widest part is found in the vicinity of Bacarra, Laoag and San Nicolas where the lowland extends inland for approximately 16 kilometers. Its narrowest width is reached north of Pasuquin. Further north the coastal lowland is broken by scattered hills backed by locally steep hills and ridges. At certain places, like in Cape Bojeador and in Mayraira Point, rugged low hills extend up to the sea. Sand dunes generally fringe the coastal lowland from Pasuquin southward to within several miles north of Currimao. West of Paoay Lake four parallel sandy ridges have formed blocking the drainage of the lake.

The interior valley is set off from the coastal lowland by the generally north-south trending Ilocos Mountains. The separation is, however, incomplete. A gap at the north end of the interior valley cut by the broad, sandy, gravelly meandering Laoag River provides easy accessibility from east to west. Slightly smaller in size than the coastal lowland, the interior valley has been formed by faulting and folding with extensive alluvial deposits overlying older sediments and basement rocks.

A larger part of the province is made up of hills and mountains. Rising from the coastal lowland, the Ilocos Mountain Range is made of low, rolling ridges and small valleys. Bordering the interior valley to the east are the foothills of the Cordillera Central, which are higher and more rugged than the Ilocos Mountains. The Cordillera Central is a rugged, irregular patter of ridges, canyons, and peaks, many above 8,000 feet in elevation. The headwaters of the Laoag Rivers and its tributaries: the Bonga, Bornay, Solsona, Cura and Tonton Rivers are found in the Cordillera Central and in the foothills.

The existence of a pronounced wet and dry climate is another physical limitation. Heavy rains are most frequent from June to October while the rest of the year is almost completely dry. A study of the maximum flow of the major rivers in the province brings out the effects of the marked seasonal rainfall distribution.

The marked and wide seasonal fluctuations of the flow of the rivers greatly limit the development of an irrigation system within a larger area unless artificial water reservoirs are constructed.

A further characteristic of the climate of Ilocos Norte is the frequent occurrence of typhoons during the rainy season. These high velocity tropical cyclones accompanied by torrential rains inflict heavy damages to crops and other types of property from year to year.

The Man-Land Ratio

In 1960, the population of Ilocos Norte was 287,029 or an increase of 35,574 over the figure in 1948, which was only 251,455. This represents an increase of only 14.15 percent as against 42.84 percent for the Philippines during the same period – 19,234,182 in 1948 to 27,473,000 in 1960. The small increase in the province is most probably no more than the net gain derived from continuous migration rather than a low rate of population growth.

To a certain degree, migration and consequently a slower rate of population increase minimize pressure on resources especially land. However, migration can also mean the loss of the more energetic portion of the population, as young people are generally involved.

With a cultivated area of approximately 705.9 square kilometers out of 3,386.8 square kilometers, the nutritional density of Ilocos Norte is 413 persons. This is very much higher than that for the whole Philippines, which is 360 persons. In terms of cultivated land per person, it is only 0.250 hectares for the former compared with 0.276 hectares for the latter. Furthermore, the rice yield of 23.61 cavans per hectare (1955-59 average) is lower than the Philippine average of 27.50 cavans – which is already very low compared with other major rice producing countries in Asia. Rice production per hectare in Ilocos Norte has already been fluctuating from time to time. For 1955 to 1959, rice yield varied from 21.60 to 27.90 cavans per hectare.

Most of the lands under cultivation in the province are classified under land capability classes A and B (Fig. 4). Although these two land capability categories constitute over one-fifth of the total land area, a significant portion is used for settlement sites. Additional cultivated land belongs to class D.

Land capability classes A and B can both be utilized for crop production with very little limitations: they are level to gently rolling. However, to insure higher productivity it is necessary to institute common farming methods and techniques such as erosion control, water conservation, simple drainage and irrigation and removal of stones, boulders and other minor obstacles. The use of fertilizers can also increase productivity levels as soils, in general, are not fertile. The use of class D is limited and even then special farming methods and techniques must be adopted. This land category includes level land, which is difficult to drain and areas with as much as 25 percent slope, which are susceptible to severe erosion. Highly porous areas with resulting rapid permeability also belong to this class.

Among the other land capability classes found in Ilocos Norte are M, N and Y: these are non-agricultural lands. Class M land is generally very steep with as much as 40 percent slope. It is best suited for forests or grasslands with limited grazing capacity as severe erosion can easily set in. Similar uses are also possible for class N land that is quite rugged and steep with shallow soil if it is not already severely eroded. Class Y includes rough broken areas and rugged mountains, bare rocky areas, active sand dunes and sandy and gravely river deposits.

The construction of the land capability map of Ilocos Norte is based on the soil map of the province prepared by the Soil Survey Division of the Bureau of Soils. Since the division has grouped the different soil series and types into land capability class, the construction of the map was greatly facilitated.

Land Utilization

The evolution of the present land use pattern in Ilocos Norte is the result of a long time adjustment to the physical environment and to the cultural and economic needs of the region. That food crops take precedence over other types of crops is primarily economic. This is further indicated by current land uses in certain sections, which do not always reflect the optimum utilization of land resources, e.g., shifting cultivation in steeply sloping uplands. However, as present and future needs from each type of land use are of continuing importance to the regional economy, deliberate steps must be undertaken toward a more efficient utilization of the limited land resources. In general, land devoted for the cultivation of field crops are fairly well tended although the need for, and benefits of chemical fertilizers are quite evident. Few farmers, however, use chemical fertilizers so that the productivity level remains low. The poverty of the individual farmer and the relative lack of government loans for agricultural development work against a far more widespread use of chemical fertilizers. The use of animal manure to compensate for the lack of inorganic fertilizers is insignificant as the amount available is usually limited. The livestock industry is not well developed.

Methods and techniques of cultivation are rarely designed to maintain, much less improve, the fertility of the soil. Limitations of the physical environment especially the uneven rainfall distribution and economic considerations militate against crop diversification and rotation.

There are at present only four major national irrigation projects in the province. These are the Pasuquin Gravity Irrigation Project capable of irrigating 1,000 hectares in the rainy season; the Laoag-Vintar Gravity Irrigation System – 2,400 hectares; the Dingras Gravity Irrigation System -1,070 hectares; and the BonganPump Irrigation System -1,850 hectares. During the dry season, the capability of each of these systems is greatly reduced as all of them depend on available stream flow. Artificial water reservoirs are non-existent.

In addition to the above, irrigation projects there are small irrigation systems which are constructed and maintained by local farmers' associations in each of the several municipalities in the province. These are the communal irrigation systems. Most of them are capable of irrigating less than 500 hectares during the rainy season.

Exhaustive crops such as rice, corn and tobacco are grown in succession on each piece of cultivated land. Restorative crops like mungo bean, cowpea, and peanut occupy less significant roles in the farming scheme. Furthermore, the growing of restorative crops seems to be more of a local preference rather than a common practice in the province. These practices no doubt can result only in low crop yields per unit area of cultivated land.

The actual cropped area shows that cereals have priority over other crops and, for that matter, food crops over commercial crops. Tobacco, the major cash crop, is raised extensively although only 4,200 hectares are used for its cultivation. The tobacco hectarage has not reached the same proportions as in other provinces in the region, e.g., Ilocos Sur and La Union. In both of these provinces, practically all of the cultivated land is devoted to tobacco production after the rice crop is harvested.

Food crops in Ilocos Norte occupy 63,960 hectares out of a current total cultivated area of approximately 70,600 hectares. About 38,000 hectares alone are devoted to rice, which occupies semi-monopolistic position in the general farming scheme of the province. During the rainy season, almost all of the irrigated lowland fields are planted to rice.

Corn occupies about 6,500 hectares, the second largest area planted to any other crop. It is, however, far behind that of the rice hectarage. Smaller hectarages are used for the cultivation of mungo bean, cowpea, peanut, onion, garlic, eggplant, tomato and other vegetables. Among these crops, only garlic, in addition to tobacco, is sold outside of the province in commercial quantity.

In the unirrrigated farmlands, tree crops like coconuts and fruit and nut trees are grown. The total area of unirrigated farmlands is considerable and it is likely that additional land for field crops may be developed from them. Adequate and improved irrigation facilities, however, are needed.

Kaingin or Shifting Cultivation

In Ilocos Norte, *kaingin* is almost exclusively practiced in hilly and mountainous areas where slopes are steep. Most of these areas fall under land capability classes M, N and Y. In some instances, class D land is also used. Since these areas have marked and permanent limitations, a correct appraisal of their uses and capabilities may lead to a more effective land utilization.

Kaingin to be legal must be first be approved by the Bureau of Forestry. Permission is granted only on the grounds that the land involved is a forested area of non-commercial value and that the cleared land before it is abandoned will be reforested. Not all kaingin though is legal. Nobody knows the true extent of the area under kaingin; in fact, the conditions set forth for its practice are not followed.

Deforestation and the spread of the cogon (tall, coarse grass) are among the undesirable results of the uncontrolled practice of kaingin. Cogon usually invades the kaingin patches as soon as the upland or dry rice crop is harvested. Although cogon can be burned easily, frequent burning only makes it grow thicker. Hence, tree seedlings are never able to grow up among the cogon. Furthermore, frequent burning of the cogon only tends to push the forest edge farther back.

Cogon lands, due to the low nutritional value of the tall, coarse grasses, are generally poor grazing lands. The livestock industry is, therefore, small and it is limited by the availability of feed raised by the farmer and the presence of a\edible grasses in the fields.

The most noticeable effects of deforestation are the more frequent occurrence of floods, increased soil erosion and siltation of rivers. Increased runoff and sedimentation have turned many permanent, deep flowing rivers into intermittent, shallow, sandy and gravely rivers. The volume of water, which may otherwise be available for irrigation is, therefore, greatly reduced and the water table during the dry season is very low. Uplands denuded of their vegetative cover and subsequently subjected to soil erosion can be reforested only with difficulty. Thus, the speed with which the change is made from shifting cultivation to permanent cultivation or to a more efficient method of land utilization, suitable to each particular type based on its capability, is essential.

Prospects

Among the immediate steps that need to be taken to overcome some of the physical limitations are flood control, reforestation, amore extensive controlled irrigation system and farming techniques designed to conserve and improve soil fertility. Kaingin must be gradually contained in smaller areas and only public lands of non-commercial forest value should be used. The proviso with regard to the reforestation of kaingin patches before they are abandoned must be fully enforced. The laxity with which land laws are applied and the impunity of certain persons in violating such laws can only lead to worsening problems of land and water resource conservation.

Increased controlled irrigation facilities within larger areas are needed to partially offset the effects of a marked seasonal rainfall distribution. These will insure the availability of water for irrigation at most times particularly during planting time in the rainy season. In addition, a larger hectarage can then be cultivated in the dry season making the practice of crop diversification and rotation more extensive.

Small water pump units can also improve the flow and subsequently increase the volume of water available for irrigation. This is quite important, as most rivers are shallow and sluggish in the dry season. Such units have already been proven to be useful, economical and within the reach of a number of farmers in other regions. As these units can easily be moved, they can also be rented out to other farmers or farmers' association by the owners when not in use.

The use of chemical fertilizers should be encouraged. The high prices coupled with he relative difficulty of securing agricultural loans by small farmers may constitute a stumbling block in the more widespread use of inorganic fertilizers. However, their application will in all probability increase crop yields considerably. Soil fertility is low and only planned replenishment of plant nutrients in the soil can increase productivity.

The cogon lands can be scientifically improved to support a livestock industry. This might be easier and more economical than the repeated attempts to reforest these lands. Besides, grasslands are also excellent deterrents to accelerated soil erosion as the thick matting of underground stocks and roots holds the soil in place.

Reforestation of denuded areas and the improvement of the tree stocks and the improvement of the tree stocks of non-commercial forest lands will not only augment the commercial forest area of the province but will also induce a healthy chain reaction with regard to water resource conservation. Water infiltration and percolation will be increased, thus improving the underground water supply. This will in turn replenish the surface flow of lakes, ponds and streams. Logging at present is insignificant, although wood for fuel, rattan, bark and bamboos are gathered from non-commercial forest lands. These lands are at least three times larger in extent than commercial forest areas.

Some of the problems mentioned in the preceding paragraphs may not easily be overcome. However, the fact remains that the land area of the province is not only finite but also has a maximum extent and limit to the use of each particular type of land. In addition, the rate of population growth could become faster and subsequently pressure on the land would increase.

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Studies of Solar Flare Effects at the Manila Observatory [1]

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The Manila Observatory is a geophysical observatory, in the broad sense that it studies not only the earth but also the earth's environment. The sun, though 93 million miles away, is now known to belong to the environment of the earth and to affect the earth by the radiations it sends forth. These radiations are a fruitful study at all times, but they are particularly significant when solar flares occur. This is one reason the Observatory, whose interest in sun-earth relationships is best symbolized by its seal (Fig.1), devotes considerable effort to the study of the effects of flares. Because this is the Manila Observatory, these scientific studies are being conducted within the geographic limits of the Philippines, such as Baguio, Quezon City, Davao, and vicinities.

[1] Proceedings IRE 38, 1264 (1950). J. J. Hennessey, S.J. "Ionosphere Research at the Manila Observatory", Philippine Studies III (June, 1955), 164-186.

The geographic location of the Observatory, with some limitations, is a major asset for this kind of work. This point will become clearer as the various projects in progress are discussed.

