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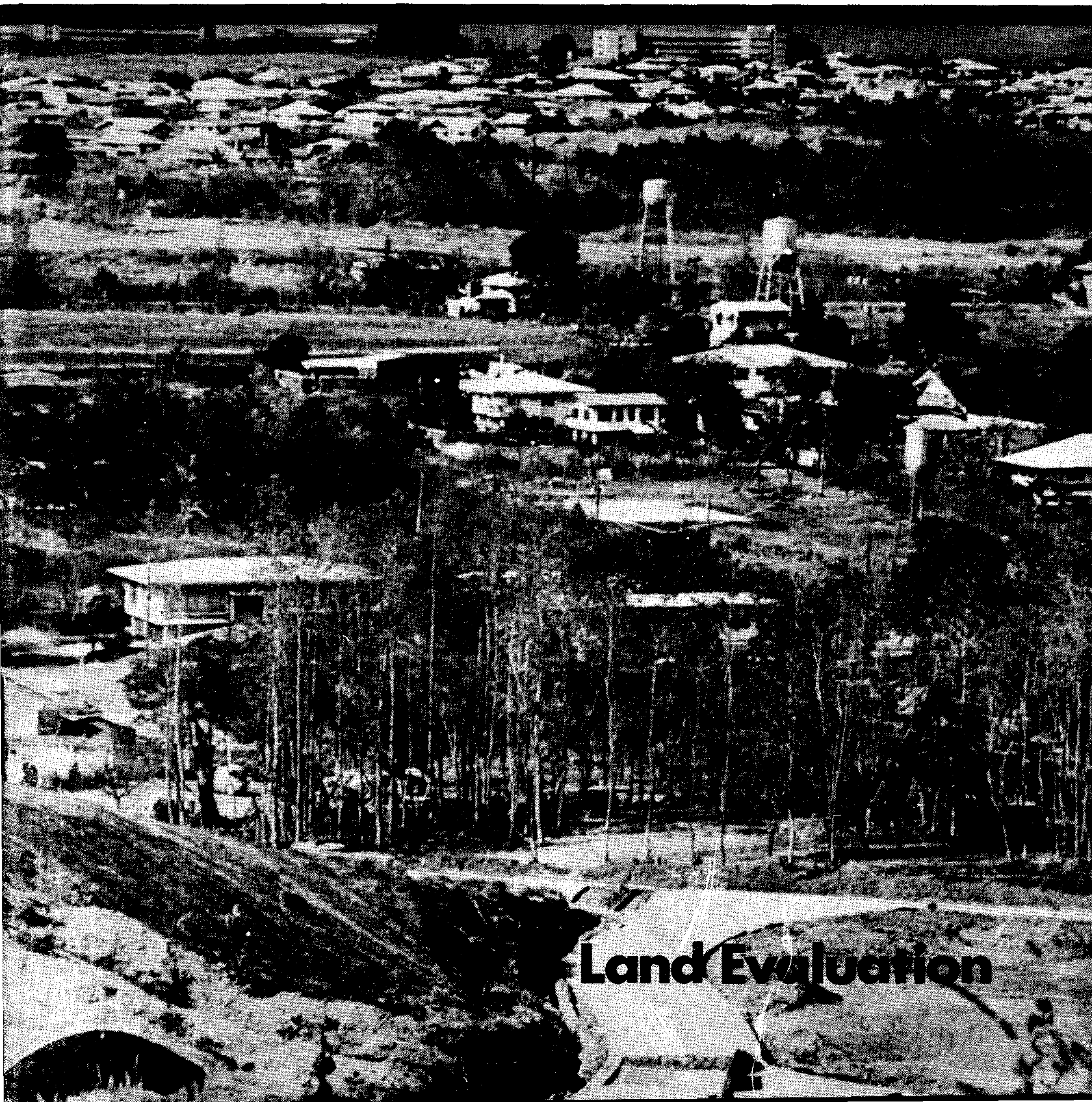

Land Evaluation

PHILIPPINE PLANNING JOURNAL

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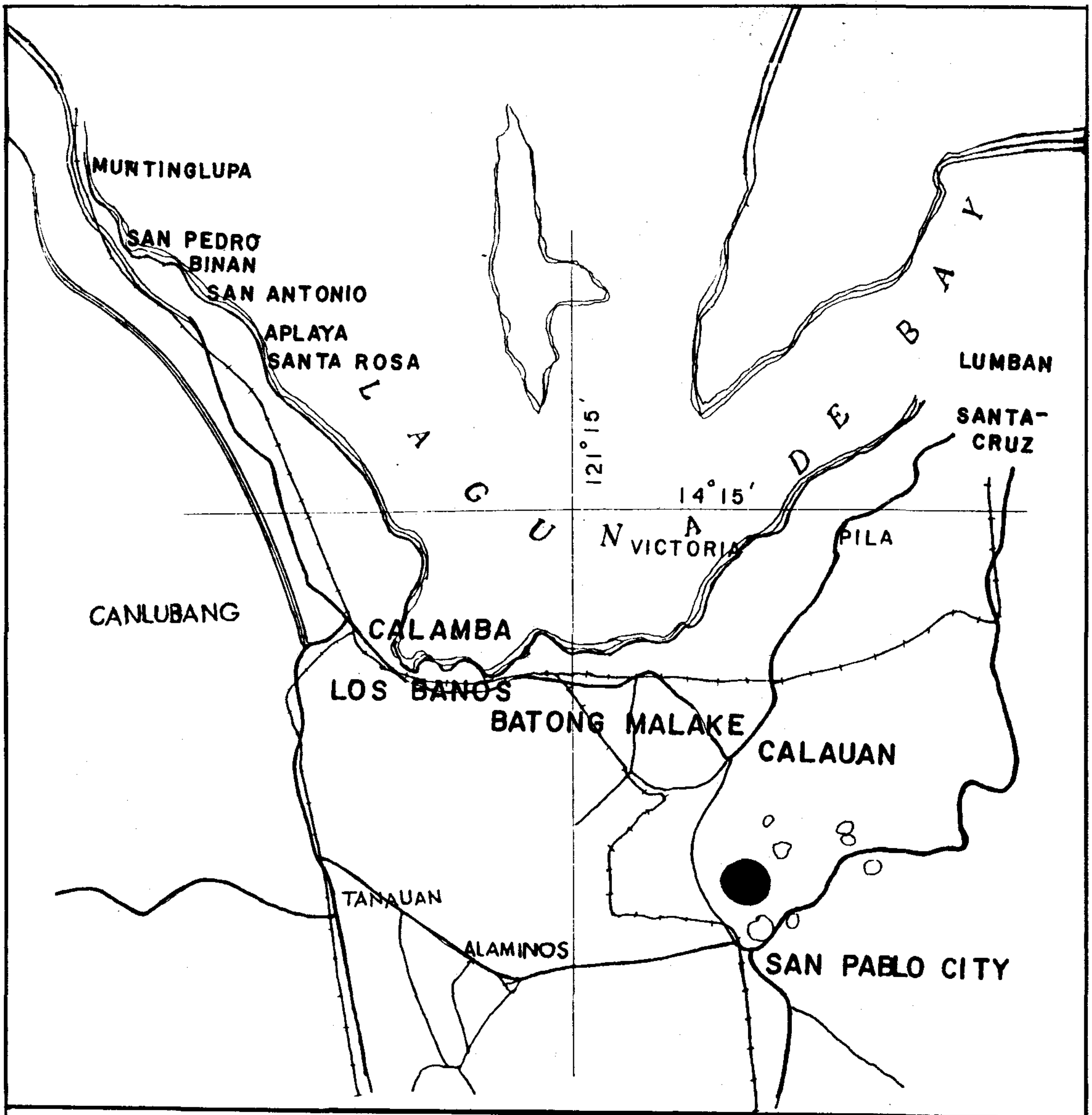

Legend

HIGHWAYS

NATIONAL ROADS

RAIL ROADS

LOCATION MAP
SAN PABLO CITY

THE APPLICATION OF THRESHOLD ANALYSIS IN THE EVALUATION OF URBAN EXPANSION AREAS: SAN PABLO CITY AS A CASE EXAMPLE*

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INTRODUCTION

The formulation of a rational plan of action which could allow for the best possible use of existing resources and the most effective protection of the physical milieu constitutes a fundamental aim of urban planning. The development of this rational planning strategy acquires urgency particularly in the large urban centers of the Philippines that exhibit high population growth rates. It is a common observation that the requirement for land for urban use correspondingly increases with population growth; however, the land that should absorb the new population may be inadequate or may not be suitable for urban expansion or development. Often, there are impediments that stifle the spontaneous and even growth of human settlements and these usually include physical geographic and economic factors. Indeed, the availability of suitable land for the anticipated growth of urban activities is a major consideration for a well-planned urban expansion.

In choosing the best areas for urban expansion, the criteria of development suitability and functional value of these areas stand out for consideration. Land suitability evaluation then becomes a vital exercise in urban planning. The evaluative process involves an investigation of the constraints (and potentialities) of the whole urban area. The significant constraints are both physical and economic and assumption in urban planning is that these constraints are surmountable. The preliminary evaluation that should be done involves the delineation of the constraints to be overcome and the subsequent estimation of the costs that the solution to the constraints would entail. The process of analyzing the development costs usually involves a rather elaborate physical and investment assessment that will ensure proper land use and economic viability. In coming up with a basis for rational decision-making in locating areas for new urban development, one technique—threshold analysis—presents itself as appropriate for dealing with the assessment processes. Other reinforcing methodologies related to threshold analysis that may be employed are map overlay and eco-engineering analysis.

Threshold theory and analysis was pioneered by Professor B. Malisz of the Polish Academy of Science in the early sixties in Poland, where it is now a widely used tool in planning. The main basis for the development of threshold theory was the observation that *expanding towns are faced with limitations imposed by physical geographic features, existing land uses, infrastructure services and public utilities. These limitations, a common phenomenon in the growth of human settlements, are called the thresholds of urban development.* Their

*This paper is based on the author's research for a masteral thesis in Urban Planning which was submitted to the School of Urban and Regional Planning, University of the Philippines.

main characteristic is that they are not irremediable, but, on the other hand, they can be overcome only at a disproportionately high per capita cost.

With its major stress on identifying and measuring the cost dimensions of thresholds, thresholds analysis provides a relatively simple framework for evaluating and guiding planning decisions. Primarily, the technique allows one to measure the development costs of alternative growth areas using a consistent and structured strategy. In this way, those areas which are cheaper to develop, or those that are most readily or easily serviced, can be identified. During the process of analysis, the investigator can appraise alternative growth options, explore financial implications and explain planning and engineering assumptions for a better decision-making procedure.[1] This study tries to apply these and other methodological techniques to come up with firmer bases for guiding growth in a Southern Luzon urban center: San Pablo City.

STATEMENT OF THE PROBLEM AND GENERAL OBJECTIVE

In the field of physical planning, rationalization can be defined as the search for the best of all possible alternatives, keeping in mind the ultimate ends desired. "Rationalization necessitates the division of the whole planning process into sequential parts so that the validity of each successive conclusion, drawn logically from the preceeding step and leading to the next one can always be checked on the basis of previous premises."[2]

The evaluation of plans in the urban planning process in the Philippines is usually achieved by intuition or subjective analysis. Except for some sporadic cost-benefit analysis, planners hardly use such complementary methods of plan evaluation as the threshold analysis, planning balance sheet or the goal achievement matrix. Although purely intuitive planning may bring outstanding results in specific cases, it also may lead to waste of capital and resources, considering that it usually involves the trial and error method. It is, therefore necessary to undertake planning more systematically by applying evaluation techniques that act as the main safeguard and control device towards the reduction of subjectivity.

The application of this analysis where the forces of urbanization are often uncontrolled may provide as its main result evidence on the irrational and uneconomic nature of some of the development that is currently being performed, which in turned may not only bring about serious problems in the future but also wastage of scarce resources. The present study tries to apply this technique and to analyze how far this technique can contribute to a fuller conception of the planning process and thus rationalize urban planning practice.

The present study has followed the general method formulated in the threshold analysis manual of the Scottish Development Department. For analyzing physical-geographic features and infrastructure and utilities and their consequent thresholds, eco-enginnering is applied. The combination of these techniques will allow evaluation of various physical aspects, costs and investments involved in overcoming the constraints as well as allow the formulation of physically suitable and economically viable alternatives for development.

The study attempts to answer the following question: What major threshold in terms of land uses and selected infrastructure and utilities are likely to be encountered by San Pablo City in its future expansion? The pursuit of this problem will involve the calculation of the threshold costs of overcoming the constraints to be identified. Thus, as a general objective, *the study attempts to evaluate the contribution that threshold analysis makes in urban expansion planning but always with the recognition*

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[1] James Smith, "Threshold Analysis of Two Potential Metropolitan Growth Corridors: A Melbourne Case Study, " *Town Planning Review,* Vol. 53, No. 2 (1982), p. 200.

[2] United Nations, *Threshold Analysis Handbook,* Department of Economic and Social Affairs (1977), p. 33

of probable modifications that Philippine conditions may impose as in the case particularly of San Pablo City as the study area. It will also take careful note of conceptual and procedural problems that may be encountered for the benefit of future applications.

OPERATIONAL OBJECTIVES

The research undertaking, which shall focus on a study of technological thresholds, has the following operational objectives:

1. To define the best overall pattern of physical growth of San Pablo City for planning its distant future expansion using physical geographic frameworks.
2. To define the threshold limitations of urban residential expansion for the near future (year 2000) using physical geographic and selected infrastructure and utility frameworks.
   a. To identify suitable areas or evaluate proposed areas of urban expansion specifically for residential purposes.
   b. To supply the comparative threshold costs of identified expansion areas.

SCOPE AND DELIMITATION

The geographic scope of the study is the City of San Pablo which is noted for its diversity of topography and surface waters. The whole territory of San Pablo City is an ideal place for the application of a thorough or detailed threshold analysis. The land area of San Pablo City, however, proved too extensive for an individual researcher to handle. Therefore, only a basic threshold analysis was carried out for the whole area while the basic and cost analyzes were done for the urban area only.

The scope of the second objective of the study, however, will include more or less 3-kilometer radius designated urban areas for expansion of the settlement that will accommodate the additional population by the year 2000. It is primarily concerned with the direct threshold costs and does not comprehensively undertake economic evaluation of the area. The process is also primarily concerned with the development of residential areas and selected supporting infrastructures and utilities. Information on other land uses, however, is indirectly investigated.

STUDY AREA

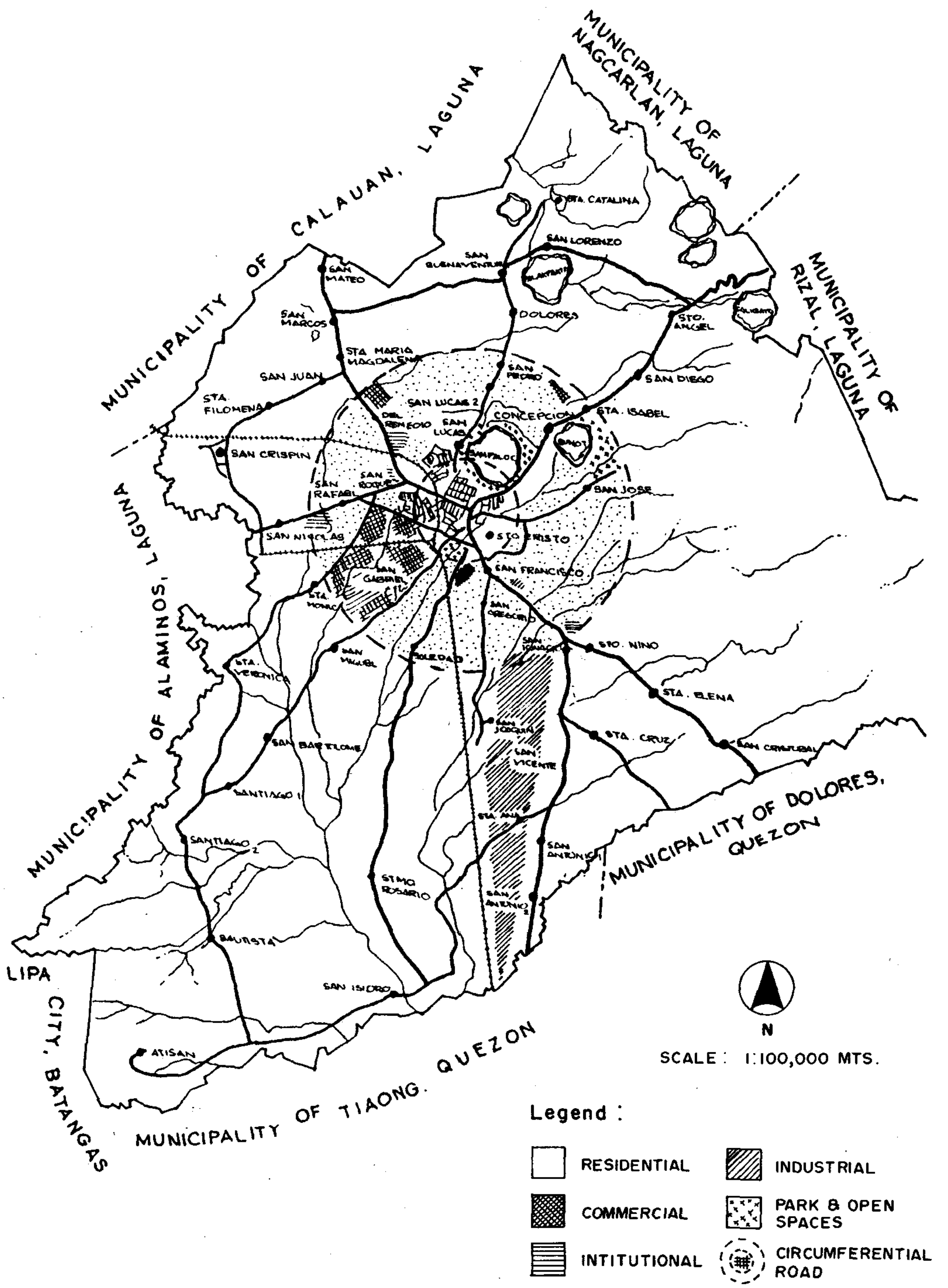
The study area is San Pablo City which is the southernmost community in the province of Laguna. The city is one of the progressive cities in southern Luzon. It is accessible from seven points by road to neighboring municipalities which consider the city as their center of trade, commerce and major services.

The recent effort of the government to develop Calamba and San Pablo in Laguna and the cities of Batangas, and Lucena in Quezon as the "Growth Corridor Sub-Region" for Region IV has positive influences on the city's future growth in terms of improving the existing transport infrastructure in these areas. The imposition of a 50-kilometer radius ban against the establishment of new industries within Metropolitan Manila has also led to the location of some industries in San Pablo. These facts have supplied the basis for the selection of the city as the study area.

The city also has been selected by the then University of the Philippines Institute of Planning (now School of Urban and Regional Planning) and the Department of Agrarian Reform as a primary sub-region urban growth center within the Southern Tagalog region. According to a report made by these two institutions, the regionalization scheme intends to emphasize "the need for effective integration of the country's land reform program with the equally important industrialization and urbanization program of the government." A growth center is chosen for future urban expansion. The basis for this choice is the "composite and relative advantage of the individual municipalities and cities with respect to their population size, percent urban population and rate of population growth, the range and supply of goods and services they offer and their general stage of development and/or economic specialization."

As mentioned earlier, the study aims to find the areas that offer the best site or sites for urban residential expansion as well as to analyze and compare the costs of developing these sites for urban expansion up to the year 2000.

Figure I: ZONING MAP, SAN PABLO CITY



In this regard, some particular areas from three major sites proposed by the City government's City Planning and Development Staff (CPDS) (Fig. 1) which are suitable for industries, commerce and recreation as indicated in the city's land use plan have been adopted for the present study, and assumed as given for further analysis.

METHODOLOGY

In arriving at the first operational objective of the study, a series of inventory maps were obtained from different sources and reproduced for the whole study area. Maps on such factors as topography; soil, underlying rock formation, surface water, watershed areas and present and proposed land uses were utilized. To achieve the first objective which involves the search for the best overall long range growth direction, another series of maps were produced to analyze various physical geographic features and the possible thresholds imposed by them to urban development. Some of these thresholds were presented in a single map. In each map, land was divided into three classes of suitability, namely: land immediately suitable at no threshold costs, land suitable at some threshold costs and land unsuitable for developlment. The following criteria were adopted for identifying lands unsuitable for future urban expansion:

1. Lands with altitudes of more than 200 meters above sea level because all the natural sources of water are located along or below this level;
2. Lands with slopes of more than 15% due to the high degree of erosion;
3. Lands already designated for other future urban functions;
4. Prime agricultural lands which are protected by existing policy considered as class A, provided they do not hamper the urban continuity and use of existing infrastructure and utilities.

A shading procedure was adopted to present different classes of suitability. For the physical geographic analysis dark shading was used for unsuitable land and light shading for land suitable at some threshold costs. The land suitable at no threshold cost was left blank. The synthesis map was produced through superimpositions of criteria maps. The suitability maps with the first and boundary threshold lines were traced. The first threshold line encompasses the existing built-up areas and immediately suitable land. The boundary threshold line is the line beyond which development is not feasible or requires high threshold costs. The intermediate areas are bounded between the first and boundary thresholds and require some threshold cost for their development. Furthermore, the final synthesis map was presented in a grid system, and unsuitable land was eliminated from further analysis. The grid system represents the basic unit which is the basis for the succeeding analysis and is discussed further below.

The methodology for the second objective is largely derived from the procedure outlined in the *Threshold Analysis Manual.* The second objective differs from the first in its scope and method of analysis applied. This objective searches for the best residential expansion for the urban areas in the near future (year 2000) using the results obtained from the physical geographic analysis plus analysis of selected infrastrucutre and utility services. Four basic urban services were selected for analysis, namely: water supply, power supply (electricity), road system, and drainage – all threshold – causing factors for future residential development. The sewerage system was not included because it is estimated by the San Pablo City Water District feasibility studies that a separate sewerage system and the corresponding sewage treatment plant could cost close to P50 million based on 1983 prices. This cost is beyond the paying capability of the city and the Water District.[3] On-site disposal system is practised by the people. The suitability and possible threshold factors by this kind of disposal is incorporated in the soil analysis.

During the preliminary analysis, it was found out that the urban population increase in the target year is not a significant number and that *the suitable areas identified from the physical*

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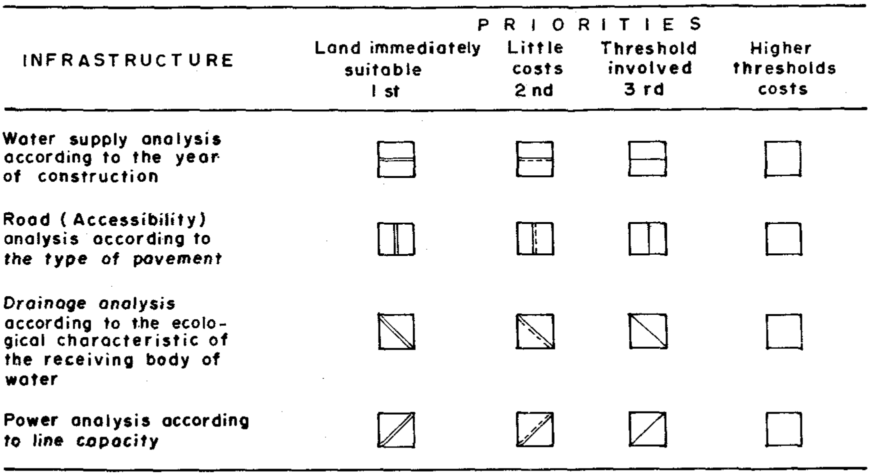
[3]Local Water Utilities Administration, (Ministry of Public Works and Highways), *Feasibility Study Report for the San Pablo Water District, Phase II Improvement,* 1982, p. 4-14.

Fegure 2 : HIERARCHIES OF LAND SUITABILITY



Different combinations may be obtained in the composite map i.e.,  . This sign shows land immediately suitable from the stand point of all the four factors cited above.

geographic analysis is much more than the land required for the residential areas. This lead the study to go to more details in identifying the most suitable areas at least threshold costs. In this regard, another version of eco-engineering shading procedure was adopted to a grid system of nine hectares, representing a Basic Unit.[4] The symbols in Figure 2 were developed to show hierarchies of suitability for each particular infrastructure and utility being investigated.

The thresholds imposed by infrastructure services are due to capacity limitations of one or more of the components in the system. In the present case, the components of each service were separately analyzed to determine whether any spare capacity or deficit existed in the system. Space capacity is defined as the remaining capacity in the existing or adjusted systems when they are used by the current number of users at target date standards.

In the case of water supply components, in addition to the existing components, the proposed sources, the reservoirs, and the distribution system were also analyzed and their spare capacities and thresholds identified. The reasons for including the proposed plans of water supply and analyzing them as existing ones was the availability of completed extensive feasibility study for expansion and improvement of water supply of San Pablo City in two phases up to the year 2000. This objective also coincides with the target of the present study. The inclusion of the data from the feasibility study allowed the consideration for analysis of lands planned for future use. These lands would

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[4]Basic Unit – The division of costs into "normal" and "additional" categories is fundamental to threshold theory, and threshold analysis concentrates on studying and analyzing in particular "additional" or "threshold" costs. When carrying out threshold analysis, "normal" cost must be held constant. Normal costs are the costs of providing services within the area of basic residential unit. This includes the cost of construction, site development and servicing while those that are incurred in providing the services to that unit are additional costs. The division of costs is done through the adoption of basic units for which a standard residential density and mix of dwelling types has been set.

The basic residential unit is a group of dwellings together with the land that is made available primarily for the use of the residents. It may vary in size–1, 4 or 9 hectares or sometimes even larger. The use of the unit would allow for an easy conversion to computer mapping should the wider application of the threshold analysis be made in the future.

otherwise have been simply eliminated on account of current non-usage. The capacity threshold of the power supply system was similarly investigated. No capacity threshold was identified in the existing road system.

The composite map produced by superimposing the results of each infrastructure and utility system revealed several suitable areas for future urban residential expansion. Three alternatives were selected for further analysis. A grid system was adopted for each alternative assumed to serve as a street system. Comparative threshold cost analysis was performed for the four infrastructure and utility systems of each alternative, resulting in the identification of the best residential expansion through lowest per capita costs involved in their development.

LAND CAPABILITY ANALYSIS FOR URBAN EXPANSION AND DEFINITION OF FIRST AND BOUNDARY THRESHOLDS

This section tries to achieve the first objective of the study which is to define the best overall physical growth and expansion of San Pablo City based on physical geographic features. To accomplish this objective, eco-engineering map analysis was conducted which subdivided the whole territory of the city into three categories of suitability for development (Fig. 3). This was achieved by analyzing separately some factors that cause major limitations to future developments. Various symbols were selected for each factor showing the degrees of suitability. The underlying rock formation characteristics were incorporated in the soil suitability map using horizontal shading. Vertical shading was used for preserved watershed areas and main bodies of water as being unsuitable for development. Diagonal lines show different land suitabilities according to the topography of the area. These maps were superimposed with one another producing a synthesis map (Fig. 3) capable of showing all aspects analyzed with the areas having more shading being less suitable and blank areas as immediately suitable for development.

The first threshold line contains all the areas that, from the view point of the group of threshold generating factors under consideration, are "immediately" suitable for urban development at no threshold costs. This line was drawn mostly from the results of slope analysis in the southern parts and the combination of slope, soil and underlying rock analysis in the northern parts. Boundary threshold deal with the definition of the factors that generate some sort of boundary limitations on urban development in general. It may be due to natural and man-made environment and because of the "dominant" non-residential functions. The boundary threshold is the line beyond which development is not possible or requires very high threshold costs. The boundary threshold line was drawn along the contour line which is 200 meters above sea level. The major reason, aside from the expected higher cost of site development and services is the presence of potable sources of water below this level. Administrative boundaries are not usually considered as a limitation to development, but since the scope of the study is limited to San Pablo City, the administrative boundaries constituted the remaining portions of the boundary threshold.

Intermediate thresholds, in turn, delimit areas that can be made suitable for development only at the expense of the costs involved in overcoming particular thresholds. These areas are therefore lying between the first and boundary thresholds. As shown in Fig. 3, intermediate areas are mostly located along the western portion of the city. Fig. 3 was further converted to a grid method representing the basic unit of nine hectares (Fig. 4). This figure shows various existing and proposed land uses and also land suitabilities analyzed earlier. Furthermore, an imaginary boundary threshold line was drawn in the form of a square around the existing urban area with distances of more than four kilometers from the center encompassing different land suitabilities and urban functions for further analysis of urban expansion areas. This area was enlarged twice (scale of 1:50,000) and is used for evaluation of urban expansion areas of second operational objective.

Findings on the first objective. The first objective is to define the best overall physical growth of the city for its distant-future expansion using physical geographic frameworks.

Figure 3: PHYSICAL-GEOGRAPHIC SYNTHESIS

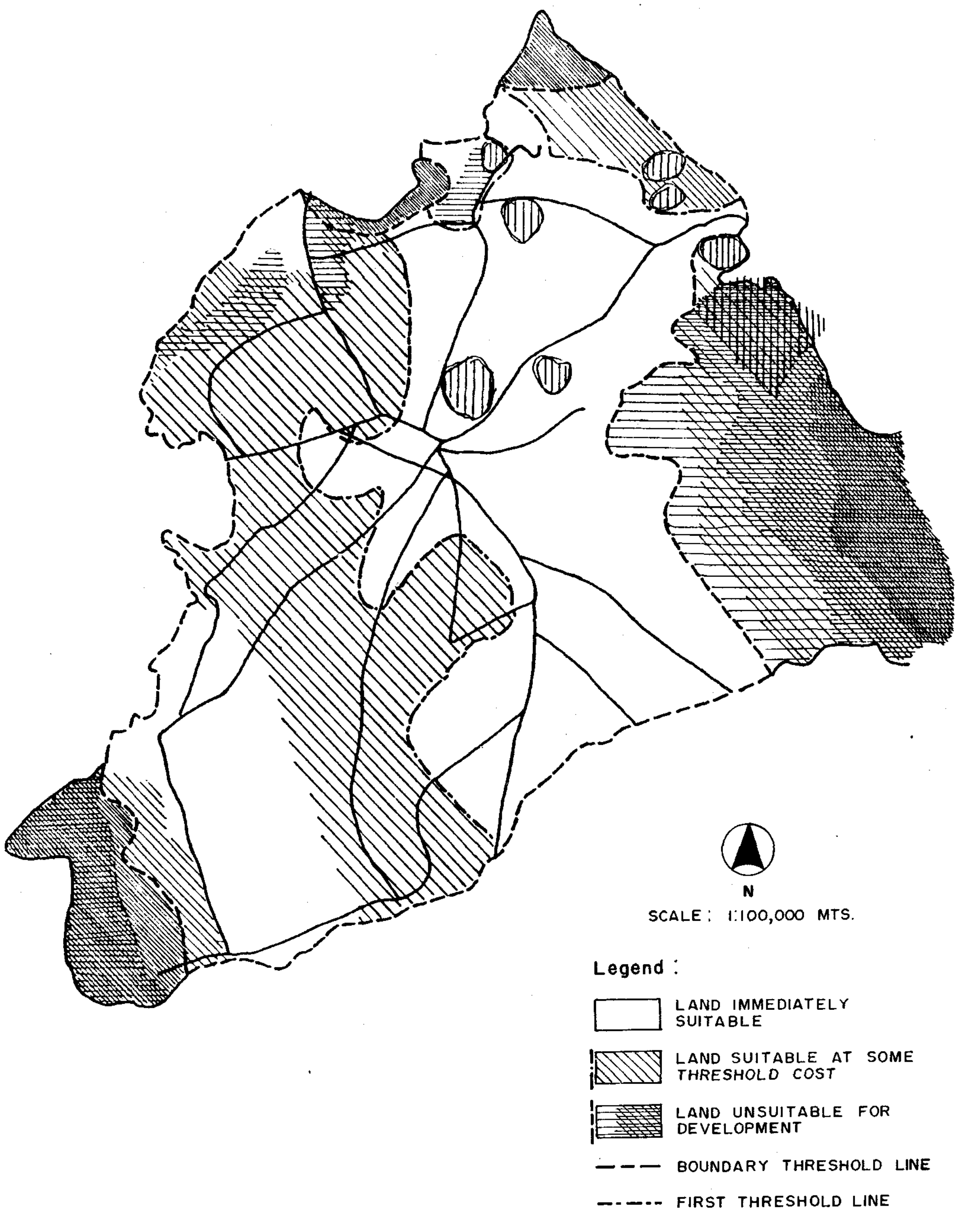
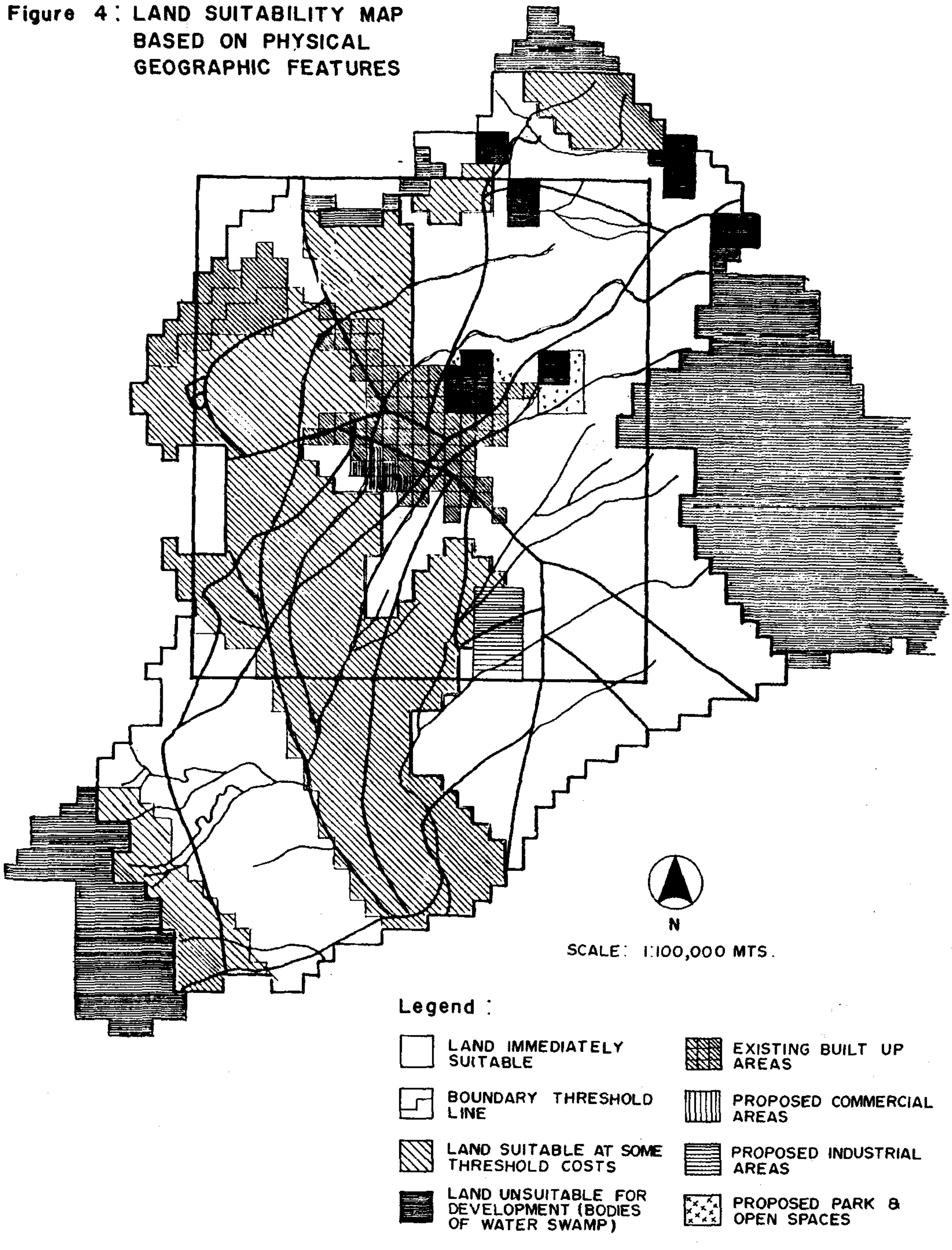


Figure 4: LAND SUITABILITY MAP BASED ON PHYSICAL GEOGRAPHIC FEATURES



The map analysis revealed that suitable land for development is abundant all around the existing urban areas. (See Fig. 4). From the results of the physical geographic analysis using the map overlay method, four distinctive sub-areas were identified, characterized as follows:

1. The Northwestern portion — This area consists of lands with different characteristics that are capable of producing disproportionately high threshold costs if a continuous urban expansion is desired. Such costs would entail those on reclamation of swampy lands, construction of retaining walls for areas with steep slopes, increasing the length of linear elements for rolling areas, construction of drainage facilities on extremely flat land with clayey surface soil that is susceptible to occasional flooding and the presence of underlying rock near the surface which may also produce higher costs due to excavation for utilities.