The study of the effects of solar flares on the ionosphere of the earth is just one aspect of the Observatory's work. However, before discussing this particular study, it will be convenient to give a general description both of the ionosphere and of solar flares. Our knowledge of these has grown so rapidly in recent years – a part of the geophysical explosion – that our description has needed modifications, some drastic and others more moderate. Much of the new evidence has come with the widespread use of rockets and satellites as scientific tools. Such tools have a new vantage point. Nevertheless, ground-based instruments also have their role in giving records, which satellites cannot provide, for example, the taking of sustained observations at one geographic location. Thus, the various types of international programs complement rather than compete with one another.

THE IONOSPHERE

For the convenience of students of the atmosphere, various regions or spheres have been assigned different names. The region of rains, clouds and weather extends upward, depending on the latitude, to approximately twelve kilometers. This zone is known as the troposphere. Above this is the stratosphere, a region more rarified, where the temperature rises as the height increases. This region reaches to a height of roughly fifty kilometers. Other regions are defined, such as the mesosphere and the thermosphere, but for our purposes, the ionosphere may be considered to extend upward from the stratosphere (Fig 2). Radio engineers have defined the ionosphere as "the part of the earth's upper atmosphere where ions and electrons are present in quantities sufficient to affect the propagation of radio waves (at present thought to be above 50 km)." That engineers and physicists commonly accept this definition is due to the historical accident that early studies of this region were made devoted to radio.

The composition of the upper atmosphere according to its predominate component is given in Fig. 3. Up to about 120 kilometers, the composition, as at sea level, is chiefly nitrogen and oxygen. Above this atomic oxygen prevails. Further aloft helium is dominant, until at about 2500 kilometers and above where hydrogen is the chief constituent.

A. History of Ionosphere Discovery

Before the present century, knowledge of the condition of the earth's upper atmosphere was extremely meager. In the last century, Gauss allowed mathematically for the possibility of an electrified region. Balfour Stewart in 1882 inferred an electric current is present in the atmosphere just above cloud level. Schuster in 1889 extended the work of Stewart. However, these early beginnings, brilliant as they are were in the nature of possible physical features rather than well substantiated evidence in the current scientific sense.

When in December 1901 Marconi sent radio waves from Britain across the Atlantic, the great theoretical physicists were faced with a problem. How was it possible for these radio waves to bend around the earth? Radio waves normally travel like light waves, in a straight line. Could diffraction effects be used to give a solution? With all their attempts, no satisfying answer acceptable to the leading scientists came out of the many equations.

A different approach was offered in dependently in 1902 by Kennelly of Harvard University, and Heaviside of England. They concluded that an electrically conducting layer of charged particles, electrons and ions, exists in the upper atmosphere. This electrically conducting layer would effectively result in the bending of radio waves from the upper atmosphere back to the earth (Fig. 4a & b). By this change in direction, radio waves can travel long distances to reach remote places on the earth. Appealing as this explanation was, no direct evidence was at hand to assure the existence of the electrified layer in [2]the upper atmosphere. If there was such a layer, then the puzzle of the Marconi experiment was solved, though the reality of the layer had not been established.

The first experimental proof of the existence of the electrified (or ionized) region in the upper atmosphere was supplied as recently as 1925 by the work of Appleton and Barnett in England and of Breit and Tuve in the United States. The method of Breit and Tuve has subsequently been widely used with improved electronic components in instruments known as ionosondes or sounders of the ionosphere. Their technique was also a prelude to the development of radar. Bursts of radio waves are shot vertically upward (Fig. 5). After a short time delay, measured in millionths of a second, the radio waves encounter the ionosphere, which behaves as a mirror reflecting the waves back to the receiver. Using various values of wavelengths and measuring the short interval required for the trip up and down, the height of the "mirror" and many of its characteristics can be known. Taking the velocity of the waves as c, the free space velocity of light, the height is obtained from the product of the velocity by half the lapsed time for the round trip up and down.

B. Structure of the Ionosphere

The mirror or ionized region responsible for the reflection of the Marconi waves has been known as the "Kennelly-Heaviside layer". But radio soundings of the ionosphere revealed a structure within the ionosphere – not merely one layer but several – proper names assigned to the layers have been dropped. Current practice following Appleton makes use of letters to designate various regions within the ionosphere. Appleton used the letter E to designate the electric field of waves reflected from the first layer he encountered. When a higher layer was recognized he used F as the indicator for the electric waves from that region. The letters E and F were then transferred to become designators for the corresponding regions and layers. The choice of these letter designators was fortunate for it allowed for possibly higher regions to be called, say, G and H, and lower possible regions, say, D and C.

Ionospheric scientists have been using the radar technique of Breit and Tuve in various parts of the world to analyze the ionosphere. They notice variations with time of day, with season of the year, with the sunspot cycle, with the latitude and longitude of the observing station. To facilitate these studies the various regions and layers have been agreed upon. "A *region* of the ionosphere is a portion of the atmosphere in which there is a tending for the formation of definite ionized layers. A *layer* of the ionosphere is a regularly stratified distribution of ionization which is formed in a region of the ionosphere and is capable of reflecting radio waves back to earth."

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[2] Homer E. Newell, "Space Science," Science 139, 465 (1963).
[3] R. Silberstein, "The origin of current nomenclature", J. Atmos. Terr. Phy.13, 382 (1959).
[4] Proc. IRE. 1. c.

The regions, which are most conspicuous in radio soundings, are the E and F. These we will mention first and later on go back to the lower region, the D region.

The E region is the zone of the upper atmosphere from about 90 to 140 kilometers. The maximum ionization density occurs at about 110 kilometers, though there are variations. Ionosonde readings indicate that the number of electrons per cubic centimeter in the E region is typically about 100,000. These remarks pertain to the normal E layer. There is in this same region another layer called the sporadic E layer. As its name indicates, it may appear or disappear quite unpredictably. Occasionally it shows an intensity of ionization in excess of that found in the higher regions with the result that it sometimes "blankets" the [3]higher layers in part or in w[4]hole. The irregularity of its characteristics makes its behavior difficult to analyze.

The F region extends upward from about 160 kilometers. During the daytime the ionosonde records (or ionograms) show the layer bifurcating into two parts or layers at different heights. The lower part is designated F1 and the upper layer is F2. A typical value for the intensity of ionization in the F region is a million electrons per cubic centimeter (Fig. 2). In sounding the ionosphere, the frequency of the electromagnetic waves used is gradually increased. The increasing frequencies penetrate higher and higher into the ionized region (or plasma). At a certain density of ionization (N_e electrons per c.c.) a particular frequency (megacycles per second) is reflected according to the relation $f^2 = 0.81 \times 10^8 N_e$.

Ground-based soundings have given at times suggestions of a higher layer, the G layer. The real existence of this layer has been in dispute. However recent "topside" soundings taken from above the ionosphere have given evidence, generally accepted, that there is no real G layer.

Ionospheric records taken at vertical incidence are very revealing about the E and F regions. Nevertheless, rarely is an echo seen from the lower D region. Yet the presence of an absorbing region below the E region is indicated in the changes which occur in the minimum reflected frequency. There is an ionized zone extending some twenty or more kilometers below the bottom of the E region, which absorbs radio waves rather than reflects them.

A general picture of the ionosphere emerges. From about a hundred up to perhaps five hundred kilometers there are the "mirror" or reflecting regions for medium radio waves. These are the E and F regions. In general, the density of ionization increases with altitude but there are a few ledges corresponding to the E, the F1, and the F2 layers. (Occasionally irregular ledges, e.g. F1-1/2, may show up.) While in going upward, density of *ionization* shows a trend toward increasing to the peak of the F2 region; the *particle density* decreases rapidly with increasing height. And so, going downward below, the E region, the D region has relatively fewer ions and electrons but relatively *more particles* in an equivalent volume. The electrons in the D region cannot move long distances without collision with particles, a restraining condition that causes the region to absorb radio waves rather than to propagate or reflect them.

In the course of a day ionospheric variations in electron density and height point to solar control, and to the influence of ultra-violet light on the upper atmosphere. Despite the overwhelming deposit of ionospheric data in the World Centers there still remain many unanswered questions, but others have met with satisfactory solutions.

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[5] E.V. Appleton, J. Atmos, and Terr. Physics 25, 551. (1963)

SOLAR FLARES

The sun appears to be a rather placid object. It sends out light and heat to the Earth. In addition, even this seems rather even so that astronomy textbooks refer to the solar *constant,* the intensity of energy coming from the sun. Yet, in reality the sun is also sending forth radiations, which are vastly varying. Fortunately, for life on earth, about 96% of the sun's energy output is radiated at wavelengths lower than those which penetrate to earth-bound dwellers. However, a closer examination of the sun shows that it is far from serene and placid. Besides the ordinary emission of radiant energy, there are catastrophic events in the hot, outer[5] layers of the sun. These are known as solar flares.

When in white light the sun is photographed through a telescope or is viewed with its image projected on a screen, the most notable feature is the sunspots. These areas on the sun appear dark because they are cooler by some 1,500 degrees than the solar surface, which is at a temperature of about 6,000°K. An observer of sunspots could follow the sun day after *in white light* and he might go through a lifetime without ever detecting a solar flare, an event that occurs in the vicinity of a sunspot group. An instrument, which observes the sun in all its colors at once, that is, in white light, is not suited for studying solar flares. Specialized instruments are required. Ordinarily either one of two instruments is used for viewing flares: the monochromatic filter because it removes all colors except one, for example, red. In this red light, many features not otherwise observed are seen on the sun. Among these are flares when they occur. The spectrohelioscope also allows for observation of the sun in a single color but it does this by selecting a single line or color of the spectrum and by following this color across the face of the sun. Both of these instruments are in use at the Manila Observatory in the patrol for flares. From sunrise to sunset, as long as the sun can be seen, it is under continuous observation for the sudden flashes of a flare. Optically a solar flare is a sudden brightening, of short duration, of the surface of the sun, usually in the neighborhood of a sunspot. The blazing up of a part of the disc can be ten times the usual brilliance of the sun in that area.

While the onset of flares cannot be predicted, their association with certain types of sunspots serves to warn the experienced observer that a flare occurrence is likely. The onset of a flare is sudden, with a rapid rise to the peak or "flash" intensity. The decay of the flare is more gradual and lasts several times the duration of the onset. From the visual evidence, flares are relatively flat structures extended parallel to the solar surface and they are essentially stationary. Though the source of the energy of a flare seems to require an electromagnetic origin, no complete explanation is at present available.

Since scientists working in a variety of fields are interested in flares and their influences, a system for characterizing their importance has been developed. The chief, but not unique, criterion for the importance class is based on the area of the flare on the sun's surface at the time of maximum brightness. The importance classes go from one minus for the subflares, through one and one plus, similarly for two and three, to three for the superflares. A subflare has an area of less than one hundred millionth of the visible hemisphere of the sun, while a superflare has an area in excess of 1,200 millionths of the hemisphere. This area is roughly equivalent to the number of square miles covered by 15 times the area of the earth's hemisphere. Besides the area of the flare, its duration in minutes and its effective broadening of the hydrogen alpha spectral line are indicators for the importance of a flare. The average time duration of a "one" flare is 20 minutes while an importance "three" flare lasts an hour. The great "three plus" flares last in excess of 90 minutes, even for several hours.

EFFECTS OF FLARES

Associated with flares are various types of emissions which produce significant effects, particularly in the Earth's atmosphere. In the broad extent of the electromagnetic spectrum there are radiation emissions extending from the short waves of the X-ray region, through the ultra-violet and visible light regions to the long waves of radio frequency. Besides thes[6]e waves, particles are emitted possessing various amounts of energy. Some of these particles are so energetic that their effects can be found by cosmic ray detectors even at ground level. While in the physical event of a great three plus flare the results are closely related, it may be helpful to consider the various effects in the following quite arbitrary categories: (a) visual and photographic effects; (b) ionospheric effects; (c) particle effects; (d) flare radio emissions. The most significant of these for Observatory program is the first two, but the other two classes of effects cannot be neglected.

Table 1

FLARE EFFECTS	
Effects	**Instrumental Study at the Manila Observatory**
A. Visual and Photographic Effects	
1. Visual brightening in H-alpha	1. Lyot filter patrol on progress of flare
2. Photographs in Calcium K-line and Hydrogen alpha	2. Spectroheliograms
3. White light effects on spot groups	3. Daily photos at Baguio
B. Ionosphere Effects	
1. SWF – short wave fadeout of radio signals	1. Ionosonde and recording receiver
2. SEA – sudden enhancement of atmospherics	2. SEA recorder
3. SPA –sudden phase anomaly	3. Equipment under study
4. SCNA – sudden cosmic noise absorption	4. Riometer and Indirect Solar Flare Detector
5. SFE - magnetic solar flare effect	Magnetic variometers – in three components – at two locations
C. Particle Effects	
1. GLE – cosmic ray ground level event	1. Not being studided at present
2. PCA – polar cap absorption	2. Not possible in Philippine latitudes
3. Magnetic Storm Particles	3. Magnetic variometers and Ionosonde
D. Solar Radio Bursts	
Type I to V	Riometers and proposed solar radio telescope

[7] D. McNally, "Emission of Gas from the Sun", The Observatory 82. p. 18 (Feb. 1963).
[8] B.E. J. Pagel, "Ultra-Violet Emission from the Sun", Planet & Space Sciences, 333-353 (1963).
[9] M.A. Ellison, "Solar Flares", Nature 193, 532. (1962).