   The advantages inherent in this area are its nearness to Manila and the presence of water mains, electricity and asphalted roads which all present attractions for expansion. This area is most suitable for commercial and small scale industries.

2. The Southwestern portion — This area is bigger in size than the northwestern portion and is predominantly flat land with a slope below 1 percent. It consists of prime agricultural land class A and almost all the rivers and creeks of the city are passing through this area which makes it more suitable for agriculture. A majority of rice plantations are located in this area. Its very flat slope, however, makes the area susceptible to flooding and also presents difficulties with regard to the future construction of a sewerage system due to the slow movement of the sewage. There are two disadvantages with regard to pollution. Firstly, there is the presence of two polluted rivers and, secondly, the prevailing winds have a northeast-southwest direction that can bring the noxious fumes of the existing industries to the area.

3. The Southeastern portion — This portion of the city possesses better overall development characteristics compared with the above two identified areas. The gentle slope of the land is favorable for development. The area appears to require the least drainage facilities. There is no major limitation identified in this section of the city.

4. The Northeastern portion — This area contains the seven famous lakes of the city. It is surrounded by mountains and hills in its outer boundary. The area has good potentials for tourist development. The dominating slope is gentle. The only disadvantage that can possibly be mentioned would lie in the rather uneven topography that may prevent the continuity of urban expansion.

Second Objective

The second objective primarily deals with the definition of the first and boundary threshold for the selected infrastructure and utility services, as a means to search for the best residential areas for the population which is expected to increase in urban areas by the year 2000 (projected to be about 12,404 people). The infrastructure and social services have thresholds that cannot be expressed as an area on the ground, since they are due to capacity limitations of the components of each of the services. These components, as in the case of water supply, may be the central works such as headworks, treatment works, storage reservoirs or the networks of pipes. This system is analyzed to find out if there is any spare capacity available or if a deficiency exists. In accomplishing this objective which is also based on the findings of physical geographic analysis, maps of larger scale (1:50,000) were produced to exclude the land which is not expected to be developed in the near future. These maps were divided into nine-hectare basic unit grids.

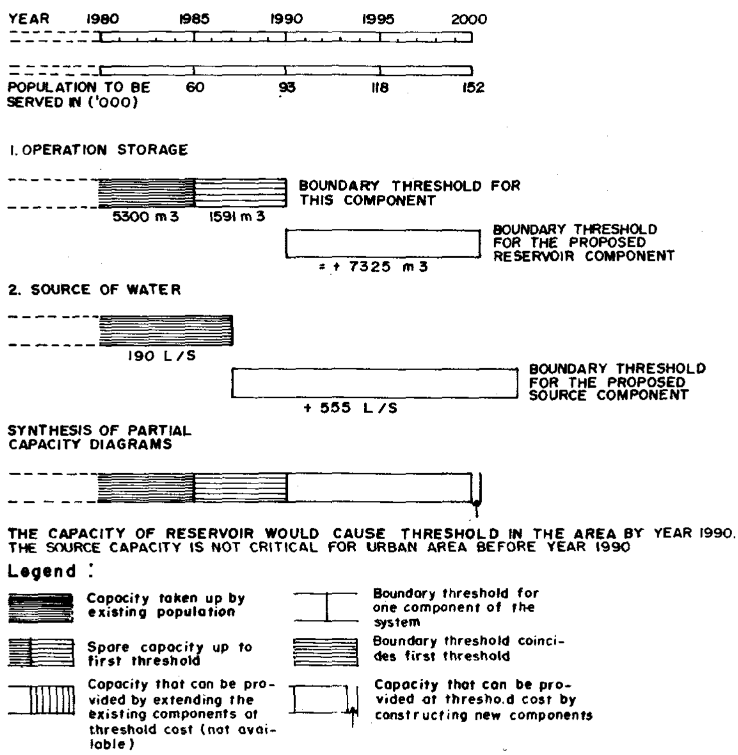
In the first step of the analysis, the water supply system lent itself to a more thorough and definitive threshold analysis compared to other utilities. This was due to the existence of an elaborate feasibility study for the expansion of the system which will be implemented in two phases up to year 2000. This is incidentally also the target year of the study's second objective. The availábility of such a study allowed the author to conduct a direct analysis and to adopt its plans as well as to present the investigations in line with the water system analysis. This was done despite the fact that the scope of the feasibility study includes both the urban and rural areas of San Pablo City while the scope of the second operational objective of this study covers urban areas only. This adoption diverted the procedure of the analysis away from the one outlined in the *Threshold Analysis Manual* of the Scottish Development Department.

The direct threshold cost analysis was to some extent modified. (Threshold costs are further discussed in the succeeding pages). This modification was largely caused by the nature of the costs involved in central works and main distribution system which include whole urban and rural areas with a population range wider than the assumed one for the urban areas. Fig. 5 shows the thresholds that the whole city will encounter due to existing and proposed water sypply system planned by the San Pablo Water District in three phases: Phase I completed, Phase II is exptected to be completed in 1990 and Phase III in the year 2000.

From the four infrastructure and utilities analyzed, only the water supply suitability analysis is presented as an example. For this utility a thorough study was conducted regarding the availability of water resources, domestic water demand, existing source facilities, proposed source facilities, etc. for the whole city and also for urban areas in particular. Fig. 6 shows the version of eco-engineering adopted for urban water suitability analysis which is based on the main distribution system. The same procedure was used for drainage, road and power supply analysis. Four maps were produced which were integrated to produce the composite map, (Fig. 7) which combined all the

Figure 5:

FIRST AND BOUNDARY CAPACITY THRESHOLD OF EXISTING AND PROPOSED FUTURE COMPONENTS OF WATER SUPPLY SYSTEM



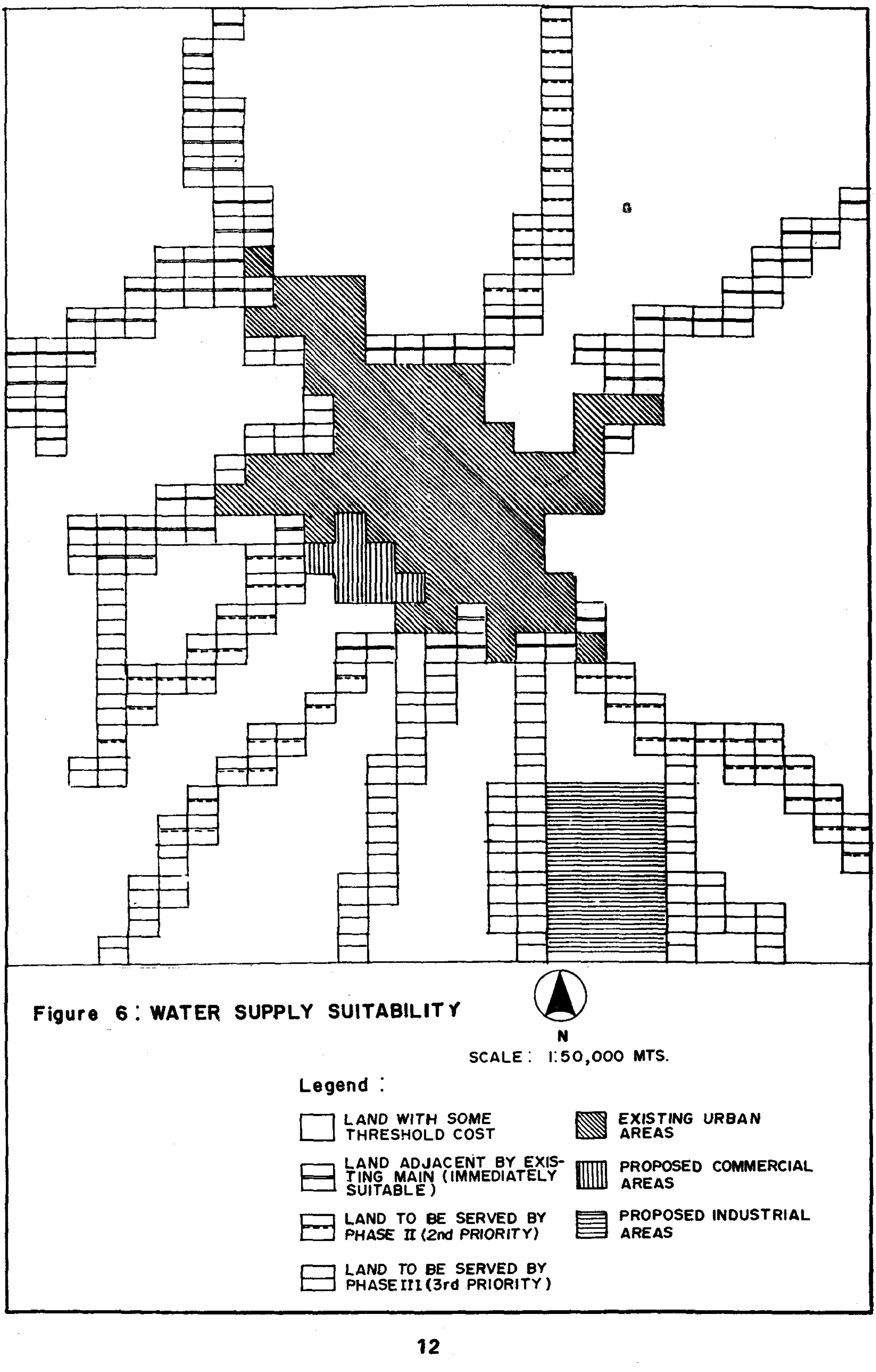


Figure 6 : WATER SUPPLY SUITABILITY

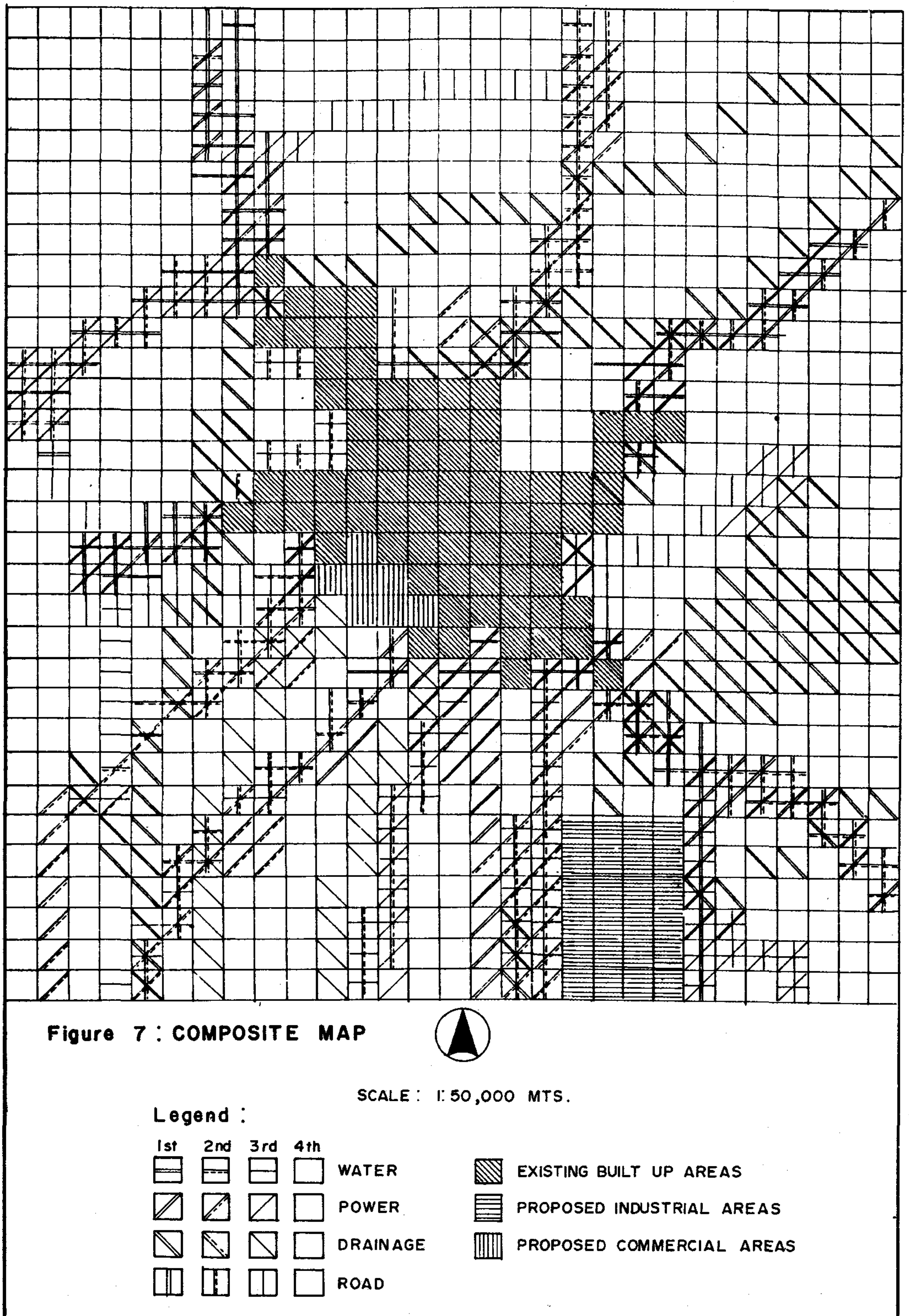


Figure 7 : COMPOSITE MAP

results and showed major suitable urban expansion areas. But this composite map due to unavailability of the physical layout of rural barangays close to urban areas and the presence of utilities along the road networks, the result of the synthesis or the convergence of suitable criteria came out mostly along the road system. The eco-engineering symbols were selected to present the basic units as having more shading to denote greater suitability for development. This procedure permits the updating of the composite map as more services are introduced to the area or any of the existing services is improved to a higher degree of suitability. The updating procedure is quite simple and can be considered as one of the advantages of eco-engineering technique over other methods such as sieve method which uses coloring with different intensities. The composite map is self-explanatory, with each grid representing its potentialities and constraints at once, facilitating the integration of various combinations of basic units to form continuous areas for urban expansion.

The concepts of Neighborhood Unit and Environmental Area have been brought into consideration in aggregating various combinations of basic units also called "Grouping." Three groupings from the composite map were identified. Some groupings were eliminated on account of their being crossed by a rail track, polluted rivers or being less suitable in comparison with the selected ones. The area of each grouping is approximately 171 hectares which is equal to 19 basic units of 9 hectares each, calculated from gross density analysis. The three identified groupings were further analyzed through isolation and adjustment of the grids (Fig. 8). This adjustment was done based on existing road alignment and closeness of a natural stream for the storm disposal of the groupings.

Grouping I as an example is presented here (Fig. 9). For each three groupings, a separate distribution of water and power (regardless of central works) were designed. Similarly, a drainage system based on the intensity of rainfall and characteristics of surface and underlying soil were designed to collect the rainfall of each basic unit to the nearest stream. For the road systems, new local and district roads to serve the basic units together with the bridges and culverts were separately designed. The total threshold costs imposed by the four infrustructure and utilities were calculated based on per capita costs for the selection of the most suitable groupings for the future urban residential areas by the year 2000.

THRESHOLD COST ANALYSIS

Threshold analysis permits identification of development constraints or thresholds restricting further physical expansion of the city, and calculation of the costs of overcoming these constraints. Thus, it permits not only the defining and characterizing of alternatives for physical urban expansion, but also the assessing of the differences in investment costs. The total costs necessary to locate a new unit of physical urban expansion in a town (C_t) are at least two fold:

1. *Costs that are contented with the location of the unit but that constitute the "normal" costs that have to be spent in any case (C_n= normal costs).* Normal development costs as attached to some set of ideal characteristics represents the constant part of development costs, that is, the part that always has to be spent for a given type of development regardless of its location.

2. *Costs tied to the existing conditions and characteristics of a given natural and manmade environment.* These constitute additional costs substantially varying from one location to another (C_a= additional costs).

Threshold analysis is usually concerned with the second group of costs, the calculation of which are undertaken in this study. Through this technique, various alternatives are compared by means of a single common denominator, namely, threshold costs. The indices of "efficiency" can be found by dividing the threshold costs (of various alternatives) by the number of new inhabitants expected to be accommodated. The main implication of threshold indices is that the lowest per unit threshold costs

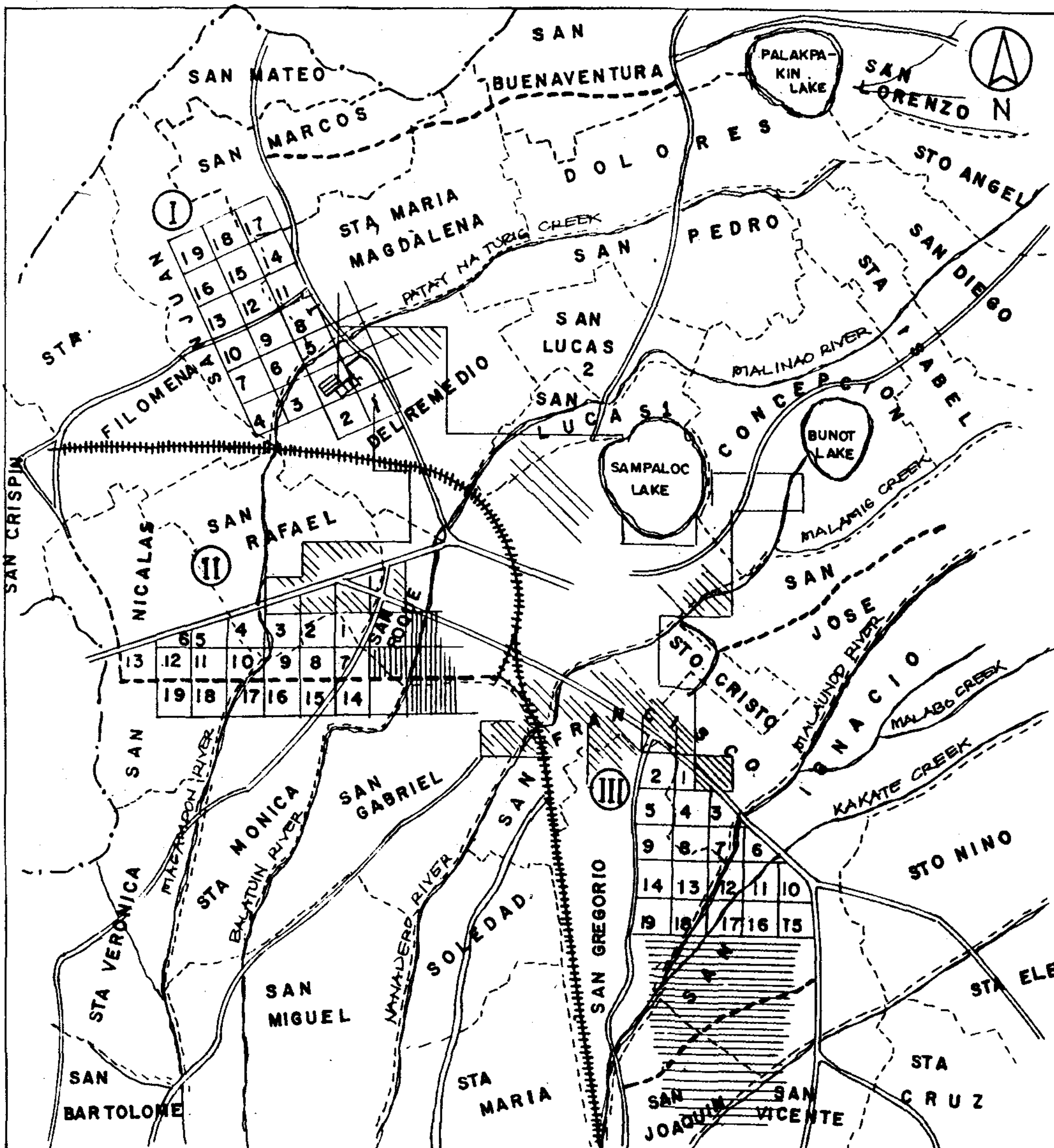


Figure 8: SUITABLE GROUPINGS

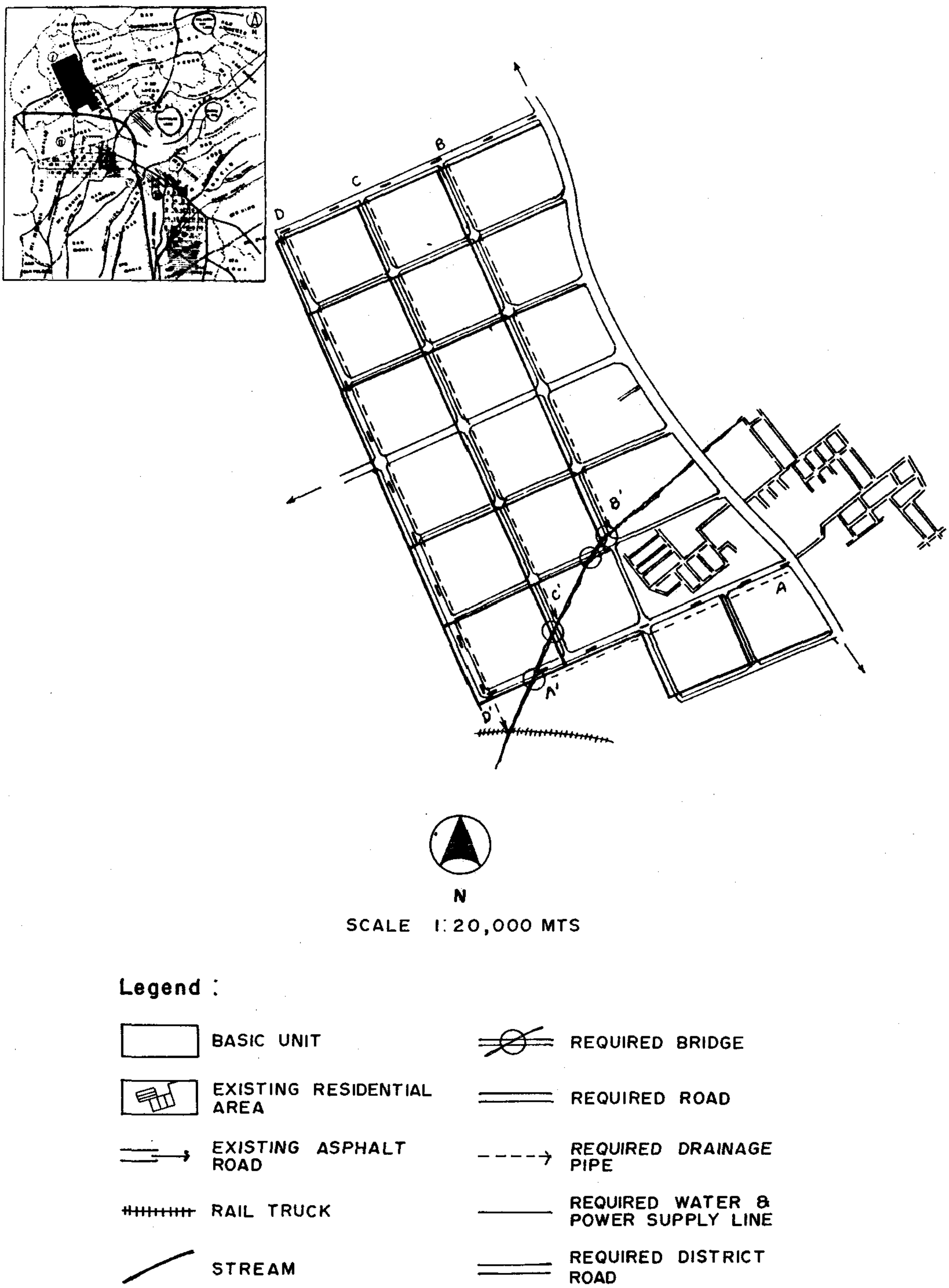
N

SCALE: 1:50,000 MTS.

Legend:

- BASIC UNIT
- EXISTING BUILT UP AREAS
- PROPOSED COMMERCIAL AREAS
- PROPOSED INDUSTRIAL AREAS
- CONCRETE & ASPHALT ROAD
- RAIL ROAD
- DIRT ROAD

Figure 9: GROUPING 1



constitute the most economical provided that all other effects can be assumed to be equal, i.e., the living conditions are kept within the same accepted standards. However, in some particular cases the decision may vary in favor of other aspects such as socio-economic factors. In any case, the decision maker will at least know the cost of the alternative concerned.

This section discusses the threshold costs associated with the construction of new infrastructure and utilities that are required for the accommodation of the estimated population of the urban areas, and therefore accomplishing the second objective of the study.

The direct threshold cost analysis applied in this study was to some extent modified with regard to the definitions discussed above. This modification was largely caused by the nature of the costs involved in central works and main distribution systems of water and power supplies which include whole urban and rural areas with a population range wider than the assumed one for the urban areas. Any expansion of these systems will affect the whole city and the distinction of the costs for urban and rural areas is rather impossible. It is also assumed that this situation is a typical case in other cities of the Philippines. It was therefore decided to come up with two categories of direct threshold costs namely:

1. Direct threshold costs, which include the whole of the city and are pre-requisite of any expansion and cannot be expressed in terms of per capita cost for the population increase in urban areas and consequently cannot act as a determinate factor in identifying the suitable areas for urban expansion (groupings). For example, in the case of water supply system costs: under this category were those of equipment and civil works for intake boxes transmission/distribution, reservoirs, booster pumps, some internal network, stored material, disinfection, fire hydrant, service connection, service vehicles, land acquisition, deep-well pump and pump house, for both phase II and III as well as cost of power supply substation including foundation, transformer disconnect switch and power fuses, switchboard, conducts control cable, grounding system, which, all together, based on 1985-86 prices totalled 166,118,600 pesos.

2. Direct threshold costs include only the estimated population to be accommodated and are used as basis for selection and expansion of different alternative areas. These costs will appear as per capita cost for construction of drainage, roads, distribution of power and water for different groupings for urban expansion. These costs included the cost of water and power supplies to the basic unit (disregarding the central works) and costs of new local and district roads plus bridges and culverts. Grouping III was found to be the most economical for development with a total cost of 40,128,861 pesos. The total costs of groupings are presented in graph form for comparison. (Fig. 10).

Summation of the first and second category threshold costs gives an indication of the amount that the city needs to overcome its major threshold costs up to year 2000. Thus:

P166,118,600 + 40,128,861 = P206,247,461

CONCLUSION

Based on the research problem, objectives and findings of the study, the following conclusions are put forth:

1. The study has shown that subjectivity and intuition in urban planning can be reduced by the evaluative techniques of threshold analysis, and eco-engineering map overlay, which have shown themselves to be more systematic, accurate and rational.

2. The study shows that through threshold analysis and related methods, wastage in land use and consequently capital resources can be avoided. The city plan has allocated much more than enough land within a three-kilometer radius for residential use while the study has revealed that only about one eighth of the residential area

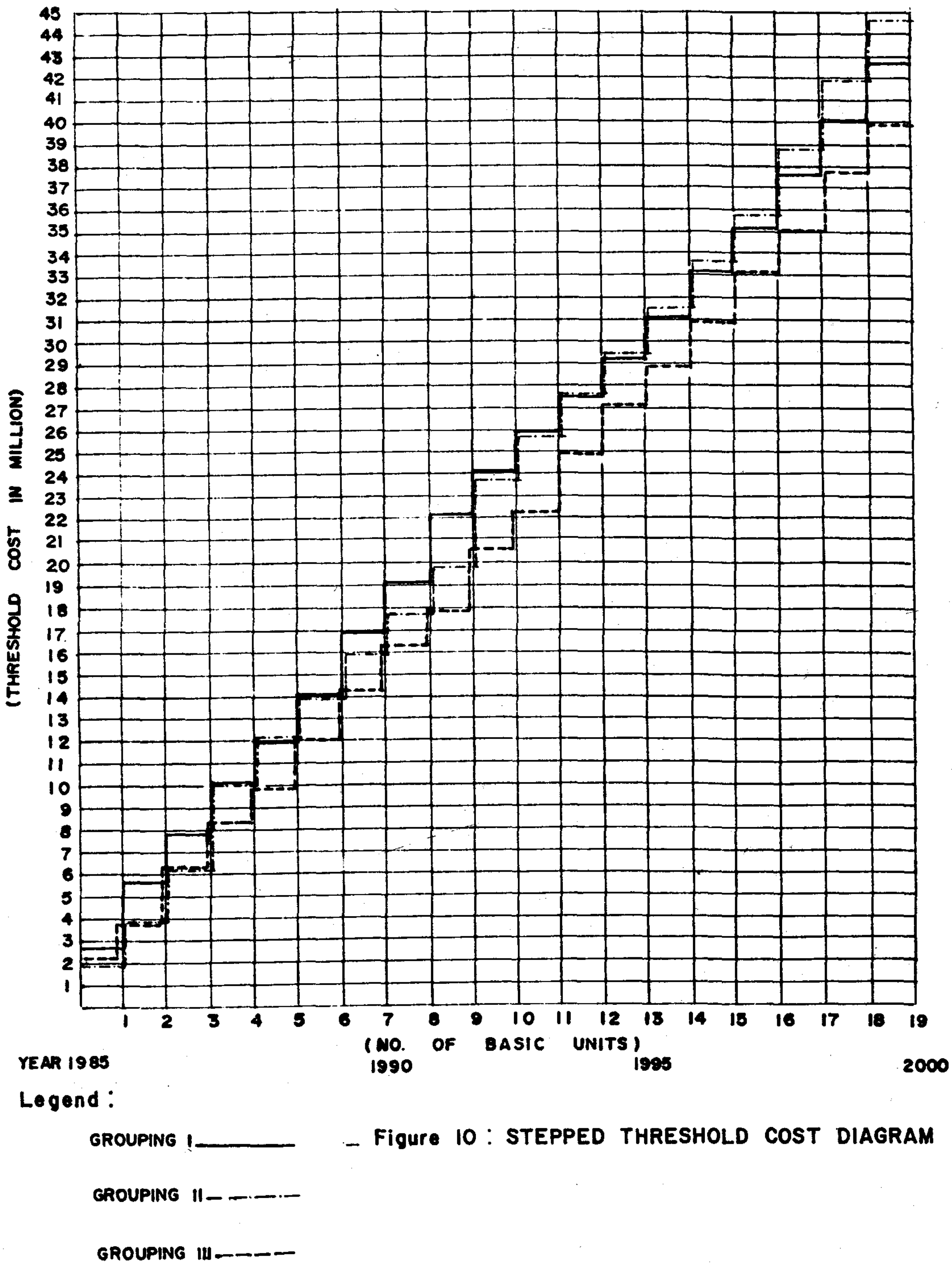


Figure 10 : STEPPED THRESHOLD COST DIAGRAM

proposed by the city planners is actually needed for such purpose up to the year 2000.

3. It has been shown that a city will encounter physical limitations to its development due to topography, soil, existing land use, and technology of infrastructure such as water supply, power supply, drainage and transportation systems. The study indicates further that these limitations or thresholds are not irremediable but can be overcome at "additional" development or threshold costs.
4. The procedure allows flexible planning, i.e., the identification of urban growth possibilities, by indicating the varying costs of these possibilities, which in turn provides a basis for further urban design. The flexibility afforded by the methods also provides planners ample basis for both short-term and long-range planning.
5. The study proves that threshold analysis is applicable to Philippine urban conditions as they occur particularly in San Pablo City. As shown by the study, however, there is a need for the technique to be tailored to Philippine conditions and to be supplemented by related techniques such as the map overlay method of eco-engineering. The study to some extent diverged from the process outlined in the commonly used *Threshold Analysis Manual* of the Scottish Development Department, largely because of the prevailing service-where-ever-the-people-go policy of the city authorities.

RECOMMENDATIONS

As applied in the findings of the study, the following are the recommendations made for the development of San Pablo City:

1. Based on the map overlay analysis (of physical geographic factors), urban expansion should be directed to the southeastern portion of the city (See Fig. 4). This portion has gentle slopes, requires the least combined drainage facilities and bridges, and encounters no major physical limitations and the agricultural lands are moving from Class A to Class B.
2. More specifically, urban residential expansion should be sited within the 170 hectares of Grouping III (See Fig. 8) in the southeastern portion of the City. This is because Grouping III has the least threshold cost compared to Groupings I and II.
3. The proposed industrial site which happens to be adjacent to Grouping III should be relocated to the left side of the railroad (See Fig. 8) which is closer to the proposed commercial area. However, if the industries to be set up are non-pollutive, it is better to retain the proposed industrial site to provide proximate employment opportunities as is suggested in the Planned Unit Development (PUD) approach.

FINAL REMARKS

Possible constraints to the application of threshold analysis in developing countries arise partly from the nature of the analysis and partly from the nature of the method, which was, as noted earlier, originally developed and found applicable to industrialized socialist countries. The technique has generally found acceptance in such countries as India, Syria, Uganda, Caribbean, Malaysia, Brazil, Iraq, Nigeria, Venezuela and Mexico. Observations from these countries show that interest in threshold analysis is not limited to one country, nor, is it limited to a single continent. Interest is worldwide and increasing. Moreover, growing interest in its use appears to be particularly evident in countries with rapid development and urbanization rates.[5]

In the Philippines, threshold analysis should not be too difficult to adopt considering that preference is generally given to outward expansion rather than vertical growth of cities. Thus, there is the seeming popularity of suburban subdivision development while on the other hand urban renewal cannot seem to take off.