A. Visual and Photographic Effects.

To one observing the surface of the sun, the most conspicuous feature of a flare is the brightening of the flare area. Certain spectral lines are greatly enhanced. For example, at times the hydrogen alpha line at a wavelength of 6,563 angstroms may increase about ten times in brightness. If the observer has selected his equipment to give him light at this wavelength or some other favored wavelength, he is well suited to follow the progress of the flare. As part of its solar patrol work, the Manila Observatory uses a Lyot Monochromatic filter to view the sun in the hydrogen alpha line. Besides, the spectrohelioscope is used to photograph flare events in the Calcium K line or some other preferred line. Thus either by visual or by photographic means, or by a combination of both, a permanent record of the flare is obtained.

The geographic importance of a Philippine observatory appears at once by consideration of times involved. Suppose a flare occurs at 10:00 o'clock in the morning at Manila. It is then nine o'clock at night the previous evening at New York and the Eastern coast of the United States and it is two o'clock in the morning at London and in Western Europe. The nighttime hours prevent any viewing of the sun in those and nearby regions. Besides this advantage due to longitude, there is the advantage due to latitude. Stations near the equator have approximately a minimum of eleven hours between sunrise and sunset. For the higher latitudes, the corresponding winter day may be as little as six or fewer hours, during the winter months. For a constant patrol, a Philippine location is recognized as being very valuable.

Besides the principal instruments, the spectroheliograph and the Lyot filter for flare patrol, the project of taking daily white light photos of the sun in the remarkable "seeing" conditions of Baguio is a valuable research adjunct. The Manila Observatory operates such a station at Baguio. White light photos may fail to reveal a solar flare but they do give information about sunspot and the solar surface as the sun experiences a flare. These aspects of the sun may suggest or confirm other evidences about the nature of flares.

B. Ionospheric Effects.

Effects of a major flare have been studied from so many different viewpoints and by so many scientists that alphabetical designations have been given to many of the phenomena. Because these effects are due to an abnormal condition in the ionosphere they have long been given the general designation SID or sudden ionospheric disturbance. For a long time it has been known that strong flares produce intense ionization in and below the D region of the ionosphere. This effect is now known as the Mogel-Dellinger effect because these two scientists recognized the effect in radio blackouts. The D region of the ionosphere is an absorbing region rather than a "mirror" or reflecting region for medium length radio waves. When dense ionization is formed in and below the D region the radio waves, which normally would pass through the E and F regions for reflection, are trapped by the relatively dense matter below the E region. Since the radio waves are absorbed, they do not reach the distant receiver. Over the sunlit hemisphere of the earth, there is a radio blackout (Fig. 6). However, the Dellinger effect has been known for the past thirty years, its complete explanation as the result of solar X-rays rather than ultra-violet light was not known until the studies of Friedman and his associates first predicted and then verified the X-rays. And before, in the Marconi experiment, it was

[10] M.A. Ellison, "The Sun and Its Influences", (1955) p. 110.
[11] J. J. Hennessey, S.J., "The Dellinger Effect of February Twenty-Third, 1956," Phil. Studied IV, 2 (July, 1956) p. 299.

known that radio waves did get around the earth but the experimental confirmation came years later with Breit and Tuve; so, in the Dellinger effect, the dense D region ionization was known long before the rocket experiments of 1956 showed the cause to be X-rays rather than an increment in Lyman alpha ultra-violet radiation.

1. SWF, the short wave fadeout of radio signals, a manifestation of the Dellinger effect, comes simultaneously with the visible appearance of the flare. The records taken with an ionosonde, for example, the one operated in Baguio since 1952 by the Manila Observatory, indicate that the transmitted signal cannot penetrate through the D region so that the reflected echoes are partially or totally absent. The radio frequencies, which are lost in the sky wave, are in the range from about 3 to 30 megacycles. Another method in use at the Observatory for detecting SWF's is the monitoring of a distant reliable radio station and the recording of its signals. If this station's signals fail to come in this is an indication of an SWF, the event in the ionosphere. An improved SWF detector and recorder are being developed in our laboratories. A simultaneous recording of three stations located in different directions from the receiver will remove any ambiguity in crediting the SWF to ionospheric conditions rather than to instrumental problems.

2. SEA, the sudden enhancement of atmospherics. This method makes use of the signals from distant tropical thunderstorms, received at 27 kilocycles per second. These radio waves are long. With the onset of X-ray ionization, the atmospheric signals increase due to the increased D region ionization. The Observatory is currently using a fairly sophisticated receiver and recorder for this type of information.

3. SPA, the sudden phase anomaly. For very long waves, there is a constant phase difference between the sky wave and the ground wave. With the lowering of the D region, a phase shift occurs from which the lowering of the height of the ionization can be determined. Equipment for the study of this type of phenomenon is under study at the Observatory.

4. SCNA or sudden cosmic noise absorption. The stars of our galaxy supply a fairly constant radio signal at a frequency of about 18 megacycles per second. If the intensity of this radio noise is recorded continuously, the record will be sensitive to changes in the ionosphere. The recorded intensity will be less as the ionosphere absorbs more cosmic noise. This galactic noise is being constantly recorded at the Manila Observatory by an instrument known as an indirect solar flare detector. Besides this, another similar recorder, known as a riometer because it gives information about the relative ionospheric opacity, receives the [8]noise from the stars at about 30 megacycles per second.

5. SFE, or solar flare effect, called a magnetic crochet. Magnetic instruments known as variometers record continuously three components of the earth's magnetic field: the declination, the vertical, and the horizontal components. When under the influence of a flare, the ionosphere suddenly becomes more electrically conducting.

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[12] K.G. McCracken, "The Cosmic Ray Flare Effect", Jour. Geophys. Res. 67, 448-458 (1962).
[13] Constance S. Warwick, "Propagation of Solar Particles", Jour. Geoph. Res. 67, 1333 (1962).
[14] Hennessey and Marasigan, "Storm in the Ionosphere", Philippine Studies 5, 336-340 (1957).

Changes in the electric current high in the atmosphere produce sudden changes in the magnetic elements on the earth. These latter changes follow the start of a flare. The Manila Observatory is operating two Askania-type magnetic variometers at different locations in the Philippines. A particularly fortunate advantage for magnetic studies in the Philippines is the passage of the magnetic dip equator through Mindanao even though the Philippines are entirely north of the geographic equator.

C. Particle Effects

The particle emissions connected with an intense flare are capable of producing different effects on earth. Three groups are considered. The most energetic particles, the protons of high energy in excess of one billion electron volts, produce secondary cosmic ray events at ground level. These are called GLE, ground level events. Slightly less energetic protons under the influence of the earth's magnetic field pour into the polar latitudes to ionize the D region. This increased ionization produces polar cap absorption, PCA. The third and least energetic group of particles is the magnetic storm and auroral particles, traveling through space as a neutral group of protons and electrons in about equal numbers.

1. GLE. Cosmic ray detectors at ground level on the earth show an enhanced reception on rare occasions. This enhancement follows closely after a large solar flare. These effects are not being studied at present at the Manila Observatory.

2. PCA. The protons, which are responsible for Polar Cap Absorption events, produce heavy ionization in the ionospheric D region near the poles. This absorption produces the ionospheric disturbance effects similar to that noted for X-rays. Since our latitude is far below the polar latitude of 60 degrees and up this phenomenon is not being studied in the Philippines.

3. Auroral and Magnetic storm particles. A cloud of ionized gas, electro statically neutral, is blown out from a flare region, toward the earth. This cloud of protons and electrons travels more slowly than the two previous classes of particles. Magnetic effects are detected about 26 hours after the flash of the flare. Barbara Bell has made some careful studies of flares and geomagnetic activity.

The Manila Observatory is in a good position for this type of study because the visual and photographic study of flares can be correlated with the SID data and the magnetic records.

C. Solar Radio Bursts

Different classes of radio emissions from flares have been divided into five technical types, I to V. These various types of emissions have their origin at different levels of the solar atmosphere. At present, at the Manila Observatory, these solar noise bursts are being detected and recorded on the two riometers. Present plans call for the construction of a radio telescope, which will follow the sun across the sky in order to [9]record the changes in radio noise emitted by the sun.

CONCLUSION

The foregoing report gives a brief account of the ways a solar flare and its effects are being studied at the Manila Observatory. This is one project with many facets. While today, the methods explained here are pioneering methods, in a year or two, as so often happens in research, these methods may be antiquated. But before this happens – we know from the experience of scientific history – new problems will have been opened up which will be just as engrossing as those which have been settled. There will always be new truths and new knowledge to be learned in sun-earth relationships. The Manila Observatory is eager to continue this study.

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Aspects of Urban Residential Patterns in Central Luzon, Philippines

D.C. Bennet

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Residential patterns in Philippine cities have been characterized as having a declining quality and value from the city's center to its periphery. Hart studied, through the use of Filipino informants, the pre-war central areas of a number of small urban places and found that there was a definite clustering to the elite in the zone adjacent to the plaza at that time.

This pattern of residences is a common one for pre-industrial cities. Cities in mature industrial societies, on the other hand, have a residential pattern such that the lowest quality houses are in the central area and improve towards the periphery. While the factors contributing to the pre- and post-industrial patterns are many and complex, it appears that the main driving force for change is the development of an extensive rapid transportation system. The improved transportation system both congests the central area and makes the periphery more accessible to the commuting higher income group.

Transportation between and within Philippine urban places has undergone a profound change in the period following World War II. Large buses are the main vehicles for long distance inter-urban transport. They probably had little effect, though, on the growth pattern of particular towns as they have designated terminals in the center of a city and usually do not provide personalized pick-up and delivery service. Jeepneys, on the other hand, have been the major improvement in Philippine intra-city transportation changes since the war. They are licensed for either an inter-urban or village-to-urban route. However, their terminals inevitably focus on the central public market and they provide a very personalized pick-up and delivery system for all streets, which lead from the market to other towns. Being small vehicles, there has developed great traffic congestion with noise and dusts in the central areas of towns of all sizes. On the other side, they provide a convenient mode of access from the periphery, especially along main streets, to the city center for shopping and jobs. Twenty years would appear to be sufficient time for changes in the locational patterns of residences to have occurred if indeed, such trends are universal.

Our purpose is to examine the geographic pattern of residential quality in Philippine towns to determine a) what differences exist between the central and peripheral areas; and b) if the major city streets are attracting better quality homes.

To answer the first question, we have selected two set of housing data for analysis: one central and one peripheral. The central residential area is defined to include the houses on all linear blocks, which either form the plaza or are adjacent to it. The peripheral residential area was defined to include all linear blocks, which are adjacent to the farm or idle lands surrounding the urban area. They are the streets, which form the outer edge of the geographic city. The break in street and residential density between town and country is normally quite sharp in the Philippines except along the few inter-city highways. A sampling of the peripheral linear blocks was taken so as to include several sectors and to provide approximately the same number of houses as were in the central zone. An Index of Concentration was used to determine what extent the houses of these two zones differ from each other and from the city average. Four towns in Central Luzon, two small and two large, have been examined. (Tables 1 and 2 summarize. ?)

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[1] This study was supported by a Fulbright-Hayes Research Award and by the International Affairs Center, Indiana University.
[2] Don C. Bennett is an Associate Professor of Geography in the Indiana University.
[3] Hart, Donna V., "The Paza Complex, Cultural Report Series" in Southeast Asia Studies, no. 3 (Yale University, New Haven: Connecticut, 1961), p.34.
[4] Sjoberg, G. The Pre Industrial City: Past and Present, (Free Press Paperback, The Macmillan Co., New York, 1965), p. 95.
[5] Prior to the war, and still operating in all Philippine urban centers including parts of Manila, is the *calesa*, a horse-drawn carriage which has been the traditional vehicle for intra-city transportation.

The quality of housing was determined by examining four visible attributes: materials, size, foundation style, and maintenance. The materials categories are consistent with, but an expansion of, the categories used by the Bureau of the Census and Statistics in their 1960 enumerations. Building materials vary substantially in cost in the order shown in Table 1. Very small houses are those that are most often identified with poor squatters; they are less than 10 by 10 feet. Small houses are less than 20 by 20 feet. The house-on-poles foundation identifies all houses in which the main living level is above ground and the floor is supported on poles. Only light materials or wood can be used in pole-construction homes. Maintenance was considered 'good' when the house do not need obvious repair; it was 'fair' when only minor repairs (e.g. to windows, roof) were required: 'Poor' conditions mean that either major repairs are needed or the home should be replaced (e.g., in the case of homes made of light materials). There are very strong statistical associations among the four attributes. Strong building materials are associated with large houses, built with the floor at ground level and in fair or good condition. Conversely, light building materials are used in small homes, with the floor raised above the ground on poles, and in either fair or poor condition.

Comparison of the central and peripheral zones. – We will compare the housing qualities of the central and peripheral zones by first examining to what extent each zone differs from the all city-average in terms of each of the four criteria. With that as a standard, we will then compare the two zones to each other.[2]

Evidence from the four towns indicates that the homes in the central zone near the plaza are decidedly better than the city average. In terms of building materials, there are significantly fewer houses made entirely of light materials than the city average would suggest. Two cities had a low incidence of houses made of a mixture of light and strong materials; two did not. Three towns show a marked concentration of houses made entirely of wood and cement blocks.

Central zone houses are also larger than the average for the city. There are fewer more homes and many more large houses than proportionate distribution would produce.

A ground-level foundation is prominent among central zone houses. There were at least 30 percent more houses built at ground level in this area of the towns than a proportionate distribution would suggest.

The maintenance of central zone houses is markedly superior to those of the entire city. There are fewer homes in poor condition, about the same proportion in average condition and far more in good condition that the city average.

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[1] The linear block is the basic data-aggregating unit of this study. It includes the area fronting of the both sides of a street, which is defined by an intersection or abrupt change in the direction of the street.

These are, admittedly, not the best criteria for housing quality or value. However, assessment data are neither current nor geographically standard. Further, there is very little housing turnover in provincial towns and most that does turnover, is arranged privately. Reliable data on current value is consequently difficult to obtain. The four criteria used reflect general conditions of quality if not specific values.

Pearsonian correlation coefficients of 0.800 or higher were obtained between all pairs of highest or lower values of all four of the attributes examined.

Houses around the city periphery do not display as consistent a pattern as those in the city center; the variations from city to city are much greater. The materials used in the peripheral zones indicate that the proportion of homes built entirely of light materials and those of a mixture of light and strong materials are not much different from the city average; wooden houses are either in the same ratio or are more frequent; there are fewer homes of wood and cement or all cement than the city average. In general, the houses on the periphery are slightly inferior in terms of materials to the city average.

Compared to an entire city, the peripheral zone has more small houses and slightly fewer large houses. There is a slightly greater frequency of the house-on-poles in the peripheral zone than in the city as a whole. In the two largest towns, Baliuag and San Carlos, there are far fewer ground-level houses in the peripheral zone than one would expect with a proportionate distribution.

In terms of maintenance, the houses in the periphery are not significantly different from the citywide average. If anything, there appears to be fewer houses in good condition than one would expect from proportionate distribution.

Thus, both the central and the peripheral zone housings differ from the all-city average. Since central zone housing is decidedly above average and peripheral zone housing is somewhat below average, it follows that there is a substantial difference between them. Our conclusion is that the gradient in housing quality characteristic of pre-industrial cities and traditional for Philippine cities is still the prevailing pattern after 20 years of a much improved intra-city transportation system.

So far, we have generalized from the data of four cities, selected to represent both small and large towns within Central Luzon. At the individual city level, we naturally see greater contrasts. Baliuag, for example, is a city where the differences between the central and peripheral zone are very marked. There is not a single characteristic of the houses in which the central and peripheral zones do not lie on opposite sides of the all-city average. San Carlos, on the other hand, is a city where the differences, while observable, are slight; neither zone differs sharply from the city average. In all four cities, however, the tendencies are consistent: central housing is of higher quality than peripheral housing.

The four cities display wide variations in terms of squatter-type homes: in one city there was a marked concentration of these homes in the central zone; in another city the central zone contained the city average; in a third city, there were many fewer than the city average would suggest; and, one city had none.

Main street orientation – Another residential feature of pre-industrial cities is the selection of main streets (streets that lead from the city center to other urban places) by the wealthy for locating their homes. These streets provide the desirable qualities of easy accessibility and visibility. With greatly increased traffic, however, such streets usually become less desirable. They are transformed into strips of mixed land uses including a large assortment of commerce and industry. Our interest is to determine what the pattern is in the Philippine towns with respect to residential quality along the main street. To answer this, we have sorted all the linear blocks in each of the four urban places into two sets. One set includes the linear blocks, which radiate from the public market towards other urban places. The other set includes all the remaining linear blocks in town. The housing along the linear blocks, which comprise the major streets, is compared to the city average, as above by using the concentration index (Tables 3 and 4).

There is a slight but definite concentration of houses made of the higher-valued building materials along the major streets. Residences built entirely of light materials are fewer in number and those built of all wood or especially a combination of wood and cement block or bricks are more frequent than the city average would suggest. This is the pattern in every city.

Similarly, large houses are concentrated along highways. Very small houses show no locational preference. In towns having a number of squatters, the squatter's preference for public land, including highway right-of-way results in their being located as frequently along major streets as in other parts of town.

The largest difference between major street-oriented and other housing is seen in foundation styles. There is a marked concentration of houses built at ground level along the inter-city highways. These are also undoubtedly the areas where greatest growth has occurred in cities and may well indicate that Filipinos are increasingly adopting the ground-level style of urban dwelling.

Finally, with respect to the maintenance of housing, those along the main highways are in better repair than those in the remainder of town. However, houses in 'good' condition are less concentrated along highways than in 'fair' condition, suggesting that the income of the occupants of the very best homes is high enough that they may have private transportation and hence seek a quieter neighborhood.

In summary, houses along major streets are superior to those in the city at large in each of the four qualities examined. A factor of some importance is the continued practice of locating one's home on the same site as one's business. So long as this practice continues, the increasing attractiveness of major streets for commerce and industry will automatically result in a number of high quality homes being located in the same streets irrespective of the declining quality aspects of these streets as pleasant neighborhoods.

SUMMARY

Our results indicate that the pre-war or traditional patterns of residential location continue to prevail in Philippine urban places even after almost a score of years of readily available auto transportation. There is still a decided concentration of the better quality homes in both the central (plaza) area and along the major streets. Our observation is that the major streets rather than the central area are increasingly attracting the wealthier citizens. The new rich are locating their business and homes along rapidly developing commercialized main streets. A final observation is that a traveler is very likely to consider the housing in a Philippine town to be better than it really is because all alone his route from the time he enters the town along the major streets to the central plaza area and out towards the next town, he has seen housing that is definitely better than the city average.

25th ANNIVERSARY GEOGRAPHY AWARD

Philippine Geographical Society

December 8, 1975

Published in the Philippine Geograpical Journal, 1975, 23(4), p. 186

To have survived time by fourscore, seven years, one month and one day is achievement in itself;

To fill all these long years with achievements that cannot be attained by a dozen men with normal effort is a feat;

And to continue achieving long after one is said to have passed his most useful years is something worth emulation.

Something that the Philippine Geographical Society, on its 25th Anniversary, would like to point out for the nation and the world to admire...

A man who has attained these achievements was

Born November 7, 1883 at the town of Unisan, Quezon just before the outbreak of the Philippine revolution against Spain;

Studied nature because he had seen God in nature;

Love nature such that he learned all about forests in the Philippines, a knowledge which he painfully gathered and generously passed to generations that followed him;

Worked among the trees as a Forester, Professor and Dean of the College of Forestry, University of the Philippines;

Loved by the people who work with him and happy in the company of the Rotarians while spending his leisure hours on Thursday noon at the Coral Hilton Rotary luncheon meetings;

Communed with the trees, a man who is happiest when he lost so to speak in the woods of albazia falcateria *trees that he planted, and nurtured as a mother nurses her children;*

Trees that have made the concessions of the Philippine Paper Industries green with forest, not brown with denudation;

A man who has lived long and well;

A man who has left his imprint on our time and in times to come –

This man is FLORENCIO TAMESIS, retired Director of the Bureau of Forestry and Dean Emeritus, University of the Philippines, our 25th Anniversary Geography Awardee – 1975.

(Director Artemio E. Gesmundo of the Bureau of Soils retired, will now read the station engraved on the Award Plaque.)

DOMINADOR Z. ROSELL

President, Philippine Geographical Society

25th ANNIVERSARY GEOGRAPHY AWARD

to

FLORENCIO TAMESIS

1. General Manager of Nasipit Lumber Company, Inc.

   Philippine Wallboard Corporation, Anakan Lumber Company and Woodland

   Realty Corporation.

2. Date and Place of Birth: November 7, 1888 Unisan Quezon

   Married to Silvina Valero with 8 children

3. Residence Address: 21 Macopa St., Sta. Mesa Hts., Quezon City

   Telephone Number: 60-17-50

4. Educational Background:

(1) UP School of Forestry-Ranger 1912

(2) University of Washington College of Forestry, U.S.A., BSF 1922

5. Areas of Specialization: Timber Utilization and Silviculture

6. Started as Asst. Ranger, 1907 to 1912 and promoted to Director of Forestry

   And Ex-Officio Dean, UP College of Forestry – 1946-1953

7. Member UP Board of Regent – 1957 to 1964

8. Awards Received

(1) Distinguished Forestry Alumnus – 1953,

(2) Presidential Award for Most Outstanding in the Field of Public Service – 1953,

(3) Diploma of Merit as Distinguished Alumnus, University of Washington, USA – 1954,

(4) Father of the year – 1956, UP Women's Club,

(5) Outstanding UP Alumnus of the Year, College of Forestry – 1957,

(6) Golden Heritage Medal – 1968,

(7) Philippine Forestry Research Society Award in Recognition of Outstanding Leadership and Interest in Forestry Research – 1972,

(8) Molawin Award for Most Outstanding Individual Achievement in Forestry – 1972.

9. Research Works and Publications: Over 100 articles and researches published in recognized publications; three of these researches appeared in the Philippine Geographical Journal.

10. Member in 18 professional and learned societies, including National Research Council of the Philippines, PHILAAS, Inc. Philippine Geographical Society, Phi Kappa Phi, UP Chapter, Gamma Sigma Delta, UPLB Chapter.

NATIONAL COMMITTEE ON GEOGRAPHICAL SCIENCES

National Science Development Board

Publication of the Descriptive Atlas of the Philippines

The National Committee on Geographical Sciences (NCGS) NSDB has made the proposal to publish the Descriptive Atlas of the Philippines. The implementing agencies are the members of the Committee, namely:

University of the Philippines, College of Arts and Sciences; Bureau of Soils; Commission on Volcanology; National Irrigation Administration; Bureau of Mines; Philippine Atmospheric, Geophysical and Astronomical Services Administration; Bureau of Forest Development; Department of Agrarian Reform; National Census and Statistics Office; Bureau of Coast and Geodetic Survey; and Philippine Geographical Society.

The publication of the Descriptive Atlas of the Philippines will provide a wealth of information regarding the geography and natural resources of the country. Included also in this atlas are: Man and his number, cultural groups, cultural institutions, the work of man such as his settlement, his economics, transportation, communication, and the energy resources and their development. The significance of this project, therefore, is that when finished and published, it will provide information of the country in a nutshell. So far, no Atlas of this kind has been published in this country.

The funding of this project will be provided by the National Science Development Board and partly by financial assistance from the Filipinas Foundation, Inc.

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Spatial Equity and Integrated National Physical Planning: Key to Philippine Regional and National Development

Manuel T. Navarro[1]

Published in the Philippine Geograpical Journal, 1988, 36(2-3), p. 45

INTRODUCTION

Spatial equity or the reduction of spatial disparities in living levels has long been recognized as a key objective of both national and regional development planning in the Philippines. For the past one-and-a-half decades, attempts have been made to forge a link between physical and socioeconomic planning. In 1970, the Congress of the Philippines approved Joint Resolution No. 3 which provided for the adoption of a National Framework Plan that would translate the national government's policies on population distribution, land capability, urbanization, housing, transportation, industrial and natural resources management into spatial terms. This resolution, however, has remained as a mere guideline in development planning and the policies it enunciated are still waiting to be concretized. In the past, and even in its present form, national development planning has always been strongly oriented towards socioeconomic planning and consequently, the spatial dimension of the problem has been unwittingly ignored. Considerations given to the physical and land use aspects almost seem perfunctory. A cursory review of the country's national development planbs will, in fact, reveal that the physical dimension of planning in the Philippines has not been given the attention that it really deserves.

[1] Assistant Professor, Department of Economics, Ateneo de Manila University. His areas of interest are urban and regional economics, economic geography and land use, spatial analysis, and location theory.

The Formulation of a National Physical Framework Plan for the Philippines: Past and Present

The 1975 National Physical Framework Plan

The formulation of a National Physical Framework Plan for the Philippines started under a United Nations Development Programme (UNDP) assisted project which likewise involved the Department of Public Works, Transportation and Communication (DPWTC), the University of the Philippines Institute of Planning (UPIP), and the Presidential Advisory Council on Public Works and Community Development. While the national goals of the Four-Year Development Plan were considered in the formulation of the Framework Plan, the basic guidelines, however, were prepared with a twenty-five year perspective. Hence, most of the projections were unrealistically remote since they extended up to the year 2000. It is plain to see that this Framework Plan was already a deliberate attempt on the part of the government to integrate in a single grand design the elements of both socioeconomic and physical planning. Unfortunately, this Framework Plan remained in its theoretical form as a mere "project output" and apparently was never officially adopted by the Philippine Government. This can be traced to the fact that, prior to the completion of the Plan, the Task Force on Human Settlements was created in September 1973 under Executive Order No. 419 with the major function of formulating an overall framework plan for the nation, which was aimed at pinpointing areas for human settlement's projects. It can therefore be surmised, that the issuance of Executive Order No. 419 had precluded the efforts of the DPWTC and UPIP to come up with an official National Physical Framework Plan. This resulted in the non-adoption of the completed document.

The 1976 Framework Plan and the 1977 Pamayanang Filipino Integrated Plan

In September 1976, a framework plan for the Philippines was officially released just in time for the international conference on "The Survival of Human Kind: The Philippine Experiment" which was held in Manila. The Framework Plan was based on eighteen (18) technical reports. Each report dealt with an in-depth assessment of the performances, prospects and feasible development schemes of a particular sector.