[5] *Threshold Analysis Handbook,* op. cit., p. 25.

Moreover, urban developments in this country are largely accounted for by private investments. Threshold analysis can be used by city governments to influence the location decisions of private developers.

In the particular case of San Pablo City, the findings of this study could now be used to revise the structure plan and the zoning ordinances. Then, a strict enforcement of the locational clearance system in combination with positive incentives to private developers should be able to influence the direction of future growth to the identified urban expansion areas. Such positive incentives may take the form of initial investments by the local government in infrastructures, utilities and services in the desired direction. It is true, as Philippine experience shows, that infrastructures and utilities have been used to service rather than *shape* development, but there can always be a first time.

Investment in local capital development is one major challenge that the findings of this study poses to the capability and commitment of the city government of San Pablo. If the city government desires to redirect future urban growth to the identified areas, a threshold investment of some P206 million will be required up to the year 2000. Luckily for the city, part of the investments need not come from public funds. Some utilities such as electric power supply and water supply are being developed by private or quasi-public agencies. These agencies normally shoulder the investment cost of expansion.

The present exercise shows nothing but interest for application of this techniques as a tool for a better and more rational evaluation and decision making in urban and regional planning. Threshold analysis has not been developed as a comprehensive tool for the economic evaluation but basically a location oriented technique introducing the quantification of threshold costs in a physical planning technique and it is essential that its limitations be understood. Some of the limitations cited in the Manual are:

1) Threshold analysis does not take socio-economic benefits into account and merely considers them as equal for the whole area.
2) Assumptions are pre-requisite to the application and the results of the analysis must be seen in relation to the assumptions made. Thus, comparison between a number of towns may be difficult if different assumptions are made for each of them.
3) The cost calculations are often based on crude assumptions and should not be treated as precise cost assessment.
4) The process is primarily concerned with the development of residential areas and information on other areas is obtained only indirectly.

The benefits obtained from threshold analysis, however, outweigh the limitations, particularly because the results of threshold analysis can function as input data for other techniques e.g., Cost-Benefit Analysis, Planning Balance Sheet, Optimization Method and Goal Achievement Matrix.

The procedure outlined in the Threshold Analysis Manual is not intended to be a rigid one, and can be tailored to any situation while maintaining the general framework of analysis. In this regard the procedure followed by the present study diverged from the process in the Manual particularly in the way of identification of thresholds and potentials by application of the eco-engineering technique. It is necessary to adjust the threshold analysis to the existing plans unless the planner has at least some control or influence over the existing plans and location of urban expansion, who can bring the different planning bodies into close coordination to control the urban growth rather than continue with the policy of service-wherever-the-people-go. It is therefore necessary to adjust the analysis in the most careful way and the significance of such adjustment must not be underestimated.

It is the main aim of threshold analysis to identify the most suitable areas for urban residential expansion. The present study also concentrated on the identification of this urban activity while other functions, such as industrial, commercial and recreational areas were assumed as given and were adopted from the existing plans. It is suggested by the present study that in future applications, if a high rate of trade and industrial growth is expected, the residential areas should be analyzed in relation to other urban functions particularly as far as the commuting patterns are concerned. In other words, the impact of residential groupings and employment concentration and the commuting pattern should be investigated and should form the basis of the road system. This was not done by the present study because the economic base of the city is agriculture and the kinds of industry and the number of workers are not clearly known and industrial growth from the current situation does not seem to be very significant. At any rate, the design of the grouping of basic units which provides for neighborhood service center tends to reduce the need for trip making.

Some other aspects that shall be brought into consideration in future applications and are usually undertaken in parallel with threshold analysis are the land ownership (tenure), land speculation, political or legislative factors that may change the results of analysis drastically. These aspects were simply excluded, because the areas analyzed for urban expansion have been zoned in 1975 for this function and interviews with authorities have revealed no significant problems in this regard.

Nevertheless, it is reasonable to expect a considerable impact of this study on land values that will require the application of appropriate urban land policies. For sure, once the identified urban expansion areas are made known to the public, an artificial increase in market values of affected lands will immediately occur. The capital gains tax should therefore be strictly enforced to enable society to recapture such a speculative land value increment.

Similarly, unearned increment in land values will accrue to private property owners immediately benefited by public investments in infrastructures and utilities. While there is a law that empowers government to recover such unearned increment in land values, this law (see Sections 47-55, Chapter V of PD 464) has not been implemented. Again, there must always be a first time.

The present study was mainly concerned with direct threshold costs. There are however, several other costs that may be significant in some cases and should be analyzed in future applications if found to be necessary, namely: cost of frozen assets; running or exploitation costs; normal costs and grade threshold costs. For instance, inclusion of some major normal cost causing variables if a detailed topography of the grouping is available may result in possible layouting of the internal streets and services (not necessarily grid method) and consequently better comparison between different groupings and better understanding of neighborhood layouts can be obtained.

On the whole, the results of this study will go a long way towards the realization of San Pablo City as one of the growth centers identified in various regional studies to catch Metro Manila's overspill population and other rural-to-urban migrants. In a broader sense, however, this study has sought to enrich urban planning practice in the Philippines. It has simply demonstrated that decisions regarding the shape, intensity and direction of future urban expansion need not be based on arbitrary and intuitive considerations but on rational, objective and, to the extent possible, quantitative ones.

THE USE OF THEMATIC MAPS IN ANALYZING SOIL EROSION SUSCEPTIBILITY OF THE PHILIPPINES

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INTRODUCTION

Soil erosion has long been recognized as a major hindrance to increased agricultural production in many areas in the Philippines. Awareness and knowledge of the extent of soil erosion are essential in planning the development of an area, especially if the activities to be undertaken will have great impact on the ecological balance of the community. One of the problems facing environmental managers and planners is the lack of reliable information regarding the extent and spatial distribution of soil erosion in the Philippines.

The principal objective of this paper is to determine the extent of different classes of soil erosion susceptibility in several provinces of the Philippines by the analyses of existing thematic maps such as land use maps, soil maps, slope maps and rainfall maps. The goal was to study all provinces particularly in places where physical and environmental conditions may heighten soil erosion. Results in fifteen (15) provinces are presented in this paper.

Overview of Soil Loss in the Philippines

Soil loss is occurring all over the Philippines. At the mouth of every river, large or small, there is a fresh and increasing delta of top soil washed off the hillsides and lands upstreams. The critical loss of Philippine watersheds is alarming. Of more than 400 principal watersheds, over half of these can be classified as critical.[1]

Practically all the lands suitable for agriculture are already farmed. Any proposal for intensifying agricultural development will most likely be toward increased efficiency in management of land already in cultivation rather than the expansion in the utilization of marginal lands. Data on changing land use will show that the growth of cities is a leading source of cropland loss in the Philippines.[2]

There is an urgent need to determine the extent and distribution of soil erosion and to identify highly susceptible areas into which appropriate preventive and rehabilitation measures could be introduced.

Basic Concepts of Soil Erosion

Soil erosion involves detachment, transportation and deposition of soil by water and wind action. The principal agent of transporting soil in the Philippines is water. The four factors

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[1] R.C. Bruce, *Principal River Basins of the Philippines.* National Water Resources Council Report No. 4, October, 1976, 82 pp.

[2] ________, *"Soil Erosion Guidelines on Urban Lands," Philippine Engineering Journal,* Vol. 3(2), December 1982, National Engineering Center, U.P. Diliman.

affecting soil erosion in Philippine landscape are: (1) land use, (2) soil type, (3) slope, and (4) rainfall characteristics.

Land Use as a Factor of Soil Erosion

Flood destroys millions of pesos worth of public and private properties and causes death and untold misery. In the Philippines this destructive force is often attributed to forest overlogging, kaingin clearing, improper management of agricultural lands especially in sloping areas and other soil-disturbing activities of man such as building settlements, installing infrastructure and preparing sites for industries.

The type of crop raised is also an important factor that determines the degree of soil erosion over cultivated areas. Observations consistently show that in places with similar slopes, the amount of surface runoff from row crops such as corn and upland rice is considerably higher than in the fields planted to coconut and other tree crops (especially if the ground is densely covered with grasses). So long as the land is densely covered with vegetation, soil type in the farm does not significanlty affect the amount of surface runoff. All soils possess certain resistibility to erosion, and this resistibility may be increased greatly by vegetal cover. The subsoil may have less resistibility to erosion, and, if the surface condition is changed by cultivation as to destroy the resistance of surface soil, erosion will begin on land which was not subjected to erosion before.

In the Philippines, natural cover, if allowed to develop, effectively protects, the soil. Consequently, disturbance and removal of cover through change of land use must be accorded higher priority in evaluating soil erosion problems and in selecting erosion control practices in the country.

Soil as a Factor of Soil Erosion

A number of properties of soils and their interaction contribute to the susceptibility of the land to soil erosion. Soil texture, depth, permeability, structure, presence of impermeable layer and organic matter content are significant factors affecting soil erosion. Permeability of the soil is a main factor affecting runoff and erosion. The depth of soil from surface to the least permeable layer affects the permeability. Rainfall in excess of the amount needed to saturate the soil above the impermeable layer would run off the ground surface and carry with it soil from unprotected sloping areas.

Depth of solum (topsoil and subsoil) is a very important factor in measuring the susceptibility of the land to soil erosion. Between two kinds of soil with similar texture, the one with thinner solum will likely be more susceptible to soil erosion. Areas with loose shallow top soil underlaid with dense subsoil of low permeability are vulnerable to serious soil erosion. In the gully, once the water has cut the resistant subsoil down into a loose or soft layer of underlying material, the caving-in that results hastens truncation of the soil profile.

Slope as a Factor of Soil Erosion

Slope is the inclination of the ground surface with respect to its horizontal distance. It is expressed in percent slope which is the rise of the land for every 100 meters horizontal distance. The characteristics of slope influencing soil erosion are the degree of slope and the length of slope. The steeper the slope, other factors being the same, the greater the velocity of the surface runoff. The length of the slope is significantly important since the greater the extension of the inclined area, the greater is the concentration of the flooding water. The lower end of the slope is more seriously affected than the upper end of the slope.

Rainfall as a Factor of Soil Erosion

High intensity and amount of rainfall contribute greatly to the problem of soil erosion in the Philippines. In some parts of the country the average annual rainfall reaches to as high as 3.5 meters. The intensity of rainfall in the Philippines is alarmingly high. Records show that Baguio City experienced 1.5 meters of rainfall per day in 1911.

Rainfall is characterized according to intensity, duration, distribution, total amount and rain-drop size. It is possible to predict the extent of soil erosion by knowing two or more of these characteristics. A high intensity rainfall which lasts for a long duration will bring about serious soil erosion. The more frequent the rain the more chances will there be of soil erosion because once the soil is saturated the excess water will occur as surface runoff. Long, heavy downpour is more erosion-promoting than light rains because great runoff results.

The soil can absorb only so much water for a given length of time and whatever rainfall is added in excess of the absorbing capacity of the soils results in more surface runoff. After many days of rainfall, the soils will become saturated with water and will no longer be capable of absorbing any additional rainwater. At this period all vegetation, including litters on the ground, are saturated. Any amount of rain falling during this time will only become runoff and will cause soil erosion.

Methods of Determining Soil Erosion

In assessing soil erosion, two procedures can be followed. The first involves direct observation and measurement. The degree of soil erosion for a given area is judged by the extent to which the original surface soil has been removed through erosion. This is estimated by a comparison between the present depth of soil profiles and the depth of comparable virgin profiles of the same type under similar topographic conditions. In cases where the virgin surface is shallower, the lower part of the solum may be used in estimating the degree of soil erosion.

The second method of soil erosion has been adopted by the Bureau of Forest Development in the absence of profile investigation. The system relies heavily on the type of ground cover and the slope of the land. Other factors like soils and rainfall are not considered.

With measurements over a long period of time it is possible to determine the erodibility of the soil and express it in quantitative terms.[3] Sufficient laboratory and field experimental data are needed. Obtaining these require long years of research and considerable amount of money and manpower.

Soil Erosion Susceptibility

Direct observations of soil erosion is virtually not available in the Philippines.[4] However, it is possible to arrive at an expression of soil erosion susceptibility by interpreting various thematic maps: land use, soil, slope and rainfall maps, singly and interactively as factors of soil erosion.

Soil erosion susceptibility is a land quality that results from the interaction of land use, soil, slope and rainfall characteristics. It is the susceptibility of the soil to particle detachment by rainfall and runoff. The degree of soil erosion susceptibility is not quantified because of the absence of laboratory and experimental data. The classification is purely in relative terms as it refers to the potential soil loss from a particular land, based on interactive effects of land use, soil, slope and rainfall characteristics.

The delineation of areas with different classes of soil erosion susceptibility was accomplished using the "covergence approach".[5] The procedure is to transform the thematic maps (land use, soil, slope and rainfall maps) into a single-factor soil erosion susceptibility map for land use, soil, slope and rainfall, with a common scale of 1:250,000. The single-factor map shows only the areas delineated as highly susceptible to soil erosion.

Single-Factor Soil Erosion Susceptibility Map

The thematic maps were transformed into a single-factor map that shows only the areas that are highly susceptible to soil erosion.

Land Use as Single-Factor Map

Areas covered with the following land use types were delineated as highly susceptible to soil erosion:[6]

1. Marginal agricultural land
2. Pasture/grassland
3. Denuded forest land

[3] R.J. Loch & Freebain D.M., "Methods for Measuring Soil Erosions," *Soil Erosion Management, ACIAR Proc. Series No. 6,* 1984. Phil. Council for Agriculture and Resources Research and Development, pp. 57-63.

[4] R.C. Bruce," Assessment of Some Erosion Prediction Models for Applications to the Philippines," *Soil Erosion Management, ACIAR Proc. Series No. 6,* PCARRD, pp. 42-49.

[5] R.C. Bruce, "Eco-Engineering Analysis for Land Use Planning," *Philippine Planning Journal.* Vol. 12 (2). Institute of Environmental Planning, University of the Philippines, Diliman, Quezon City.

[6] Ministry of Human Settlements, Regional Land Use Map, Scale 1:250,000. 1980. Unpublished.

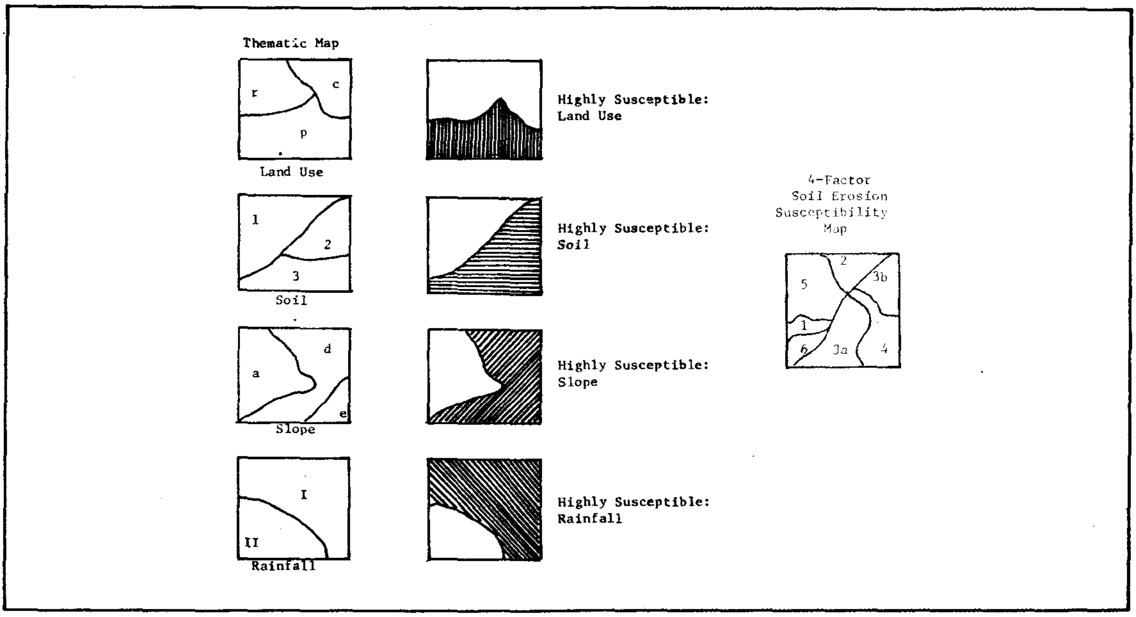

Fig. 1 Single-Factor Soil Erosion Susceptibility Map (Hatched Area)

Schematic diagram of thematic maps, transformed to soil erosion susceptibility map and superimposed over one another to produce the four-factor soil erosion susceptibility map. Explanation: Land use+ r-rice paddy, c-coconut, p-pasture; Soil + 1-deep clay loam, 2-shallow sandy loam, 3-shallow silt loam; Slope + a-0-3% slope, d-18-30% slope, e-greater than 30% slope; Rainfall + I – More than 2 dry months, 5-9 wet months; II – 2-4 dry months, 3-4 wet months Dry month is when the rainfall is less than 100 mm per month and wet month is when the rainfall is more than 200 mm per month. Four-factor soil erosion susceptibility map; – 1-not susceptible to soil erosion; 2-slightly susceptible to soil erosion, 2-factors converges (slope and rainfall); 3a – moderately susceptible, 3 factors converged (land use, soil and slope); 3b – moderately susceptible, 3 factors converged (soil, slope and rainfall); 4 – highly susceptible, 4 factors converged; 5 – highly susceptible due to rainfall only; 6-highly susceptible to land use factor only.

Soil as Single-Factor Map

Considered to be highly susceptible to erosion are the following soils:[7]

1. Soils with less than 50 cm. solum; less than 40% clay-silt fraction. This category includes all fine sands and sandy loams.
2. Soils with less than 50 cm. solum; 40-60% clay-silt fraction. This group includes all silt loams, sandy clay loams, and silty clay loams.
3. Unclassified soils in the mountains.