On May 13, 1977, Presidential Decree No. 933 was signed, abolishing the Task Force on Human Settlements and creating the Human Settlements Commission. The Commission updated the Framework Plan of 1976 in a document entitled "Pamayanang Pilipino Integrated Plan". This was a twenty-three Year plan that will supposedly focus on physical planning goals, policies and development strategies in order that these be translated into priority and critical areas of development. An interesting aspect of the Plan is the adoption of the "growth center strategy" which allocated infrastructures and services to settlements ranked according to their accessibility to the greatest number of people and their suitability for urban expansion. The Plan likewise underscored the requirement that the implementation of the land use strategy calls for the institution of development controls in the form of zoning, building and subdivision regulations, plus financial or fiscal measures. However, the two plans never reached the implementation stage since a year later, another development plan was enacted.

The National Multi-Year Human Settlements Plan: 1978-2000

In June 1978, the Human Settlements Commission was given ministerial status under Presidential Decree No. 1396. Section 4 (d) of this Decree provides that one of the functions of the MHS is "to prepare and submit to the Board of the National Economic and Development Authority a National Multi-Year Human Settlements Plan which shall translate

the Philippine Development Plan into spatial and temporal terms, based on the locational distribution of natural resource endowments, population, climate, and production capacity". Pursuant to this decree, the Ministry of Human Settlements formulated a National Multi-Year Plan covering a 23-year period, 1978-2000. This Multi-year Plan considered the earlier Framework Plan for the Nation and the Pamayanang Pilipino Integrated Plan. Its approach is sectoral and included in its scope are mining, manufacturing, housing, health and forestry, and proposed land uses for the year 2000. A growth center strategy was adopted with the end in view of assessing the further growth of the largest city, and as a basis for a rational allocation of resources. A hierarchical structure of settlements was conceptualized with the regional and metropolitan centers occupying the top of the pyramid. Next in line are the major and minor urban centers, and lastly, the satellite municipalities serve as he smallest type of settlement. All in all, the plan is a useful document particularly as a guide in the planning of human settlements.

The National Multi-Year Human Settlements: 1983-1987 and 2000

In October 1983, the MHS finalized a revised National Multi-Year Human Settlements Plan covering the period 1983-1987 and the year 2000. In contrast to the earlier Multi-Year Plan, this revised document is more explicit in stating that it is a physical framework that complements the country's socio-economic Philippine Development Plan. "A Physical Development Framework" prominently stands as a subtitle of the document.

It is interesting to note however, that while the earlier plan was sectoral in its approach, the revised version focused specifically on the provision of eleven (11) "basic needs of man". It is on this count that a divergence between the two plans in terms of content and preservation exists. The newer plan also dealt with the institution of livelihood programs. Unfortunately, the section on land use was not treated adequately compared to its counterpart in the earlier plan.

On the whole, the plan is quite comprehensive since it covered practically all the functions of government agencies. However, the attempt to translate the sector-oriented Development Plan into spatial and temproal terms through the "basic needs approach" suffered from a dilution of the spatial character of the Plan.

The National Physical Framework Plan: 1986-2000

On August 2, 1983, about three months prior to the completion of the revised National Multi-Year Human Settlements, Letter of Instruction (LOI) No. 1350 entitled Providing for the Institutional Framework for National Physical Planning was signed by the President. The LOI delineated the role of agencies in physical planning and created an inter-agency National Land Use Committee (NLUC), which was chaired by the National Economic and Development Authority (NEDA), with ten other agencies.

Section 3 of this LOI stated that NEDA should be primarily responsible for physical planning both at the regional and national levels. MHS, on the other hand, shall be responsible for undertaking, through the MHS Regulatory Commission, general human settlements planning at the sub-national levels.

In keeping with the mandate of the aforementioned LOI, the National Land Use Committee mobilized its member-agencies to directly participate in the formulation of National Physical Framework Plan. The preparation of the envisaged Plan necessitated a thorough review of the Philippine Development Plan: 1983-1987. The plan was completed at the end of 1985 but was not implemented in view of the February Revolution in 1986.

The Medium Term Philippine Development Plan: 1987-1992

On March 18, 1986, Memorandum Circular No. 4 was signed by the President, which provides for the formulation of the Medium-Term Philippine Development Plan. The plan serves as the framework of development policy-making fo 1987-1992.

Like the earlier development plans, the Medium-Term Plan is sectoral in its approach of addressing the structural problems of the economy. It includes a regional development framework based on the Regional Plans and Investment Programs of the Regional Development Councils.

The Plan quite predictably emphasizes the socioeconomic dimensions of development planning according to the "Policy Agenda of People Powered Development". Like the previous plan it failed to forge the link between physical and socioeconomic planning.

Spatial Framework of Development Planning

In order to achieve efficiency and equitable regional integration of the physical and socioeconomic variables, a spatial development framework for measuring and evaluating spatial inequalities is necessary. This involves the comparative analysis of the existing structures and profiles of the various subsystems, which constitute the whole social system. These include the demographic, sociocultural, economic, and environmental subsystems.

The Demographic Subsystem

This refers to the human population concerning its size, structure, and distribution in space as well as the changes, which take place in these aspects. The demographic subsystem is in many ways an influence on the well being of the people living in a particular region. The problems of urban regions characterized by a very high population density, age of population, and migration are the most significant influences.

The Sociocultural Subsystem

The sociocultural subsystem can be defined as man in his behavior of self-determination. Individual self-realization can be conceptualized according to the levels of needs, arranged in an order from lower needs to higher needs, as follows:

- physiological needs (hunger, thirst, shelter, etc.)
- safety needs (Security, Order, Stability, etc.)
- esteem needs (prestige, success, self-respect, etc.)
- need for self-actualization (independence, creativeness, etc.)

A lower need must first be adequately satisfied before the next higher need can fully emerge and enhance a person's development. The degree to which these needs are satisfied is generally denoted by the term "culture".

The Economic Subsystem

We should consider here the income generating factors in society. These may be classified into five categories. In the first category are social security, transfer payments, pension plans, and property incomes. The second refers to the public sector and the level of government expenditures. The distribution of government spending is determined by both historical and institutional variables. In fact, it has become an important instrument in regional development. The third category is agriculture. The primary factors, which determine the distribution of agricultural benefits, include such necessary natural preconditions like soil quality, climate, etc. However, even if the favorable natural conditions are present, agriculture still has to compete with other economic activities like industry, traffic, etc. Next, we have industrial activity. In order to determine which factors influence the regional differences in industrial location, some understanding of business firm behavior is needed. In a heterogeneous space, maximum profit will vary according to location because both revenue and the cost functions also vary in response to differences in location. Because of existing spatial cost and revenue differences incentives inevitably arise putting pressure on firms to change location. Lastly, the fifth category is the service sector. It covers a conglomerate of economic activities like banking, insurance, medical and social care, education, etc. The rational locations of these activities are in general, dependent on the respective locations of these activities for which these services are intended for.

The Environmental Subsystem

This consists of the organic and inorganic world in which man lives and which he uses to satisfy his needs. In traditional economics, the ecological subsystem is treated as a datum because of the abundance of natural resources. In the 1960's much of this situation has changed not only because of the enormous expansion of world population and the economic expansion of highly developed nations but because of the imminent exhaustibly of the natural resource base. The environmental subsystem can therefore no longer be treated as exogenous or existing outside the realm of orthodox development planning.

The Systematic Planning Process

The steps necessary for the formulation of a land use plan according to the above framework are illustrated in Figure I. This methodology for land use analysis basically involves resource assessment and the matching up of land use potential and land requirements for development.

The first requirement for sound land use planning is the availability of adequate data. For instance, basic information on the following are needed in the formulation of the plan: environmental factors (topography, soikls, climate, water resources, existing land use); agricultural aspects (cropping systems, soil crop relations, yield potential); geological aspects (basic geology and known areas of marketable mineral); social factors (land tenure, population growth in both rural and urban areas, existing social infrastructure); transport facilities (existing roads, railways, air transport and airports/landing strips, navigable rivers and seaports).

These basic data are evaluated in the next phase of the planning process. Evaluation involves determining the potential of lands for specific land uses. Some of the questions that must be addressed are as follows:

- What agricultural systems are best suited to the prevailing climatic, topographic, and social conditions?

- What opportunities exist for agro-industries based on the suitable agricultural systems?

- What opportunities exist for mineral extraction?

This is achieved by combining the results of agricultural and other investigations with surveys of basic natural resources. For example, an area may be divided into agro-ecological zones each with each own range of agricultural systems best suited to its environmental conditions. The second step of the evaluation process is the qualitative land evaluation phase in which some social and economic factors are considered in conjunction with the technical aspects. The more important aspects of this stage include a review of current land se and the assessment of the availability of labor input and markets. The principles behind this type of land evaluation have been laid down in the ""FAO Framework for Land Evaluation". Each unit of land, with its own set of physical and social conditions, must be carefully assessed based on its suitability for a wide range of land utilization types.

The final step entails the analysis of the various land opportunities and constraints for development which are then to be evaluated and plotted in maps. The final output is a land use plan showing the proposed major types of land uses.

Policy Implications

To outline a policy framework for planned development, attention has to be focused on the decision-making process, for the quality and effectivity of any policy is largely dependent on it.

In the course of regional development, a crucial role is played by the regional policies pursued by governments with their consequences on the national level. Such policies continuously intervene in demographic, economic, sociocultural, and ecological processes. These interventions can be labeled as part of regional policy only if they form a set of actions that aim at conscious, consistent, and comprehensive guidance or control of society.

As to the process of decision-making, the following components must be well defined:

1. Establishment of goals and of social utility function pertaining to these goals.
2. Establishment of interrelations among physical and socioeconomic variables.
3. Preparation of a complete set of available alternative policies.
4. Preparation of a complete set of valid predictions of the cost and benefits of each alternative and calculation of the net benefit of each alternative.
5. Identification of the best alternative.

These components can be combined and arranged in different ways so that different kinds of decision-making models come into existence.

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Correlation of River Channel Reclamation and Liquefaction Damage of the 16 July 1990 Luzon Earthquake in Dagupan City, Philippines

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INTRODUCTION

At 4:26 PM of 16 July 1990, central Luzon was rocked by the strongest quake to hit northern Philippines this century. The earthquake registered a magnitude of 7.8 on the Richter Scale with epicenter in the town of Rizal, Nueva Ecija. Another major shock followed three minutes later and its epicenter was located near Kayapa, Nueva Viscaya. A 125 km-long ground rupture was consequently formed along the Gabaldon (Nueva Ecija)-Kayapa (Nueva Vizcaya) segment of the Philippine Fault-Digdig Fault System (Fig. 1). The measured displacements along the ground rupture range from 01 to 06m horizontally and from 0.1 to 02m vertically.

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The 1990 Luzon Earthquake was felt in many places at Intensity VIII (based on a modified version of the Rossi-Forel Intensity Scale of I to IX currently used in the Philippines). The partial isoseismal map shown in Fig. 1, however, is provisional as there were areas like Dagupan City, Baguio City and the town of Rizal which seemed to have experienced the earthquake at Intensity IX based on observed wave-like motion of the ground surface and documented occurrence of thrown-out boulders.

The severe and unusually long groundshaking caused widespread destructions in the form of collapsed manmade structures, liquefaction, and lateral spreading, and slope failures in places near and far from the ground rupture and epicentral area. In Baguio city, several multi-story building collapsed, including the exclusive Hyatt and Nevada Hotels. Groundshaking also triggered extensive landslides in the nearby mountain ranges, especially along steep-sided valley walls, steep slopes with deep roadcuts and outer curves of river bends. This widespread occurrence of landslides during the earthquake and those induced later by the monsoon rains effectively isolated many places in central and northern Luzon for several weeks to several months. Dagupan City and the rest of low-lying areas in Central Luzon, which experienced the earthquake at Intensity VIII, suffered largely from liquefaction-related processes. Based on the distribution and chractersitics of areas affected during the 1990 Luzon earthquake, three general types of site vulnerable to liquefaction were recognized: (1) beach zones and sand spits as in Agoo, La Union; (2) alluvial fans asin Gerona, Tarlac; and (3) river deltas as in Dagupan City, Pangasinan. Although Dagupan City is located 95 km away from the Rizal epicenter and 65km from the Kayapa epicenter, the damage wrought by the earthquake is many times more severe here than in the areas nearer the epicenter.

A Quick Response Team (QRT) of the Philippine Institute of Volcanology and Seismology (PHIVOLCS) was dispatched on 17 July to Dagupan City and vicinity to investigate the impacts of the July 16 earthquake and to set up a seismic station for monitoring and locating the expected aftershocks. Follow-up surveys were conducted to characterize the nature and extent of earthquake damage within the city and to be able to explain why some parts of it were severely damaged and others were spared. The survey involved measurements of the tilt magnitude and direction and relative subsidence of buildings and mapping of ground fissures and sand boil distribution.

Geologic interpretation of aerial photographs taken by the Philippine Air Force three days after the earthquake yielded vital information for the conduct of the study. Another set of aerial photographs taken within the period 1966-74 provided insights on the rate of physical developments in the city and made possible the identification and delineation of some critical geologic features now obscured by man-made structures.