Slope as Single-Factor Map

Lands with the following steepness of slope were classified as highly susceptible to soil erosion:[8]

1. Steeply sloping and steeply rolling land, 18-30% slope.
2. Hilly and mountainous land, 30% or more slope.

Rainfall as Single-Factor Map

Areas with the following rainfall characteristics were considered highly susceptible to erosion:[9]

[7]R.C. Bruce, Soil Map of the Philippines based on Depth of Solum and Clay-Silt Content of Surface Soil, Scale 1:250,000. TCAGP. University of the Philippines, Diliman, Quezon City. Unpublished.

[8]________., Regional Slope Map of the Philippines, Scale 1:250,000. Land Use Planning Under Different Agroclimatic Environment. International Food Policy Research Institute (IFPRI) and Asian Development Bank (ADB) Research Paper, 1984.

[9]IRRI, Agroclimatic Map of the Philippines, International Rice Research Institute, 1979.

1. Areas with less than 2 dry months, and 5-9 wet months.
2. Areas with 2-4 dry months, and 7-9 wet months.
3. Areas with 2-4 dry months, and 5-6 wet months.
4. Areas with 5-6 dry months, and 5-6 wet months.
5. All areas with one or more months with 500 mm or more per month of rain.

Classes of Soil Erosion Susceptibility

The single-factor soil erosion susceptibility maps with a common scale of 1:150,000 were printed on transparent overlays. When superimposed over one another, a converged area for 4.3 and 2 factors appear and become the basis of soil erosion susceptibility classes as follows:

1. Areas highly susceptible to soil erosion: where 4 factors converged;
2. Areas moderately susceptible to soil erosion: where 3 factors converged;
3. Areas slightly susceptible to soil erosion: where 2 factors coverged.

Figure 1 shows the schematic diagram of the four thematic maps, transformed to soil erosion susceptibility maps and superimposed over one another to produce the final soil erosion susceptibility map. This map shows areas susceptible to soil erosion on the basis of the combined effects of four factors of soil erosion: land use, soil, slope and rainfall characteristics.

When overlaid with one another, the single-factor soil erosion susceptibility maps show the areas with susceptibilities ranging from none to highly susceptible depending on the number of factors shown on the converged portion. Area designated as 1 in the final 4-factor soil erosion susceptibility map is not susceptible to erosion because of the favorable condition of each of the four factors. Where two factors converged the area is classified as slightly susceptible to soil erosion. It could be a combination of any two factors. The area where any three of the four factors converged is identified as area which is moderately susceptible to soil erosion. Where all four factors converged the area is classified as highly susceptible to soil erosion.

Residual area of one-factor is classified as susceptible to soil erosion due to the unfavorableness of that factor. Areas 5 and 6 are classified as areas susceptible to soil erosion due respectively to rainfall and land use only. In the study of 15 provinces, areas 1, 5 and 6 in the final four-factor soil erosion susceptibility map are included in the area classified as slightly susceptible to soil erosion.

Soil Erosion Susceptibility of Selected Provinces

Soil erosion is the most serious form of land degradation in the Philippines. While the soil scientists, engineers, agronomists, farmers and the public in general acknowledge that soil erosion is serious in the country, no analytical or systematic study has been undertaken to document the problem, its consequences, or potential solutions. This simplified method of determining the soil erosion susceptibility will be of great value for proper land use planning of the provinces, particularly in the utilization of hilly regions of the country. Due to the population explosion and food shortages, hilly regions will be cultivated more and more in the near future. Measures must be undertaken by the government to combat the land misuse problem. Delineation of areas into various classes of soil erosion susceptibility will help planners in formulating a land allocation policy for the Philippines.

The methodology of determining the susceptibility of the area to soil erosion was utilized in fifteen (15) provinces of the Philippines, as follows:

Abra	Ilocos Sur
Antique	Iloilo
Batangas	La Union
Bohol	Masbate
Capiz	Marinduque
Cebu	Zambales
Cotabato	Zamboanga
Davao	

Each province was studied, classified and mapped according to the following soil erosion susceptibility classes:

1. Areas highly susceptible to soil erosion
2. Areas moderately susceptible to soil erosion
3. Areas slightly susceptible to soil erosion[10]

[10] Includes also areas classified as "not susceptible" and areas classified as "susceptible" to soil erosion due to one factor only.

The factor which has overriding effect on the susceptibility of the soil erosion was determined for each province. This is indicated by the single-factor effect on soil erosion susceptibility of the land. The single-factor that placed the biggest hectarage of land to a category of highly susceptible to soil erosion was considered the overriding factor of soil erosion susceptibility in the province.

Results of Soil Erosion Susceptibility Study

Table 1 shows the area in each of the provinces with different classes of soil erosion susceptibility. The overriding factor of soil erosion susceptibility is also indicated.

In eight of the fifteen provinces, rainfall was the overriding factor of soil erosion susceptibility. Contrary to what has been claimed by many workers, slope is not the principal factor of soil erosion susceptibility. Abra and Zamboanga were the only two provinces where slope was found to be the overriding factor. Soil type as an important soil erosion susceptibility factor was true only in the province of Cotabato.

Results of the study show that a combination of high amount of rainfall and land use type that provide less or no cover to the soil makes the land highly susceptible to erosion.

Changes in land use greatly affect the susceptibility of the soil to erosion. Vegetative cover is the most important factor affecting the initial resistance of soils to erosion. Vegetative cover breaks the force of rain drops, thereby reducing the effects of the energy of falling rain in breaking down the crumb structure of the soil and packing the surface soil. As long as the soil is covered with vegetation, soil erosion is minimal even on moderately sloping land.

Limitations of the Methodology

This method of determining the susceptibility of the land to soil erosion is by no means without limitations. The thematic maps utilized were not evaluated in terms of their accuracy. Rainfall intensity, although a very significant factor of soil erosion, was not considered. There are other important factors of soil erosion that were not considered because of the absence of information from thematic maps used. These include characteristics of soil profile, density of vegetation, length of slope and the geology of the region. The methodology needs a number of refinements and evaluation of the results must be done for modification and inclusion of other factors of soil erosion susceptibility.

TABLE 1. Hectarages of Soil Erosion Susceptibility Classes for Selected Provinces in the Philippines*

Province	*Land Area (ha.)*	*Highly Susceptibly*	*%*	*Moderately Susceptible*	*%*	*Slightly Susceptible*	*%*	*Overriding Factor*
ABRA	397,555	29,700	7	333,655	84	34,200	9	Slope, land use
ANTIQUE	252,251	57,600	23	97,626	39	96,975	38	Rainfall, soil
BATANGAS	316,586	177,288	56	15,830	5	123,468	39	Land use, slope
BOHOL	411,772	–	–	46,800	12	364,926	88	Land use, soil
CAPIZ	263,317	–	–	84,600	32	178,717	68	Rainfall, slope
CEBU	508,939	437,687	86	30,536	6	40,716	8	Land use, slope
COTABATO	2,379,705	–	–	445,950	19	1,933,755	81	Soil, slope
DAVAO	1,459,580	134,100	7	1,102,280	56	730,800	37	Rainfall, slope
ILOCOS SUR	257,958	29,075	11	102,825	40	125,883	49	Rainfall, land use
ILOILO	532,397	43,425	8	139,275	26	349,697	66	Rainfall, land use
LA UNION	149,309	71,668	48	26,876	18	50,765	34	Land use, rainfall
MASBATE	404,769	–	–	27,900	7	376,869	93	Rainfall, land use
MARINDUQUE	95,926.	–	–	68,813	72	27,112	28	Rainfall, land use
ZAMBALES	371,440	14,360	4	174,340	47	182,700	49	Rainfall, slope
ZAMBOANGA	1,599,730	31,500	2	1,136,230	71	432,000	27	Slope, rainfall

*No provincial subdivisions was made for Cotabato, Davao and Zamboanga. Percent (%) indicate the percent of the total land area of the provinces.

There is need for research on the effect of each of the four factors on actual soil erosion. For example, what types of land use is more soil erosive under:

a. certain steepness of slope
b. particular types of soil, and
c. certain rainfall characteristics

CONCLUSION

The methodology is applicable in rapid assessment of all provinces in terms of the susceptibility of the land to soil erosion. The use of recent aerial photo coverage and LANDSAT imagery will increase the delineation accuracy of soil erosion-prone portions of the province because land use type and topographic characteristics can be determined with high degree of accuracy. Spatial distribution of susceptible areas can be precisely drawn with the use of aerial photographs. In many provinces intensity of rainfall can be estimated to improve the rainfall data input in the system.

PROBLEMS OF DEVELOPING A LOCAL LAND POLICY: THE CASE OF SANTA ROSA

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POPULATION GROWTH IN THE PERIPHERY OF METROPOLITAN MANILA

Most municipalities experiencing rapid population increases are faced with the huge problem of coping with the demands of the newcomers. The demands may take the forms of additional job opportunities, an improved system of waste disposal, provision of essential social services and facilities, and many other equally urgent needs. These needs generally require land as a physical base or site for building structures, communities, facilities and human activities. Often vast areas of rich agricultural land are converted into urban uses to accommodate the requirements of the urban population.

Municipalities that suffer most the heavy pressure of converting agricultural land to other uses are the municipalities at the periphery of fast growing metropolitan areas. These municipalities attract households from the metropolitan core cities and municipalities who move to suburban places in search of residential units which they can eventually own.

The process of suburbanization, characterized by the flow of population from metropolitan areas to suburban municipalities, is very evident in Metropolitan Manila. As shown in the national census data of 1980, the municipalities close to Metropolitan Manila were among those which recorded the highest percentage of population increase over the 1975 census figures. For instance, the municipalities of San Pedro, Santa Rosa, and Cabuyao in the province of Laguna, had population increases of 71.63 percent, 35.03 percent, and 26.75 percent, respectively. These are municipalities next to Metropolitan Manila toward Southern Luzon. The towns of Bulacan near Metropolitan Manila that registered equally high rates of population increase during that period are Marilao (66.86 percent), Meycauayan (38.78 percent), and San Jose del Monte (53.73 percent). Bacoor in Cavite had 45.22 percent increase. The population of Dasmariñas, also in Cavite, jumped by 127.56 percent, but Dasmariñas had been the relocation area of Metropolitan Manila squatters. In Rizal province, Antipolo had an increase of 68.31 percent, Cavite had 59.65 percent and Angono had 51.19 percent.

The population increase of the city of Manila during the period studied was only 10.23 percent. Pasay's population grew by 12.85 percent, that of Quezon City by 21.84 percent, Caloocan City by 17.78 percent, Makati by 11.42 percent, Malabon by 9.22 percent, and San Juan by 6.20 percent. These are the cities and municipalities at the core of Metropolitan Manila. In contrast to the municipalities at the periphery, the political units at the Metropolitan core had insignificant increases indicating out-migration of the population to suburban settlements. The small gains in population of the mentioned cities and municipalities could be attributed to natural increase and to immigration from distant rural communities.

Industries were also pushed to suburban locations by high population densities, traffic congestion and high land values or rentals in the inner portion of Metropolitan Manila.[1] Besides, heavy industries are discouraged from locating within the 50 kilometer radius from the City of Manila.[2] From a study by the National Economic Development Authority (NEDA) Region IV office, the following were found to be the most influential factors that forced industries to move to suburban towns: 1) low cost of labor; 2) availability of sufficient water; 3) good transportation; 4) availability of reasonably-priced industrial sites; 5) relative ease of disposing factory effluents; 6) nearness to large potential markets; 7) pleasant living condition in the area; 8) availability of low cost raw materials; and 9) greater potential for economic growth.

THE NEED FOR EFFECTIVE LAND POLICY

From the discussion above, it becomes clear that the municipalities at the fringes of Metropolitan Manila need to anticipate the problems that may arise due to population overspill from the metropolitan area. Each unit of government should adopt a land policy to guide the physical expansion of the town to prevent haphazard and uncontrolled growth and, perhaps, overcrowding in the future. Rapid increase in population without new sources of revenue to support the requirements of the newcomers can put unnecessary strain on the existing facilities and resources of the receiving town.

A sound land policy can direct development to a desired location. It certainly has to be anchored on the land use plan which embodies the aspirations and hopes of the residents. The land use plan can establish the scale of urban expansion realizable within a specified period, judged on the local government capacity to absorb the cost.

In the land use plan, the residents can set their objectives regarding the character of the environment they prefer. How fast should the municipality grow? What areas should be conserved to maintain the natural systems? What should be the role of the municipality in the province or region to which it belongs? Through proper implementation of the land use plan, urban sprawl can be contained and incompatible land uses minimized.

Based on the above, the following questions arise: Are the local officials conscious of the environmental problems that will emerge if the municipal government is unprepared to accommodate changes in population densities? Are there measures taken to preclude or minimize the effects of the threatening problems? Have the local officials initiated the formulation of policies to provide the direction of the growth of their communities? To seek the answers to these questions, a study was made of Santa Rosa town in Laguna Province during the latter part of 1985.

The main objective of the study was to obtain insights into the awareness of the municipal officials of the importance of the land use plan or land management to promote the attainment of the environment they desired. The study could also reveal the techniques used in implementing tha land use plan as well as the nature of policy adopted to guide the physical development of the town.

Data were gathered through interviews with the local officials, representatives of national agencies, and developers. Analysis was also made of the comprehensive plan and other reports filed in the planning coordinator's office. The minutes of the Sangguniang Bayan (local legislative body) from 1980 to 1985

[1]Cited in *Towards Regeneration and Redevelopment of Manila*, an unpublished report of The Business Research Center, Makati, February, 1985.

[2]Memorandum Circular issued by the Office of the President on December 17, 1973 instructed the Human Settlements Commission to see to it that "there shall be no more factories, plants, industries and the like to be established within a 50-kilometer radius of Manila."

were examined to seek information on policy statements, resolutions and ordinances related to land and to the development of the town.

PHYSICAL AND DEMOGRAPHIC CHARACTERISTICS OF SANTA ROSA

Santa Rosa is about 40 kilometers from the City of Manila and is accessible from the metropolitan area through the old national highway. The new Manila South Expressway passes the rural portion of the town but no exit route to Santa Rosa was provided.

The jeepneys serve the transport need of the residents whose destinations are the nearby towns of Laguna and Cavite. The Biñan-Calamba route which passes Santa Rosa and Cabuyao had more than 700 passenger jeepneys in operation in 1983 and the number could have gone up considerably since then.

Feeder roads connect the 15 barangays or villages of Santa Rosa and the *poblacion* as town center. Three barangays comprise the *poblacion*, making the total number of barangays to eighteen. The residents in barangays use tricycles in commuting to the *poblacion* where the public market, municipal hall, shops, clinics, and offices are located.

Vast areas are still devoted to agriculture. Of the total area of 5,415 hectares, only 580 hectares (10.71 percent) comprised the built-up portion in 1983. Some 4,793 hectares (88.51 percent) were planted to crops and fruit trees.

The land is level and fertile. The slope rarely rises above 2.5 percent. There is sufficient ground and surface water for irrigation. The major crops are palay, sugarcane and vegetables. The sugar cane fields are in Pulong Sta. Cruz, Sto. Domingo, and Don Jose, the three biggest barangays of Santa Rosa in terms of area. Most of the sugarcane fields belong to the Canlubang Sugar Estate.

The total population of Santa Rosa in 1980 was 64.325. This was 35.03 percent higher than the 1975 population of 47.639. In that year (1980) Santa Rosa ranked fifth in population among the towns of Laguna. Its *poblacion* had 13.4 (or 8,618) percent of the town's population resulting in a density of 157 persons per hectare, the highest among the barangays.

The *poblacion* is the center of activities and has mixed land uses. The residential areas usually follow a linear pattern with houses fronting the old national highway while behind the buildings are ricefields. Many of the residences perform other functions. They provide space for offices and commercial establishments.

Balibago, a barangay situated near the southern end of the town, functions as a subcenter where a private market conveniently cater to the shopping needs of the residents of the surrounding barangays. A few industries are in operation in Balibago.