Definition of Terms

Liquefaction is a process that transforms the behavior of a water-saturated deposit from solid to liquid. The vulnerable deposits for liquefaction are sand layers, which are below the water table and poorly densified. During strong groundshaking, a liquefying sandy deposit loses its resistance to deformation and undergoes compaction. The attendant decrease in the volume available for interstitial fluids causes an increase in pore water pressure. This pore water pressure buildup is a product of several factors, e.g., earthquake magnitude ground acceleration, distance from the seismic energy source, duration of shaking, grain size characteristics, and sand density (Bennet, 1990). Liquefaction occurs when the pore water pressure equals the weight of the overburden.

A deposit exhibiting liquefaction undergoes unlimited deformation, yielding readily to overlying man-made structures. Severe tilting and subsidence and extensive sand boil occurrences are commonly observed, most noticeably at places with heavy concrete structures. Since shear waves are unable to effectively propagate through the liquefied layer, effects of groundshaking are not very pronounced.

Geological Setting of Dagupan City

Dagupan City is located in the northern part of Pangasinan and along the southern shores of Lingayen Gulf. It has a total land area of 37.4 sq.km. in a predominantly flat terrain within the Agno River delta. It lies just a meter above sea level and is traversed by Pantal River, a major tributary of the Agno River.

Macro-setting: Wave-dominated delta

Dagupan City is situated at the eastern margin of the delta of Agno River (Fig. 2). The present active channel of Agno River traverses the western boundary of Pangasinan and empties into Lingayen Gulf. However, based on interpretation of Landsat imageries, Agno River seems to have undergone several episodes of channel avulsion, the latest of which occurred within the vicinity of Urbiztondo where a river course flowing along the east side of San Carlos City and towards Binmaley was abandoned.

Although a high-energy environment prevails along the shores of Lingayen Gulf, the delta front of Agno River continues to prograde slowly due to the confinement of sediment redistribution within the Lingayen-Dagupan shoreline. Delta front progradation maintained in this high-energy environment most probably via barrier-beach accretion. Strong wave action redistributes most of the sediments supplied to the delta front by Agno River and its distributaries to form multiple elongate coastal ridges aligned parallel to the Lingayen-Dagupan shoreline. Discrete group or bundles of parallel coastal ridges separated by discontinuities indicating the changes in channel positions (Psuty, 1967) most probably exist within the delta with the bundles occurring in pairs and symmetrically disposed with respect to the active emptying points of distributary channels. Thus, beneath Dagupan City, these bundles of coastal ridges are very likely to be found.

Micro-setting: Meandering river environment

The meandering Pantal River flows through Dagupan City and reworks the marine deposits of the Agno River delta. Its sediment supply comes from reworked volcanic materials of Quaternary volcanic cones dotting the southeastern plains of Pangasinan and from detrital materials brought down by Agno River from the highlands of Nueva Vizcaya and Benguet. The high inflow of sediments from these sources into Pantal River, especially during its flood stages, induces increased fluvial sedimentation at places where there exist recently abandoned coastal ridges along the course of Pantal River. Formation of channel levees attests to the high sediment competence of Pantal and high frequency of flooding in the study area.

Because of the non-entrenched meandering pattern of Pantal River, dynamic lateral shifting of its channel is to be expected. This lateral shifting of Pantal River in the recent past left numerous abandoned channels and created a low-lying terrain made up of levees and back-swamps (Fig. 3). Many of these backswamps and other depressed grounds found within Dagupan City become inundated during floods and high tides.

Development of Dagupan City

Spanish writers described Dagupan as an extensive marshland with rich alluvial soil. It was thickly covered with mangrove and nipa palm trees which served as habitat to many marshland wildlife species. Early settlers lived in small clusters of houses along the shoreline and river banks of Calmay, Pantal, and Bonuan (Fig. 4). Later migrants moved inward occupying the agricultural lands of Malaued, Lasip, Pogo, and Bacayao. Pantal and Bonuan

became the fishing, salt making, and "bangus" (milkfish) - raising centers and Malaued, the agricultural settlement area. Travel was mainly by "*bancas*" (dugout canoes) and sailboats through the river channels.

In 1590, the house clusters were resettled into compact communities and converted into a town named initially as Bacnotan and renamed later in 1720 as Dagupan. A site for town plaza was constructed along Pantal River surrounded by the town hall to the east, public market to the north and the Catholic Church to the west (Pangasinan Folio, 1970). In 1780, Pantal, as its original name Pantalan (port) implies, became a trading center and docking station for merchant ships. At about the same time, bangus industry thrived and more mangrove swamps were converted into fishponds. The development of Dagupan as a commercial center was firmly established in 1891 when the Manila-Dagupan railway was completed. Up to the 1900's the site of the present public market was still a swamp with waist-high water level. Much of the present downtown area along A.B. Fernandez Ave. (formerly Torres Bugallon Avenue) was a marsh. The continuous growth of the city necessitated the construction of Perez Blvd. and Magsaysay Bridge in 1948 to create more space for commercial activities via the usual practice of reclaiming and constructing on swamplands and less productive fishponds.

Historical earthquake that had affected Dagupan City

A review of the history of major disasters in the Philippines would easily established the fact that Dagupan City and other places in central and northern Luzon had been repeatedly visited by very destructive earthquakes. Many of the church buildings which were damaged by the recent earthquake and old ruins had been similarly leveled by strong quakes in 1645, 1789, 1796, 1799 and 1892.

Dagupan City has been perennially experiencing strong earthquakes. The most vividly described ones were the 1796 and 1892 Luzon earthquakes, which were probably triggered by the movement along Philippine Fault-Digdig Fault complex. Familiar features such as "sinking" grounds, cracks and outpouring of water and black sand were also observed in Dagupan in 1892 (Repetti, 1946) and are probably analogous to ground subsidence, tension cracks due to lateral spreading and sand boil during the 16 July liquefaction phenomenon.

The Effects of 16 July 1990 Earthquake at Dagupan City

In contrast to other areas devastated by the earthquake, Dagupan City sustained only a few collapsed structures. The effects of ground shaking were limited to the damaged unreinforced Old Catholic and Protestant church buildings (fig. 5). Most of the destructions noted in the city were attributed to liquefaction hazards triggered by an estimated peak ground acceleration of 0.18g (Midorikawa, 1990). Observable effects of liquefaction include sand boil, lateral spreading, land subsidence and upheaval, and ground undulation and fissuring. The commercial district, located west of Pantal River and between A.B. Fernandez Ave. and Perez Blvd., was severely damaged. Residential houses in Pogo Chico, Pogo Grande and Lasip Grande were partially to totally damaged. At Pogo Grande, some mango trees were uprooted. The blocks enclosed by Gomez, Burgos and Zamora streets, which contain the old and new Catholic Church buildings and the town plaza, were largely unaffected (Fig. 6).

Sand boils were the most extensive effects of liquefaction in Dagupan City. During the earthquake, sand boils were erupted through cracks at the sides of buildings, ruptured pavements, and covered concrete roads with dark gray fine sands and muddy waters (Fig. 7). Drainage systems were clogged by the accumulated sand causing temporary flooding of the main thoroughfares. The ejected sandy materials were sorted and poor in fine components and consist of sub-prismoidal to sub-spherical grains (Torres, et al., 1990).

Sand boil distribution in Dagupan City, as delineated from aerial photographs taken three days after the earthquake and ground truthing, is shown in Fig. 8. Based on standard penetration test data of the Department of Public Works and Highways, the source layers are up to about 5.0 m below the ground surface. In some places, however, the source layers are shallow seated enough to be directly observed through open fissures. For example, the deposit found inside the Divine Word Academy adjacent to Nazareth Hospital appears to have originated from a layer less than a meter below the ground surface.

Although limited in scope, lateral spreading accounted for most of the destruction of structures, which had been emplaced closed to open channels and swampy areas in Dagupan City. Buildings and other man-made structures were damaged when river banks slid into Pantal River and dry lands slid into the swampy areas during the earthquake.

Lateral spreading along the banks of Pantal River appears to have occurred at portions where its channel is notably narrow or constricted. Magsaysay Bridge is located across one these constrictions and its collapse were brought about by lateral spreading on both sides of Pantal River. During active lateral spreading of opposing banks of Pantal River where Magsaysay Bridge abutted, the generated local compression directed towards the bridge swept away its piers at the same time when the riverbed was liquefying. Consequently, the bridge was broken into several segments like an accordion (Fig. 9), although the portion close to the west abutment collapsed horizontally onto the riverbed. The segment abutting against the east bank was thrust westward under the adjacent segment and the middle pier underwent subsidence and tilting towards the east. A similar compressional phenomenon was observed where a road payment of Galvan St. overlying an open canal was thrust over a resisting abutment.

Ground subsidence is a direct consequence of liquefaction. However, this effect is different from relative subsidence, which is the magnitude by which the ground yielded to the loading pressure of the overlying structure. Relative subsidence in Dagupan City was determined by measuring the amount affected buildings had sunk with respect to a reference plane, such as road surface or sidewalk. In cases when even relative subsidence cannot be determined due to the absence of a reference point, high-water marks were measured to provide a minimum estimate of relative subsidence. The measured amounts of relative subsidence, however, would not yield a definite picture on how much ground sinking have taken place in Dagupan City as buildings, Because of their weight, are expected to sink more and faster than the surrounding land surface. Determination of absolute subsidence requires the reoccupation of geodetic benchmarks and this was not done during the period of the survey.

Subsidence phenomena are notable within the commercial district where some buildings sank by as much as 2 meters, but most of the affected buildings in Dagupan City subsided by less than a meter (Fig. 10). Adjacent concrete pavement dips towards the subsided structures and ground cracks are disposed perpendicular to the direction of subsidence. The resulting subsidence in Dagupan City becomes more evident when the affected areas got flooded by rainwater, high tide incursion and jetted-up groundwater. Flooding was aggravated by the alteration, disruption and clogging of both the natural and man-made drainage systems. Some houses remained underwater by 30-50 cms. for several months. The whole stretched of Don Jose Calimlim St. and swampy areas and fishpond communities such as Bgy. Lasip Grande, remain underwater even during low tide conditions.

In a more severe form of liquefaction, relative subsidence is usually associated with the tilting of heavy structures (Fig. 11). Badly tilted buildings are concentrated along Perez Blvd. Some are tilted by as much as 19 degrees, but generally, the magnitude of tilt is within 2-5 degrees (Fig. 12).

Buried buoyant structures such as gasoline storage tanks (Fig. 13), septic tanks, and drainage pipes exerted upward pressure resulting to the upheaval of the ground and breaking of pavements. This effect disrupted the operation of most gasoline stations and caused water supply problem, especially the availability of potable water many weeks after the earthquake.

An eyewitness described a rolling ground surface during the earthquake as "a jeep parked along the road appears and vanished from his line of sight." Evidence of rolling ground seems to have been preserved in the deformation of some fences and roads. Along the portion of Dagupan-Lingayen road enclosed by Tapuac-Malaued diversion road, cracks developed in the concrete fence coincide with the crests and troughs of undulations (Fig. 14). The cracks which formed at the crests are characteristically open and tapering downwards – an extensional feature – and the ones that formed at the trough exhibit shortening feature in the form of tight fractures. Using this observation as basis for determining the wavelength of ground undulation, the amount of separation between the extensional and the shortening cracks was measured along a deformed residential fence and a ground undulation wavelength of about 25 meters was obtained. Observable effects of ground undulation did not extend beyond the junction of the Tapuac-Malaued and the Dagupan-Lingayen roads.

Fluvial Sedimentation and Artificial Channel Cutoffs

Bathymetric data provided by the Dagupan City Engineer's office revealed a depth of 5-6 meters at the thalweg, the deepest portion along the river channel. The thalweg forms close to the concave side of a river channel and this is exemplified by the Pantal River segment near the Asia Brewery compound along Zamora Street. As it approaches the Magsaysay Bridge, the thalweg becomes subdued to almost indistinct. A map from the City Engineer's office also disclosed an eastward lateral migration of the river banks. Along the Magsaysay Bridge, the position of the present east bank shifted by about 60 meters and the west bank by about 90 meters.

Looping configuration of swampy areas and natural drainage represents the position of former river meanders (Fig. 15), which had been abandoned by the dynamically shifting channel of Pantal River. These abandoned river meanders are very prominent and are, therefore, identifiable from aerial photographs covering Dagupan City. In some cases, several meander loops are intertwined and coalescent. The relative ages of abandoned meanders could be inferred from its depth, distance from the presently-active channel and cross-cutting relationships. Most of the meander scars exhibit well developed point bar deposits and scroll bar ridges. However, some point bars were already obliterated by crosscutting meander loops and are covered by channel levee deposits. Very young active meanders, particularly those within the vicinity of the city proper, are characteristically without distinct levees. Based on these observations, it is very likely that some of these meander scars have been artificially made, probably during the development of the city.

Channel abandonment along Pantal River was a consequence of natural shifts of its meandering course and construction of artificial cutoffs. Slow sedimentation of suspended materials and episodic influx of flood-borne sediments would eventually fill up the abandoned channels. These natural reclamation materials, which are largely uncompacted and water-saturated sediments, are highly susceptible to amplified ground shaking and liquefaction. At some later stages of natural reclamation, the abandoned channels are transformed from oxbow lakes into swamps or marshlands.

Artificial cutoff and reclamation have long been employed along Agno River for two primary reasons: (1) to shorten travel time around meander loops and (2) to diffuse floodwater especially at constricted portions. One exceptional case was the famed Limahong Channel, named after the Chinese pirate who established his colony in Lingayen during the late

1500s. According to historical accounts, the combined Filipino and Spanish forces laid siege on his fortress by blocking the river outlets. Limahong broke through the siege by secretly digging a channel from the Agno River to Lingayen Gulf (Callanta, 1989).

Man-made alteration of the fluvial environment of Dagupan City becomes more evident with the abrupt change in the sinuosity of Pantal River as it meanders around the city proper. Based on the ratio of the channel length and meander wavelength, the sinuosity of the active and abandoned channels of Pantal River lying south of Dagupan City proper has an average value of 2.31 and 4.19 respectively. In contrast, the meander character around the city proper was calculated at 1.40 for the active channel and 2.14 for the abandoned channels. These sinuosity measurements distinguish straight and meandering channels at boundary ration of 1.5. Therefore, the channel character of Pantal as it approaches the City proper transforms from a meandering channel to a straight channel. Furthermore, the similar sinuosity of the abandoned channels passing through the city with the active meanders at the southern continuity of the river suggests that these abandoned meanders were not yet primed for natural cutoff but were artificially severed from the main channel.

The degree of destruction along A.B. Fernandez Ave., which largely lies on a reclaimed swampland, is generally less than that in the Perez Blvd. area within a stretch near its intersection with Rizal St. where there occurred pronounced relative subsidence and structural tilt. The heightened ground response to liquefaction along this 100 m stretch of A.B. Fernandez Ave. can be traced to modification of channel path of Pantal River. Prior to northeastward expansion of Dagupan City, Pantal River used to pass around the area now partly occupied by A.B. Fernandez Ave. and Rizal St. before bending westward parallel to Pantal Road (Fig. 15). Thus, the segment of A.B. Fernandez exhibiting severe liquefaction-related damages coincides with the crossed-over area of the old Pantal River and is underlain by young deposits of similar age as those in the Perez Blvd. area. The rest of A.B. Fernandez Ave. which was built on a reclaimed swampland suffered less damage via liquefaction because it is basically underlain by relatively older deposits.

CONCLUSION

Dagupan City, being situated on a delta, is indeed highly vulnerable to liquefaction hazards. However, the level of vulnerability to liquefaction hazards of the various parts of the city can be assessed by determining their location in relation to ancient and recent abandoned river channels. The study has pointed out that built-up area on abandoned river channels, along the banks of the active river channel and on young point bar deposits are most vulnerable to liquefaction hazards. This explains the spatial distribution of damages in Dagupan City and clearly demonstrates that the line separating the damaged and undamaged area is a geological boundary.

The plan to rebuild Dagupan City and to even constitute it into a larger commercial area as a metropolis would have to consider its unique geological environment and high vulnerability to liquefaction hazards. Various structural works soon to be emplaced within the city must be properly designed and made compatible with the existing geological conditions. Detailed geologic and foundation studies will to be conducted to delineate the boundaries of areas which are likely to liquefy during the next earthquakes. These dangerous grounds in Dagupan City, once delineated and presented in an easy-to-understand map format, should be shared and discussed with the public and potential land users for the purpose of minimizing losses from future major earthquakes. For towns and cities in other countries of the world which lie within the earthquake belts and share a similar setting with Dagupan City, the same sort of studies and public awareness campaigns should be done to avoid what Dagupan City experienced during the 1990 Luzon Earthquake.

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Small-scale Industries and the Informal Sector in a Medium-sized Urban Center in the Philippines: The Case of San Fernando, La Union

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The concept of an urban informal sector was formulated mainly based on empirical surveys done in large metropoles of the so-called Third World. Whether the conclusions derived from this concept are valid – all or in parts – for smaller urban settlements located in considerable distance from the large metropoles, was the guiding principle of a survey of small scale industries undertaken in San Fernando, capital of Ilocos Region and the province of La Union in Northern Luzon, Philippines. The following questions will be discussed: 1. Is the sector of informal or small-scale production activities a homogeneous "economy of poverty" and may all those engaged in it be classified as "working poor?" 2. Who is able to enter this sector? 3. How may the customers of those small or informal enterprises be classified? The empirical evidence in San Fernando shows that there are significant deviations from the central thesis of the informal sector concept, which have to be taken into consideration for small-scale industries promotion strategy.

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The "Discovery" of the Informal Sector

Twenty years ago, the dearth of development successes in Third World countries also led to changes in development theory, which gave way to a new view of the role of small-scale industrial enterprises in the development process. In the context of modernization theory, which dominated the debate after 1945, small-scale industries were mainly seen as structures quickly to be overcome or at least to be modernized, as parts of a rapidly vanishing traditional sector (e.g., Staley/Morse, 1965). But with the switch to the new development paradigm of "redistribution with growth" (instead of "accelerated growth" alone, see Chenery, 1974), a new target group appeared: the "working poor," meaning those who – amidst the lack of survival alternatives – are forced to take up any occupation, no matter how little it pays.

This is also where the starting point for the informal-sector-concept is to be found. An informal sector was distinguished from a formal or organized one according to a definition of the International Labour Organization (ILO) in the sense that it is characterized by ease of entry for employment seekers, the use of local resources, the predominance of small-scale enterprises and family labor, the use of labor-intensive technologies, the acquisition of qualifications outside the regular educational system, and the existence of competitive markets (ILO, 1972). New in the informal-sector-debate is the emergence of this long-neglected field, which had been regarded as traditional and hampering development, whose gradual disappearance seemed certain, but is now seen as an outcome of the modernization process itself, which would not disappear in the short run. Furthermore, the informal sector seemed to have a considerable potential for development, primarily concerning employment and income generation as well as commodity production and provision of services for lower-income groups. According to estimates compiled by the ILO, 20 to 70 percent of the employed population is Third World urban agglomerations are engaged in the informal sector, with a share of 20 to 30 percent of the total urban income (Sethuraman, 1981:8). But these figures depend heavily on the definitions of being adopted. Presently, an action-oriented understanding of a "sector of relative poverty" has gained ground, but which cannot be marked off exactly (Elwert, *et al.,* 1983). The search for employment and income and the dominance of reproduction needs (of the individual and/or the family supersedes orientations on capital accumulation and profit maximization. Counted among the informal sector are the self-employed, petty commodity producers, artisans, and partly even petty capitalist enterprises, which already employ wage labor on a regular basis.

However, there remains a gap between those definitions and the needs of practical research. For practical purposes, normally a pragmatic approach is adopted: the upper limit for informal enterprises mostly is measured in terms of numbers of employees. According to this, enterprises with less than 10-20 employees are counted among the informal sector (Sethuraman, 1981:189; Schmitz, 1982). Following this, almost all small-scale industries studied in San Fernando, La Union are part of the informal sector.

The strategic action of those belonging to the so-called "stratum of the unsecured" is directed towards a combination of different income sources (Elwert, *et al.*, 1983). A group of Bielefeld sociologists, arguing from the point of view of an "articulation approach," had criticized the informal-sector concept for still being dualistic. Households, enterprises, and individuals can have functions beyond the limits of informal or formal sectors and may have to combine sources of income from different sectors, be it simultaneously or in the course of time.

The various approaches in the critical discussion of the informal-sector concept (see e.g., Bromley, 1979; Sethuraman, 1981: Schamp, 1990; Turnham, 1990) have in common the assumption that commodities and services by this sector are geared towards the demand of the low-income strata. Besides, it is assumed that the informal

sector primarily is of interest to the so-called frustrated job seekers, e.g., less qualified migrants from rural areas who have no access to formal employment or are being pushed away from it. In this way, it is said that a more or less homogeneous sector of poverty emerges.

What all those theories mentioned above have in common is that their empirical proof still is insufficient. In addition, previous research on small-scale industries and the informal sector has heavily concentrated on large urban areas. On the other hand, there is a need for related studies in small- and intermediate-sized towns and cities, which have to play a crucial role in all strategies of regional decentralization and of steering rural-urban migration away from the big agglomerations.

Profile of Respondents

In a study on Philippine small-scale industries development undertaken in San Fernando, La Union in 1983 (Schneider, 1986), it was found that the official Census of Establishments underestimates the number of small manufacturing enterprises. The NCSO Listing of Establishments in the year 1982 included only 95 manufacturing enterprises of all sizes (!) in San Fernando. But according to the author's own listing in 1983 there existed 338 small manufacturing enterprises (total work-force less than 100) in San Fernando. Through stratified random sampling, 94 enterprises were selected for study.

The total labor force of the sample establishments was 703, ca. 75 percent were working on a regular basis (including the enterprise owners), 11 percent as seasonal laborers, and 14 percent of casuals.

Small manufacturing in San Fernando was shown to be dominated by men, whereas the share of women in the whole population of San Fernando was ca. 51 percent (1980). Among the enterprise owners, there were only 18 percent females; among the employed workforce women held a share of only 22 percent.

Thirty-two percent of the interviewed enterprise owners had 5 or more family members who depended on their income. It was found that the smaller the enterprise, the more family members depended on it. In 40 percent of all cases, the manufacturing establishment was the only source of family income; this number also increased with decreasing size of enterprises. The conclusion is that, on the average, more persons depend on income of the smallest establishments compared with larger ones and at the same time those households have less chances to tap other sources of income.

Approximately thirteen percent of the interviewed owners had finished college, 57 percent had finished secondary school and 22 percent left school before finishing the secondary level. Concerning knowledge and skills needed for their present activity, 80 percent of the enterprise owners obtained these through "learning by doing," while 26 percent had some kind of vocational training. Most of the interviewed owners wished to have more practical and technical training. Of the sample enterprises' total workforce, about 67 percent were skilled laborers, 25 percent were semi-skilled and 8 percent unskilled.

The total investment was below P250,000 (1 peso = US$ 20 ca. 1983) for 87 percent of all sample-enterprises, the majority (ca. 54 percent) had a total investment between 5,000 and P100. Sales per year were below P50,000 (1982) for 51 percent of the sample-enterprises; but 22 percent had sales per year between P100,000 and P500,000. The capital efficiency (value added per unit of capital) was 0.66 for the sample enterprises, compared with an

average of 1.06 of large manufacturing enterprises in the Philippines (1978). The average daily income of enterprise owners was between P26-30 (1982), compared with P7.50-10 average daily wage for employed laborers in small manufacturing in San Fernando.

The main problem when taking up business was obtaining start capital (named as a problem by 54 percent of the interviewed owners) followed by marketing difficulties (named by 29 percent). Ninety percent of the enterprise owners were able to use own or family savings when setting up their business, 21 percent also used bank credits and only 9 percent had access to grants of government institutions (numbers do not add to 100 percent because of possible multiple answers). In those Indus-making, tailoring) the owners are faced with the problem that workers who qualified themselves by training on the job, tended to leave in order to set up their own establishments. (For further details, see Schneider, 1986).

Research Area and Selected Research Questions

For the reasons given above it was an aim of the study to find out whether the explanatory value of hypotheses mainly on the findings in big cities could be proved for a mdeium0sized regional center located in considerable distance from the next agglomeration (in this case Metro Manila). San Fernando, capital of La Union province and the Ilocos Region, situated at the northwestern coast of Luzon, and a municipality with almost 70,000 (1983) inhabitants, was chosen. The Ilocos Region is one of the traditional outmigration areas of the Philippines because of limited potential for agrarian production, a high degree of property fragmentation, and a great population pressure originating from the Spanish colonial period.

So far, San Fernando has become to a very limited extent, the target of intra- and inter-regional migration, which continues to be directed preferably toward Manila, but also to pioneer areas in eastern Luzon or Mindanao. Migration to Manila, the outstanding economic center of the country, amounted to an average of 125,000 to 175,000 persons a year (Bronger, 1983:114). Among the relative dynamic countries of the ASEAN group, the Philippines has to fight with the greatest economic and political problems for years. More than 750,000 people per annum enter the job market, and spatial disparities, augmented by the archipelagic character of the country, are distinct. This underlines the necessity to strengthen the function of small- and medium-sized towns and cities.

The three following questions show to what extent the above mentioned hypotheses can be verified or have to be modified by the sample surveyed:

1. Can all those engaged in informal enterprises be classified as belonging to a relatively homogeneous sector of poverty, i.e., the "working poor"?
2. Who has access to informal small-scale industries?
3. Who are the customers of informal enterprises?

Inner Differentiation of the Small-Scale Industries Sector

The small-scale industries sector in San Fernando differs markedly from a small group of manufacturing enterprises with 100 or more employees, indicating a highly polarized size structure:

- None of the enterprises surveyed employs more than 20 workers on a regular basis. If different forms of temporary employment are considered, an upper limit of 30 employees is not exceeded.
- All enterprises surveyed are one-owner, one-shop enterprises, while all larger manufacturing establishments in San Fernando are branches of big, partly transnational companies.
- The investment capital of more than 87 percent of the sample remains below the threshold for small-scale industries as it is defined by government agencies (P250, 000> <P2 million). The majority even belongs to the lowest size category, the so-called "cottage industries" (DeVries, 1980; BSMI, 1982).

Despite this, it is by no means an indiscriminate unity, as a closer look on the size structure will show. Following the theoretical discussion as well as the results of other empirical studies, it was to be expected that the self-employed, those working on a casual or seasonal basis and unpaid family laborers would hold big shares in contrast to regular wage labor. In the case studied, however, unpaid family workers only held a share of seven (7) percent while different forms of temporary employment accounted for 35 percent. On the contrary, regularly employed wage laborers already made up more than half (55 percent) of all employees. Among the business owners, only 15 percent could be qualified as self-employed. These findings contrast with a study about the informal sector in Manila showing that more than half of the business owners surveyed were self-employed (see Jurado, *et al.*, 1981). As opposed to that, in the small-scale industries sector of San Fernando, a distinct hierarchisation already took place, in the course of which the development towards accumulation-oriented, petty capitalist production has progressed considerably.