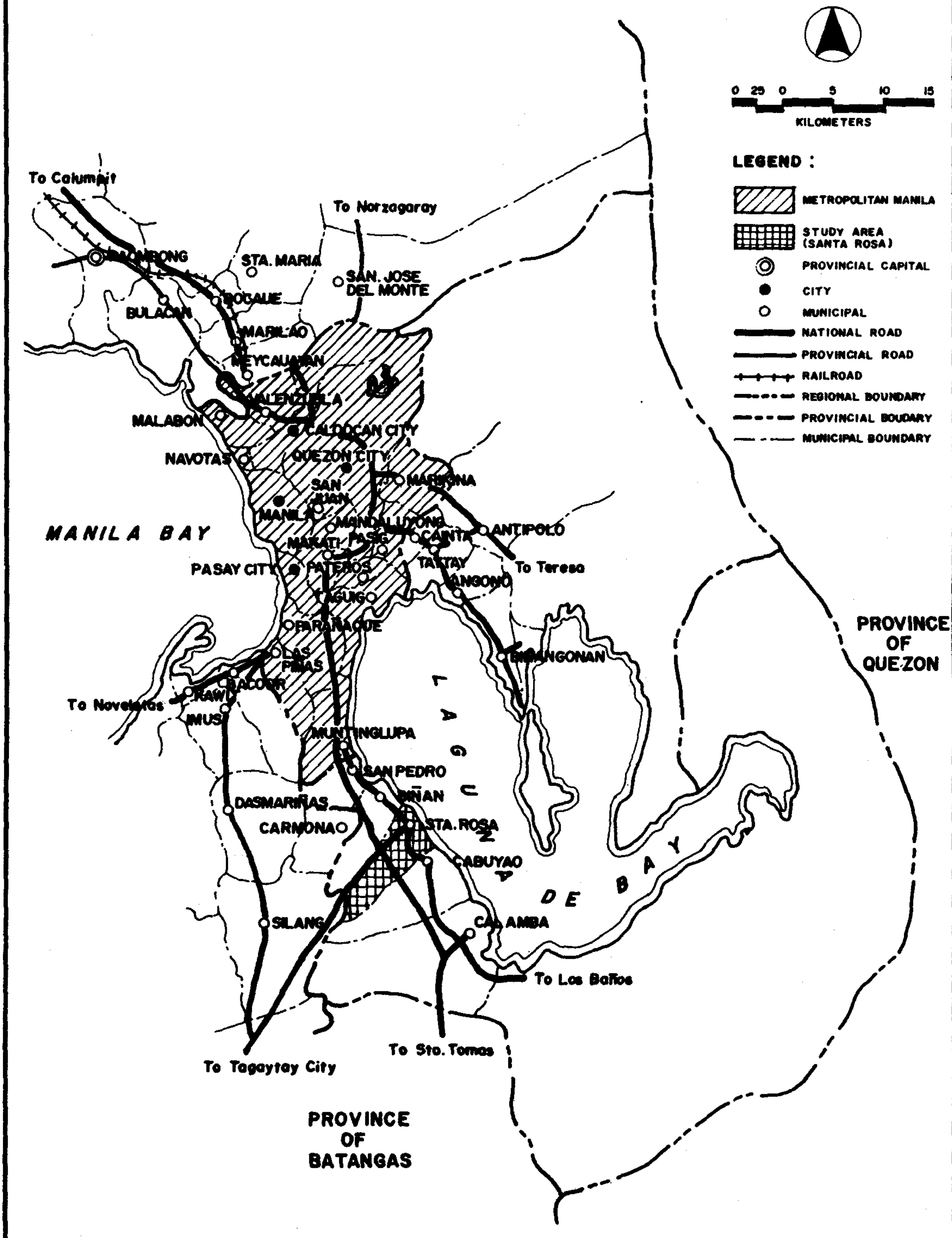
Several residents work outside the town. One can notice a huge number of commuters boarding vehicles for Metropolitan Manila in the early morning of any ordinary working day.

THE LAND USE PLAN OF SANTA ROSA

The town of Santa Rosa has a comprehensive development plan prepared in 1980 with the assistance of a team of planners from the Human Settlements Regulatory Commission (HSRC) and the Laguna Lake Development Authority (LLDA). An essential component of the plan was a land use scheme which stated the role of the town in the development of the Southern Tagalog Region as a member of the "multi-functional urban nucleation" to absorb population overspill from Metropolitan Manila. The other towns were San Pedro, Biñan and Cabuyao in Laguna and Carmona in Cavite. The type of development preferred was a compact one which would try to consolidate the loosely settled areas and thereby avoid sprawl.

The scheme divided the town into zones which were to expand gradually. A specific land area was allocated to allow the expansion of each. The principal objective for the residential areas was to achieve a pleasant, safe, and healthy environment. The approach was to form neighborhood units which would be provided with vital community facilities and services.

Identified as the main commercial zone was the central business district which was in the *poblacion*. A small commercial center in Balibago was proposed for development as supplement to the business district in the *poblacion*.



MAP : STUDY AREA (SANTA ROSA) AND METRO MANILA

Institutional and recreational areas were, likewise, in the *poblacion* where, at present, the health center, scouting office, gymnasium, basketball and tennis courts, parade ground, police headquarters, children's playground and majority of the institutional offices are found. Accessibility from all sectors was the important factor why the *poblacion* was assigned these functions.

The sites of existing large industries were to be maintained as industrial zones. Only light and medium-scale industries which did not produce nuisance were welcome. Nuisance, of course, referred to the discharge of excessive smoke and other harmful effluents, the traffic problems generated due to the movement of heavy trucks, and many other disturbances inherent in the operation of heavy industries.

Proposed industrial sites were in Pulong Sta. Cruz, along the national highway towards Cavite, Dita, near the boundary of Santa Rosa and Cabuyao, and Tagapo along the provincial road at the boundary of Biñan and Santa Rosa. The factors considered in selecting the sites were: 1) some industries were already there; 2) the land was non-irrigated, generally planted with sugar; 3) the proposed sites were along major highways, and 4) they were far from the *poblacion.*

Agro-industrial activities were to be encouraged by providing infrastructure support such as feeder roads, water supply and power. Although power and water supply were available, these were not under the responsibility of the municipal government. Placed in the category of agro-industries were livestock, poultry, piggery, and duck-raising.

Also stressed in the land use plan was the proper conservation and optimum utilization of prime agricultural areas. As much as practicable, conversion of high-yielding agricultural land into urban uses should be prevented.

POLICY AREAS

A clearly defined land policy respected by the decision-makers and the people will facilitate the implementation of the land use plan. There are factors that will ensure the effectiveness of the policy to which the alert municipal officials should focus their attention. One is the availability of resources to carry its implementation. Another is the capability of the organization (assigned with the responsibility of executing it) to translate the policy into action. The third is the willingness of the citizens to support it.

By examining the Local Government Code, one can find the areas upon which the land policy can be based. It is understood that the formulation of any policy at the municipal level is the prerogative of the Sangguniang Bayan. Section 149 of the Code enumerates the powers and duties of the Sangguniang Bayan and among them are powers related to the control or influence over the development of land, whether it is government- or privately-owned.

Some of these powers are concerned with the control and regulation of the use of property, maintenance of utilities, establishment of infrastructure facilities, construction of roads and bridges, adoption of measures to protect the public from floods, fire and other calamities, and abatement of nuisance.

The type of policy that can be promulgated may represent any or a combination of the following:[3]

1. A policy that will directly control or regulate the development of land (e.g. zoning and other kinds of regulation);
2. A policy that touches on the expenditure of municipal funds (e.g. acquisition of land by the municipal government for future use or for conservation, government operation of services, and expenditure on infrastructure); and
3. A policy that can influence private action on land through use of incentives (e.g. offering cheaper sites to industries, pro-

[3] In his investigation of land policies around the world, Nathaniel Lichfield found three major categories of land policy: 1) direct control of development, 2) fiscal control over development, and 3) general influence over development. *c.f.* Nathaniel Lichfield, *Settlement Planning and Development: A Strategy for Land Policy.* (Vancouver; University of British Columbia, 1980), p. 32.

viding utilities to reduce cost of development, and eliciting support to conservation measures).

IS THERE A LAND POLICY IN SANTA ROSA?

The best source of information about the land policy (if one existed) in Santa Rosa would be the minutes of the Sangguniang Bayan. A study of the minutes over a period of five years (1980 to 1985) was therefore made. The resolutions and ordinances enacted and the discussions of the Sangguniang Bayan on various matters affecting land were investigated. The search for the policy proved to be a very frustrating exercise. As Philip M. Raup observed, "Our policies have failed us, not in the sense that they were wrong, but in the sense that they were non-existent".[4] This statement aptly applies to Santa Rosa.

Certain policy statements could be extracted from the zoning ordinance enacted on August 26, 1981, but these were quite general in nature. For example, a statement was made about land as a limited resource and, therefore, should be managed for public welfare rather than as a commodity of trade subject to price speculation.

There were attempts to develop a coherent policy but the Sangguniang Bayan members were confronted with difficulties, some of which were beyond their powers to resolve. Besides, developing a land policy was still far from their thinking until in 1985, when some members of the Sangguniang Bayan expressed concern over the dwindling agricultural lands due to their conversion to subdivisions or urban uses. It was the feeling of the *kagawads* or members that the growth of population would increase the demand for production of agricultural crops. As a result, Ordinance No. 8 was passed on March 13, 1985 providing that any landowner who desired to convert his agricultural property into industrial use should be required to obtain permit from the municipal government.

This ordinance saw its enforcement in the case of Fabercon Builders Incorporated, late in 1985, when it applied for the conversion of a piece of agricultural land in Balibago into a housing subdivision and, at the same time, requested the munipality to lease (for ten years) a municipal road at P*1,000 annually as access* to the proposed subdivision. All the *kagawads* voted against the application with one citing the need to produce food as the first priority while housing was only second. It was also noted that many subdivisions had been opened resulting in the massive reduction of agricultural hectarage. Another Sangguniang Bayan member reminded his fellow *kagawads* that there was an organization which wanted the conversion of its agricultural land to another use but which was not granted. At this stage, it seemed that a policy on land development was emerging but, as stated earlier, the municipal officials were burdened with major difficulties, among which were the following:

A. Pervasive Control Over Land Development of Higher Authorities

Sometime in 1980, the municipal government of Santa Rosa tried to establish control over the development of the lakeside. A few barangays were at the edge of Laguna de Bay and fishing and duck raising were two principal occupations of the residents in these barangays. The Sangguniang Bayan enacted Ordinance 12 which amended Ordinance No. 10 of 1974, providing among others the "zonification of municipal waters for . . . delineation of areas allowable for fishing purposes." A distance of 50 meters between reservations had to be maintained for free navigation and fishing was not allowed "within 200 meters from a fish coral licensed by the municipality." Again, in 1981, a Sangguniang Bayan member suggested in the Sangguniang Bayan's session that a ceiling of P50,000 capitalization be imposed so that the big capitalists would not endanger the livelihood of small duck raisers.

Unfortunately for the town, LLDA, a national agency empowered "to conserve and

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[4]See Philip M. Raup, "Urban Threats to Rural Lands: Background and Beginnings," in the *American Institute of Planners,* November 1975, p. 377.

develop the resources of the Laguna de Bay region" exerted its rights to issue the permit as provided for in PD 813 of 1975. According to the decree, one of the special powers of the LLDA was "to pass upon and approve or disapprove all plans, programs, and projects" proposed by the local government, public corporations and private persons or enterprises if such plans, programs and projects were related to those of the Authority.

What the municipality did was to pass Resolution No. 30 on August 11, 1982, requesting LLDA to first refer to the municipal mayor all applications received by the Authority for installation of fish pens over portions of the lake which were within the territorial jurisdiction of the town before taking action. The move was intended to protect the small fishermen of Santa Rosa.

The implementation of the zoning ordinance was not purely a local responsibility. In fact, the zoning ordinance of Santa Rosa, although adopted by the Sangguniang Bayan, was a version drawn up by the Human Settlements Regulatory Commission (HSRC). Letter of Instruction 729 of 1978 had assigned the power to issue development permits to the Ministry of Human Settlements and this power was exercised by HSRC. In turn, a zoning administrator appointed by the municipal government was deputized by HSRC to implement the ordinance. A complicated situation therefore existed where the land use plan was prepared by the municipality and the zoning ordinance enacted by the Sangguniang Bayan as an implementing tool was enforced by HSRC, through the deputized zoning administrator, who was an employee of the municipal government.

Ordinarily, the zoning administrator issued locational clearance for certain uses. Appeals to his decisions were forwarded to the regional office of HSRC for final action. Applications for other types of development were referred to HSRC. Among these were dumping sites, incinerator plants, cemeteries, filling stations, cockpits, highly pollutive and hazardous industries, public markets, slaughterhouses, subdivisions, projects of national significance, projects categorized as environmentally critical, and development of environmentally critical areas. Issuance of permits for a number of the mentioned projects could easily be handled by the municipal government.

The subdivision plans of developers in Santa Rosa were approved by HSRC without first being referred to the municipal government. The zoning administrator was bypassed. From an interview with the municipal mayor, it was gathered that as soon as the plan was approved by HSRC the developer approached the municipal officials for the issuance of building permits. It was only then that the officials came to know of the subdivision project which had already been approved.

As of 1986, there were 52 housing subdivisions with a total area of about 207.35 hectares. Some developers sold lots only and the buyers generally purchased them for speculation. Other developers constructed houses and sold both lots and houses to buyers.

The conversion of agricultural areas into subdivisions resulted in wastage of resources since lots without houses built on them remained idle and unproductive. Large tracts of agricultural land serviced by irrigation systems (operated by the National Irrigation Administration) had been converted into subdivisions. For instance, between 1984 and 1986, a loss to urban expansion of approximately 44 hectares of irrigated agricultural land was recorded by the National Irrigation Administration.

It was difficult, however, to retain the land for agricultural use, according to the municipal agriculturist. The subdivision developers offered attractive prices for the land which the landowners could not resist. Even tenanted lots, the conversion of which was controlled by the Ministry of Agrarian Reform, were taken out of cultivation. The landowners were able to find ways of circumventing the law on land conversion.

Lack of communication by HSRC with the municipal government concerning subdivision applications caused development sprawl. Roads between adjacent subdivisions were not coordinated. In 1986, the Sangguniang Bayan asked HSRC to carefully check the road plan before approving any subdivision plan so that the roads to be built could be neatly integrated with the existing network. Other subdivision problems later became so intolerable that the town officials were forced to request HSRC to refer the subdivision applications to the municipality before acting on them.

A number of reasons can be cited why consultations with the municipal government is necessary before HSRC approves subdivision plans. First, the local government has to provide services to the growing population, including the subdivision residents, and the proper location of such services is of prime consideration. Second, subdivision roads and open spaces are turned over to the municipality for maintenance and improvement and the municipal government naturally would like to see that the roads are of acceptable standard. Third, the subdivision plans may not be in agreement with the objectives of the land use plan. Finally, if the municipal government is unaware of the new subdivision, the lot buyers could construct buildings without first applying for permit and this may result in the loss of revenue. Several buildings without tax declarations were discovered in 1985 by the assessor's office after tax-mapping activities were conducted in six barangays.

B. Preoccupation with Demands and Complaints of Residents

The Sangguniang Bayan spent most of its time attending to the complaints and demands of the residents from various sectors of the town. Represented by the barangay Chairmen and leaders of private groups the residents requested the allocation of funds for basketball courts, artesian wells, repair of roads, completion and repair of classrooms, health center buildings, and numerous others. The local government, likewise, was asked to assume the duty of paying MERALCO for street lighting in subdivisions.

Citizen complaints often originating from the residents of subdivisions included nuisance caused by foul odor from piggery, poultry, and drying of fishmeal. The homeowners' associations would advise the Sangguniang Bayan not to accept the donation of roads and open space by developers of certain subdivisions due to non-fulfillment of obligations to homeowners.

The land use plan was never a subject of the Sangguniang Bayan's sessions since its approval in 1980. The zoning ordinance, on the other hand, was amended a few times. All the three amendments as recorded in the minutes of the Sangguniang Bayan were for the extension of the industrial zones. Subject to rezoning were parcels formerly in agricultural use.

C. Lack of Personnel Trained in Urban Planning

The planning and development office of the municipality did not have anyone with a background in urban planning. The staff of the office consisted of a lawyer, an engineer, electrician, and clerical assistants. The planning and development coordinator, who was also the civil registrar, had a public administration expertise. This may explain why the matters usually discussed in the Sangguniang Bayan sessions were administrative in character.

The planning office miserably lacked vital information relevant to the understanding of the physical growth of the town. It did not even have an official map to show the approved land use plan. No system of monitoring the physical changes in the different sectors of the municipality was introduced. The assessor's office was better informed about subdivisions and their locations. It had the summary of the uses of land of the whole town from 1980 to 1982, although the objectives of the assessor in keeping such data were different from those of the urban planner.

As regards the functions of the planning coordinator enumerated in the Local Government Code, some of these were taken over by other officials. The local government officer from the Ministry of Local Government did the integration and coordination of sector plans. Analysis of the municipal income and expenditure pattern of the municipality as well as the formulation of fiscal plans and policies were done by the budget officer. No progress was made insofar as promoting citizen participation was concerned. The planning office found the barangay chairmen disinterested in performing their job without compensation.

D. Political Affiliation of the Officials

The municipal mayor and majority of the Sanggunaing Bayan members belonged to the opposition. The town officials apparently felt the lack of support by the Marcos Administration because of their political differences.

There was a feasibility study made on the modernization of the public market in the *poblacion* way back in 1981. The mayor sought loans in the amount of ₱7,000,000 from the different financial institutions of the national government but he never got the loans.

The national highway between Balibago and Tagaytay City was due for widening and improvement. The project had an appropriation approved by President Marcos. However, the mayor claimed, the funds for the project were diverted to other projects in Mindanao.

There could have been other setbacks caused by "politics" but this study did not delve deeper on the problems. The informants were hesitant to give information critical of the Marcos Administration.

CONCLUSION

It is not easy to evolve an effective municipal land policy under a set-up where the development of land is under the control of central agencies. The objectives of the central agencies may sometimes contradict the objectives of the local government. In their zeal to fulfill their functions the centralist planners or technical personnel often fail to consult local leaders. Whenever possible, certain functions should be decentralized to build the capability of the local government to cope with development problems; more so if the local government unit has shown signs of self-reliance and initiative.

Even at the present state (without decentralization) the local government should examine what can be done regarding the expansion of the town. The government unit must have in its employ an urban planner who is trained in land policy matters. This is especially true for the municipalities at the periphery of Metropolitan Manila. Without an urban planner or anyone with sufficent knowledge of urban planning, the local officials might take courses of action detrimental to the future development of the town. No one can advise the officials of the possible consequences of their decisions.

The time for instituting a land policy is now. For some municipalities it might be a bit late, but innovative measures can be introduced to remedy the problems that are already there. It will be more costly to solve problems that grew because of neglect and inaction.

"A sound land policy can direct development to a desired location. It certainly has to be anchored on the land use plan which embodies the aspirations and hopes of the residents. The land use plan can establish the scale of urban expansion realizable within a specified period, judged on the local government capacity to absorb the cost."