It was to be expected that these differences would also be evident in the income structure according to the author's estimation based on value-added figures of the sample enterprises, the average income of a business owner is 2.4 to 2.6 times as much as that of the employee. Views expressed in the relevant literature – that income differences between business owners and employees had no great weight and both groups lived almost "equally" in a state of relative poverty – could not be confirmed. At the time of the survey (1983), legal minimum wages for non-agricultural work outside Manila lay between P20 and P22. The average daily wages estimated for the small-scale industries sector in San Fernando were distinctly lying below this daily income necessary to meet the basic needs of a family of six (P60 ca. 1983), the average daily wages achieved – partly even the income of business owners in the mall-scale industries sector of San Fernando – are not sufficient, meaning that further sources of income have to be found.

These findings, however, do not allow one to speak of a homogeneous sector of poverty. Rather a differentiation and hierarchisation of income levels is typical. Compared with the daily wage in large-scale industries (i.e., in the Philippine statistics enterprises with 10 and more employees), the incomes of business owners in the small-scale industries sector of San Fernando can be equal, partly even higher. This shows that working as "informal" entrepreneur can be an attractive alternative to "formal" wage labor and need not be a forced expedient as is implied by the hypothesis of the "frustrated job-seeker," who, lacking access to formal employment, has to do jobs with markedly lower income in the informal sector.

Access to the Small-Scale Industries Sector

This brings us back to the second question: Who has access to the informal small-scale industries sector? A further reinforcing circumstance adds to the confusion about the validity of the hypothesis of the "frustrated job-seeker," which was formulated above with regard to the income relationships. Following this hypothesis, frustrated job seekers entering the informal sector are predominantly poorly qualified, rural-urban migrants who have

no considerable means available as start capital worth mentioning. Of those entrepreneurs who were interviewed in San Fernando, about one-half were in-migrants, a percentage share a little lower than that in Manila (60 percent) (following Jurado, *et al.*, 1981) – but high above the average measured with the mobility of the total Philippine population. According to an estimate, approximately 30 percent of the Philippine population at the beginning of the 1970's did not live in their place of birth (i.e., Hanisch, 1983:411). For the majority of those questioned, the place of origin is the surrounding province with regard to formal educational qualifications, the migrant entrepreneurs, compared with the population average of equal rank, were even better qualified. It is, however, striking, that 75 percent of the in-migrants employed paid laborers in their businesses. Self-employed – 15 percent of the total in question – are even less represented among the migrants. Taken together, this suggests the conclusion that among the migrant entrepreneurs, the majority were entrepreneurial, accumulation-oriented people who must also have had a certain amount of start capital at their disposal.

This supposition is also supported by the data that in the case of 80 percent of the enterprises concerned, there was a period of only two years between the in-migration if the owner and the establishment of the business; in a third of the related cases of the year of in0migration and year of business start were even identical. One may assume that it is generally not possible to accumu7late the start capital for larger units in the small-scale industries sector (employing already several paid employees) in such a short period.

It can be concluded from these results that the majority of migrant business owners strategically made commercial use of locational advantages of a central place like San Fernando. An already exiting entrepreneurial rather than employment-oriented view must have determined their reasons for migration. So it is not the destitute, poorly-qualified, job-seeking rural-urban migrant who shapes the picture of small-scale production units in San Fernando.

But even the thesis of modernization theory- inspired by Weber and Schumpeter – emphasizing the role of the social outsider as a potential entrepreneur (e.g., Seifert, 1974), could not be confirmed. Indications of a particular role for ethnic or religious minorities among the questioned owners were not found. More importantly, however, is the assumption, formulated with regard to the supposition of the social outsider, that the owners of small-scale manufacturing enterprises "are drawn far more frequently from the trading sector than that of craft-work" (Michel/ Ochel, 1977). But no proof could be found for this assumption either. Only about nine percent of the interviewed owners were self-employed before founding their business, though from those again only a few previously worked as traders. On the other hand, 60 percent had, before their "entrepreneurial" activities, performed craft-work or worked as (small) farmers, which as a rule are activities linked with low social status and earnings, showing an origin of lower social classes. Craftwork activities in a narrower sense, particularly those of tailoring and carpentry, again carry the largest weight in this group. The abilities and knowledge acquired in the course of depending employment can be incorporated by a relevant group in later, independent activities.

The results underline the statements made earlier that taking up independent business activities in the small-scale manufacturing sector was, more specifically, seen by a large proportion of those interviewed as a process of social ascent; that is, from small farmers, laborers and on average, comparable with those in "formal" employment. In any case, it is above that of independent employment in the "informal sector" or of small-scale farming. If one also regards as an indicator of social origin the job that was performed by the owner's father, more specifically the father's means of gainful employment, then an origin from lower social classes for 70 percent of those questioned can be assumed.

If one analyzes the data on the origin of the owners of the small-scale manufacturing enterprises of San Fernando, the following results arise:

†About half of those questioned are migrants, the majority coming from the surrounding area. The picture is not determined by the poorly qualified, destitute, employment-oriented and, in the first place, self-employed migrants. Much more dominant among the in-migrants – more so among all those questioned – is the already strongly entrepreneurial, commercially oriented type.

†Socially, the majority of those questioned came from lower social groups, and the work in the small-scale industries sector can be understood by them as a process of social ascent. Compared to former small-scale farmers, laborers and craftsmen, former merchants play only a marginal role among the interviewed owners.

Production for whom?

Finally, the third question: "Who are the customers of the goods produced by small-scale manufacturing establishments?" will be dealt with. In the academic literature, the supposition is largely incontestable – that "informal" manufacturing units produce as a priority cheap consumer goods for low-income groups (e.g. Sethurman, 1981:33). Before this is examined based on the industry groups in small-scale manufacturing and of the income structure of the population in San Fernando is given.

a) Branch Structure

Table 1 shows the branch structure of the small-scale industries sector in San Fernando in comparison with corresponding data are provincial and regional levels as well as for the capital region, Manila. Almost 90 percent of all business units account for industry groups where small-scale units enjoy comparative competition advantages. This is due to labor-intensive production, lower return-to-scale, the processing of spatially dispersed raw materials and the cost-intensive transportation of pre-products, as well as the necessity of direct-customer contracts. This applied to industry groups such as production of foodstuffs and furniture. In San Fernando alone, half of the small-scale manufacturing units are in the foodstuffs and clothing sectors. This dominance of the production of consumer goods is certainly no special feature of the study area, but rather a characteristic of the small industrial structure in the Philippines as a whole.

In the case investigated, it shows, however, that these branches are of a clear lower weighting (compared with the Philippine average). While a larger proportion is allotted to the remaining industry groups in manufacturing. The manufacturing structure of San Fernando proves itself, in comparison, to be more widely diversified. An explanation for this can be found in the combination of locational factors, which result, firstly, from the considerable distance to the next urban agglomeration (Manila), and secondly, from the central place functions of San Fernando. This determines a comparatively differential demand potential – compared with other small towns, but especially compared with rural areas, a relatively confined market. Linked to that is an accumulation-maximum,

which up to now counteracted the development of bigger autochthonous industrial production units. The lack of local large-scale business comparative pressure, as well as the existence of transportation-cost determined protection from suppliers from other areas gave small-scale manufacturing in San Fernando access to industry groups which in rural areas and- due to other reasons – also in Manila are not or at best in a very limited degree open for small-scale enterprises.

In the investigated example, such industry groups which benefited from and are connected with a modern building construction sector are affected by an intense local traffic resulting from the central place functions of San Fernando. In particular, those are construction material suppliers, for whom the local availability of "transportation-cost intensive" pre-products and at the same time low "weight per unit" prices for the final product represent a comparative advantage. The manufacture of construction components made of wood and metal as well as furniture production should be mentioned here. Production of the latter will often be in accordance with the customers' wishes. This, and a bulky freight-intensive final product that can only be transported with the risk of damage under the available traffic conditions, acts as protection against competitors from outside.

Industry groups oriented towards local transportation are mainly engaged in construction and fitting of car bodies for small buses (jeepneys) as well as for motorbikes and motorbike side-cars (tricycles). While the traffic of the center of the settlement is made up mostly of tricycles, jeepneys serve as a means of interlocal transportation. In the car-body industry it is the expensive-to-transport final product and, especially in the case of San Fernando, the existence of a local, large-scale supplier of the pre-products like sheet metal and steel profiles which are costly to transport, which has the effect of acting as competitive advantage against suppliers from other areas.

b) Income Structure

To what extent the goods of the small-scale manufacturing sector are absorbed into the consumption of the low-income population groups depends naturally on the type of goods produced as well as on the available income of the local population. At the time of the study (1983), in the Philippines, the average monthly income of a household of six was P1,162, whereby, according to official data, 72 percent of all households were under this average sum. It can be assumed here that the level for the regional capital, San Fernando, is higher, although exact data was not available. As a yardstick, one may take the results of a survey in one barangay of San Fernando. According to the personal valuations of those questioned and the "valid" definition of "absolute poverty" in 1983, P1,800 was regarded as sufficient to provide the livelihood of a 5-6 member family.

From these introductory remarks, it is already obvious that a large proportion of the Philippine population such as that of San Fernando cannot sufficiently satisfy their basic needs. The low-income level is reflected in the expenditure of an average income for San Fernando, it means that a six-member family, statistically, has P18 for clothing and P4.50 for furniture per month only.

c) Production for whom?

The initial question can be answered if one looks now at the types and the prices of the product produced by San Fernando's small-scale manufacturing enterprises. It can be assumed that the foodstuff and clothing industries account for a considerable volume of the demand by low-income groups. Bread, confectionary, rice and rice

products, as well as diverse fish products are demanded by all social groups and are affordable for almost everyone. In the clothing industry, it must be differentiated between the standard mass-produced goods (T-shirts, trousers) and the custom-tailored ware. The latter is, as a rule, unaffordable for a household with below-average income (for example, P150 for an individually tailored pair of trousers).

Most products of the other branches are, in comparison, aimed at the needs and demands of higher-income groups. This applies, on the one hand to the aforementioned industry groups, which are linked to the modern building activities. The minimum cost of building a modern, bungalow-style house was, at the time of investigation, about P100,000 which is far beyond anything that an average family can afford. In addition, beyond the reach of the majority of the population are the corresponding household articles produced by wood processing industries.

On the other hand, there are the goods of the transport-oriented sector (jeepney body work: P10-16,000, sidecars: P3,000) which are still more oriented towards the demand of higher-income groups. This is true also for the altogether less-weighty electrical and printing industries.

The assumption that the goods of the informal small-scale industries sector are predominantly consumed by the lower-income groups could not be confirmed in the course of the undertaken study. In each case the hypothesis requires a qualification. Except from the less absolute figures dominating but below-average representation of the foodstuff and clothing industries (the latter not completely), most of the products of the small-scale manufacturing units in San Fernando are demanded by a relatively narrow, but well-financed segment of the population made up of higher-paid civil servants, white-collar workers and entrepreneurs. Due to the lack of competitive alternatives that are found, for instance, in Manila, this group falls back on the products of the branches of small industry, which, due to the distance from Manila and of a central place location, enjoy comparative advantages.

It must be noted here that this does not apply to complex industrial production (e.g. electronics, optics, motors, etc.) for which the transport costs only account for a very small proportion of the cost of the final product. In these cases, small-scale manufacturing units do not have competition chances at all.

Summary and Conclusions

In summary, it has been shown that the central hypothesis about the functions of "informal" small-scale industries which, with few exceptions up to now, had been developed on the basis of studies in large metropoles, cannot be confirmed for regional centers lying in considerable distance from the next urban agglomerations as in the case of San Fernando, La Union.

More specifically, it must be qualified:

†The "informal" small-scale manufacturing sector is no homogeneous sector of poverty but it is rather characterized by the development of different types of businesses and income-levels,

with the position of the independent business owner differing clearly from that of the dependent worker.

†The business owners, of whom the majority are migrants, are mostly commercially and profit-oriented. This means the search for employment and (adequate) income is outweighed by the "accumulation" desire. For the majority, the work in small-scale manufacturing enterprises is also a process of social ascent.

†The goods of these small-scale manufacturing units are only partly absorbed into the consumption of lower-income groups. The noticeable, above-average proportion of modern industry groups is explained by the demand of a small segment of higher-income groups.

Not only a greater differentiation of industry groups and of incomes, but also a stronger social mobility and hierarchisation seems to be made possible by the market niche constituted by distance from large metropoles and central place functions. This is revealed in the strong position of the larger, more developed enterprises among the small-scale industries units. That the access for destitute, job-seeking rural-urban migrants is more difficult and limited (in comparison to larger, urban centers) can be linked to this.

This might contribute to the fact that not only San Fernando, but also other small and medium-sized towns in the Philippines could, up to now, function only to a limited extent as absorption basins for the rural-urban migration, thereby relieving the large cities. For verification of such suppositions, further investigation of the urbanization process in small- and medium-sized urban areas in different Third World countries is necessary.

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