ECONOMIC VALUATION OF THE ENVIRONMENTAL QUALITY EFFECTS OF DEVELOPMENT

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INTRODUCTION

In the past, project analysis had given very little attention to the economic valuation of environmental impacts of development projects. The reasons behind this may be summarized into two main points: the lack of adequate interest in conserving the natural resource systems and the environment particularly on the part of developing countries which have concentrated more on production and consumption targets; and the dearth of technical expertise which can enable analysts to factor environmental benefits and costs into the calculation of economic viability indicators like the Internal Rate of Return, Net Present Value, and the Benefit/Cost ratio.

Objectives of the Paper

This paper addresses the following objectives:

1. To highlight the global concerns expressed by various quarters regarding the adverse effects of development on natural resource systems and the environment;
2. To present the attempts made thus far at incorporating environmental effects in cost-benefit analysis;
3. To focus on two (2) specific economic valuation techniques notably the cost-effectiveness and productivity techniques which may be used in quantifying environmental benefits and costs; and
4. To show by way of some case illustrations from the Asia-Pacific region how the above economic valuation techniques are applied.

Scope of the Paper

Section I deals with the global concerns expressed in international conferences sponsored by the United Nations and other U.N.-affiliated agencies regarding the rapid depletion of natural resources and the degradation of the environment particularly in developing countries. Section II shows how cost-benefit analysis (CBA) may be applied to include environmental benefits and costs. A brief inventory of economic valuation techniques is presented to show how monetary values are assigned to environmental benefits and costs. Section III zeroes in on two (2) specific techniques, namely, productivity technique and cost-effectiveness analysis, and provides two supporting case illustrations: The Coastal Development in Tokyo Bay, Japan and the Tongonan Geothermal Plant in Leyte. Section IV gives the writer's assessment of the prospects for the future application of extended cost-benefit analysis, and Section V provides the concluding note.

I. THE GLOBAL CONCERNS OVER THE ADVERSE EFFECTS OF DEVELOPMENT ACTIVITIES ON NATURAL RESOURCE SYSTEMS AND ON THE OVER-ALL ENVIRONMENT

In 1969, The United States passed the National Environmental Policy Act (NEPA) in answer to a legitimate and essential need to protect the environment. The Act required the preparation of a formal Environmental Impact Statement (EIS) for development projects. In 1972, the U.N. Conference on the Human Environment held in Stockholm expressed the worldwide concern that technological change was often accompanied by unanticipated damage to natural resources and environmental quality. The conference made the environmental and natural resource problems of developing countries the object of global attention. The conference called for the need to have environmental policies and assessment procedures.

The concern for the environment permeated many other succeeding world conferences notably the following:

- U.N. World Population Conference in Bucharest in 1974;
- U.N. World Food Conference in Rome also in 1974;
- Habitat: U.N. Conference on Human Settlements in Vancouver in 1976;
- International Conference on the Survival of Humankind in Manila in 1976;
- U.N. Conference on Desertification in Nairobi in 1977; and
- UNESCO/UNEP Intergovernmental Conference on Environmental Education in T'blisi in 1977.

From the above conferences emerged the recognition that "the critical environmental resources of developing countries are today subject to stresses of unprecedented magnitude. Because the health, nutrition and general well-being of the poor majority are directly dependent on the integrity and productivity of these resources, the capability of governments to manage them effectively over the long term may well be the single most important prerequisite to the eradication of poverty, the fulfillment of basic human needs, and the ultimate achievement of sustained development. Conversely, it is the poor who suffer most from the failure to address these problems successfully."[1]

After the Stockholm Conference, many countries started to adopt environmental policies and assessment methods. In the Philippines, on June 6, 1977, P.D. 1151 also known as the Philippine Environmental Policy was decreed which required the preparation of an EIS for all projects, public or private, with significant environmental impacts. The policy was largely patterned after the U.S. NEPA. Earlier, on April 18, 1977, the National Environmental Protection Council (NEPC) was created via P.D. 1121 to serve as the policy formulating body on the environment. P.D. 1586 was subsequently passed on June 11, 1978 which institutionalized the Philippine EIS system. The implementation of the EIS system in the Philippines and elsewhere in the developing world was plagued with a number of problems. These problems include the following: inadequacy of financial resources as well as the trained manpower to effectively carry out the assessment; baseline data on natural resource systems are very limited; and, an essential ingredient to a successful EIS system is the aspect of public discussion of environmental issues which in developing countries, particularly those under authoritarian leadership, has been grossly absent.

In 1980, it was the U.N. Environmental Program (UNEP) Regional Office for Asia and the Pacific which suggested that a model for environmental assessment should include cost-benefit anlysis. However, in the succeeding case studies drawn up, the UNEP model was beset with problems such as double counting, neglect of shadow pricing and the like. Thereafter, the East-West Center, Environment and Policy Institute (EAPI) spearheaded a program entitled: Natural Systems Assessment for Development (NSAD) which among others has been undertaking the following:

1. Defining and quantifying the significant natural systems factors that can limit the success of development projects; and,

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[1]US AID. *Environmental and Natural Resource Management in Developing Countries: A Report to Congress,* Vol. I, (Washington, D.C.: US AID, 1979), p. 10.

2. Evaluating these factors in economic terms for cost-benefit analysis.

The latter involves the techniques which attempt to valuate and monetize nonmarket environmental aspects of development. Some of these techniques will be discussed later in this paper.

II. THE INCLUSION OF ENVIRONMENTAL BENEFITS AND COSTS IN COST-BENEFIT ANALYSIS (CBA)

Cost-Benefit Analysis, Some Basic Definitions:

- A systematic method/technique of identifying and measuring the economic benefits and costs of a program or project. The benefits of a project are the values of incremental outputs of goods and services, including environmental services, made possible by the project, and the costs are the values of incremental resources used by the project.[2]
- An estimation and evaluation of net benefits associated with alternatives for achieving defined public goals.[3]
- An approach rather than a technique which provides a rational framework for project choice using national objectives and values. Projects are judged in terms of their precise impact on the economy, and this impact is evaluated by using parameters reflecting national goals, social objectives and global facts. This definition is more in line with what is referred to as "social cost-benefit analysis"[4]

For purposes of this paper, the first definition is adopted.

CBA, The Conventional View Vs The Extended View

Conventional CBA largely ignores off-site or non-marketed goods, services and effects. Extended CBA, stated simply, picks up the conventional approach and "extends" this to include a wider range of goods, services and effects, i.e., off-site, marketed and non-marketed goods, services and effects. CBA applied in this manner can assist in the protection and management of environmental quality. At the project level, it can help to prevent projects from being undertaken that might lead to reduced levels of socio-economic welfare because of damages to the environment. An example follows to illustrate the on-site and off-site effects.

Illustration: Agricultural activities

If the cropping pattern and farm management practices fail to consider the environment, more specifically, fail to address the soil erosion problem adequately, the following on-site and off-site effects may arise:

On-Site Effects

Erosion affects soil productivity by reducing the available nitrogen in the soil and by decreasing the moisture retention capacity of the soil. Soil loss translates to yield loss. The extent of damage depends on the soil type and the soil depth. Even with fertilizer application, with soil erosion, crop yields decline.

Off-Site Effects

With water-induced erosion, we have soil runoff. Once soil runoff begins, the velocities and direction of the water over the land surface depend on the intensity and duration of the precipitation, the slope, the channels and ditches of the conveyeance systems, and the physical barriers to the flow. The runoff carries sediments or solid materials and other residuals from agricultural activities particularly from irrigated agricultural activities such as nutrients (nitrogen and phosphorous), pesticides, and salts which attach themselves to the soil particles or are in dissolved form. These sediments and residuals find their way into the water system. If the river system flows

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[2]Maynard Hufschmidt, et. al., *Environment, Natural Systems and Development: An Economic Valuation Guide,* (Baltimore: Johns Hopkins University Press, 1983), p. 2.

[3]Peter Sassons and William A. Schaffer. *A Cost-Benefit Analysis: A Handbook,* (New York Academic Press, 1978), p. 3.

[4]UNIDO, *Guidelines for Project Evaluation* (New York: U.N., 1972), p. 14.

into a reservoir, the off-site effects of the sedimentary deposits in the reservoir causes reduced storage capacity, thereby causing reduced outputs of electrical energy and irrigation water, and increasing the potential for flood damages. Another off-site effects of the sedimentary and residual deposits in the river system is the increased turbidity of the water leading to decreased fish production.

The above illustration shows how important it is to consider the environmental quality effects particularly off-site effects in the analysis of projects. The "Environment, Natural Systems and Development: An Economic Valuation Guide" prepared by the East-West Center, Environment and Policy Institute (EAPI) describes the following approach to the problem of economic valuation of environmental quality effects of development projects. The EAPI approach embodies the following steps:

Step 1 — Identity the boundaries of the analysis. The boundary should be wide enough to include most major identifiable results and effects but not so broad that analysis is impossible.

Step 2 — Analyze the activity under consideration and identify all flow of goods and services as well as effects on the environment. This includes the usual marketed goods and services used or produced by the project as well as less tangible, unpriced or off-site goods, services or effects.

Step 3 — Quantify the identified effects. Any effect that cannot be valued or quantified can be retained as qualitative rather than quantitative information.

Step 4 — After effects are quantified, monetary values are placed on these effects. Some of the techniques which may be used for this purpose are covered by this article.

Step 5 — Proceed with the over-all economic evaluation of the project including all direct and indirect, on-site and off-site benefits and costs. The resulting economic feasibility indicators are NPV, IRR, and the B/C ratio. NPV is equivalent to the net benefit of the project when all costs and benefits have been discounted to the present at the selected discount rate of interest. The IRR is the yield or profitability of the project based on the discounted cash flow analysis. IRR is the discount rate which when applied to the stream of benefits and costs produces a zero net present value. The B/C ratio is discounted benefits over discounted costs. Ideally, the ratio should be greater than "1".

Economic Valuation Techniques which may be used in the Quantification of Environmental Benefits and Costs

The follwoing presents a brief inventory of available techniques which may be used in assigning monetary values to environmental benefits and costs:

1. *Techniques based on actual market prices of goods/services:*

   1.1. Productivity or market value technique — Measures the change in the value of the output using market prices. In a watershed project, for example, the environmental benefit may be increased production in the lowland fields due to plentiful irrigation water. The value of the incremental production is the measure of off-sie effects of the project.

   1.2 Earnings foregone or loss of earnings technique — Quantifies the potential savings as benefits to be realized by the project by improving the environmental conditions which result to a decrease in illnesses and therefore less absences and greater earnings. Also included are savings on medical expenses among the affected community residents. For example, a project which will install a new technology designed to correct the air pollution in a cement plant may use the technique described herein.

2. *Techniques based on market prices of environmental protection inputs:*

   2.1 Cost-effectiveness analysis — Asseses the costs of actions that reduce external or environmental negative effects. It seeks the least cost of meeting a given goal. For example, for a project involving the setting up of a treatment plant to handle the wastewater discharged by a textile mill which damages crops, fishery resources, and induces other environmental damages, cost-effectiveness analysis can assess various water treatment options in order to arrive at the most cost-effective solution.

2.2 *Preventive expenditure technique* – This is based on the money spent by industries/firms/agencies to counteract a negative environmental effect. In an airport example, a study was done on the cost to be incurred by nearby residents to soundproof their houses. These preventive expenses were then compared to alternative options that may be applied to decrease the sound generated by the aircrafts such as installing sounds barriers, by initiating engine modifications or undertaking runway realignment. The information on preventive expenditures were used to reach a decision on the control measure to be adopted.

2.3 *Replacement cost technique* – This uses the costs of physically replacing damaged or lost goods/services and treats such costs as the minimum value of preventing these losses. For example, for a soil conservation project in an upland area, mulching and land preparation techniques were examined as a means of reducing soil erosion. The primary benefit was a substantial reduction in the costs of replacing the soil and the nutrients that would have been required in the absence of any soil conservation project. The costs of replacement would have included the cost of the soil and nutrients plus the truck services and spreading costs.

3. *Techniques based on surrogate markets:*

3.1 *Property value technique* – Uses the prices of land, houses and other real property to place a value on a changed environmental variable. For an air pollution control project, for example, information on changes in property value based on a comparison of real properties in a polluted area vs. real properties in a relatively pollution-free environment taking into consideration varying differences in property characteristics such as number of rooms, type of construction, access and other variables provides an estimation of the benefits from decreased pollution.

3.2 *Wage differentials technique* – For some jobs which are hazardous, a wage premium may be required to entice workers to accept such jobs, The wage differential gives some indication of the value of compensation demanded because of these environmental effects.

3.3 *Travel cost technique* – This technique which is often used in recreation projects uses information on visitation rates and the cost of travelling to a site. From these two data inputs, a demand curve may be constructed. From the demand curve, the consumer surplus may be determined. The value of the consumer surplus gives an indication of the benefits accruing from environmental improvement or maintenance.

4. *Hypothetical Valuation Techniques:*

These techniques question the people on their willingness to pay to retain an environmental good/service or their willingness to accept compensation to give up their right.

4.1 *Bidding game* – The person interviewed participates in a bidding process to determine willingness to pay or compensation demanded. For example, in a move to determine whether a public park will continue to be kept open, users were asked if they were willing to pay a certain entrance fee to ensure this. If the response was positive, this initial amount was raised by a certain increment until a negative response was obtained. Once this was reached the amount was correspondingly lowered until a positive response was again reached. The average of such positive responses multiplied by the number of park visitors per year yielded the monetary value of keeping the park open annually.

4.2 *Trade-off game* – In this case, the person interviewed is offered a choice between several goods, one of which is an unpriced environmental good and the others are marketed goods. In a particular case, a person was asked if he preferred a certain amount of money or 20 percent reduction in the noise level for one year. Another person is asked, but this time, the amount of cash is different from the first (either higher or lower) but the 20 percent noise reduction is retained. The information is collated in order to estimate an average per person value of the 20 percent noise reduction.

III. PRODUCTIVITY OR MARKET VALUE TECHNIQUE AND COST-EFFECTIVENESS ANALYSIS WITH SUPPORTING CASE ILLUSTRATIONS

The choice of the two (2) techniques listed in the above is based on the relative ease and the straight-forward manner of applying such techniques in quantifying environmental benefits and costs. Among the methods available, these two are also the most widely used. Productivity technique applies to the valuation of environmental benefits while cost-effectiveness analysis applies to environmental costs.

Productivity or Market Value Technique

The productivity or market value technique also referred to as the change in productivity approach values the effects of development on the natural system by measuring the increase in the physical productivity of the system or the prevention of its deterioration over time. As such, the environmental benefits can either be the increased production or the value of damages prevented. This method is commonly applied to watershed management projects, erosion control programs, reforestation programs and coastal development projects.

Case Illustration: The Valuation of Losses (Benefits Foregone) in Marine Product Resources caused by the Coastal Development of Tokyo Bay[5]

Background Information:

Several decades ago, Tokyo Bay used to be a very productive source of fish and seaweeds, and a popular recreation area. By the 1970's, Tokyo Bay was already surrounded by highly industrialized and thickly populated areas (Tokyo, Kanagawa and Chiba Prefectures). In Tokyo Bay, one finds the heaviest shipping traffic in Japan. As may be expected, the industrial development of the coastal area has destroyed the coastal ecosystem. The urbanization of the surrounding areas has also resulted in polluted water due particularly to the delayed sewerage system development.

In 1961, the Gobernor of Chiba Prefecture announced an ambitious industrialization plan which included land reclamation along the seashore in Tokyo Bay. The land reclaimed from the sea was intended to serve as site for heavy industries. By the early 1970's, the industrial profiles of Chiba, Tokyo and Kanagawa Prefectures have considerably expanded to include 13 oil refineries, 6 petrochemical plants and 12 other chemical plants, 3 iron works, 10 automotive factories, 17 power stations and 10 shipyards. As a result, the productivity of the bay declined and to make up for the lost productivity, compensation payments were made to the fishermen.

Procedures Used: The lesson to be learned from the environmental degradation of Tokyo Bay may be quantified by using the *productivity* technique, which in turn, can serve as valuable inputs to the planning of

[5]Yuzuru Hanayama and Ikuo Sano, "Valuation of Loses of Marine Product Resources Caused by Coastal Development of Tokyo Bay" in ***Economic Valuation Techniques for the Environment: A Case Study Workbook,*** eds., John A. Dixon and Maynard M. Hufschmidt, (Baltimore: The Johns Hopkins University Press, 1986), pp. 102-120.

other similar coastal development projects in the future.

The task at hand is the estimation of the economic value of the marine product resources destroyed by the development in Tokyo Bay over a given period. The economic valuation procedures used may be outlined as follows:

1. Estimate the decline in physical productivity of the marine product resources from the start of the coastal development to the present based on the assumption that such decline has been largely due to the urban and industrial developments in the bay;
2. Using market prises, attach an economic value to the lost productivity. Make assumptions as to future market prices for marine products and then estimate the future annual economic value of the lost productivity.
3. Convert all values to a common price level. The annual value of the lost resources would be the market value of the lost annual output less the estimated capital and operating costs of producing the output.
4. Compute the present value of this annual value using one or more assumed discount rates.

A major issue in the application of the technique is the treatment of the fishermen's labor, i.e., whether at market wage rate or at a shadow price which may be zero. Following the outlined procedures, the case study yielded cumulative productivity losses of 52 billion yen at 1979 prices. This approximates the negative environmental effects (in terms benefits foregone) of the industrial and urban developments in Tokyo Bay on the coastal marine resources.

Cost-Effectiveness Analysis (CEA)

CEA as applied to environmental quality seeks to anlyze alternative ways of reducing the adverse effects of residuals and discharges on the natural system. Its main objective is to arrive at the least or minimum cost of effectively handling such adverse effects on the environment. The geothermal example given below shows how CEA is used.

Case Illustration: Alternative Waste Fluid Disposal Schemes: Tongonan Geothermal Power Plant[6]

Background Information:

The Tongonan geothermal plant lies within the catchment area of upper Mahiao and Sambaloran Rivers, north of Ormoc City in Leyte. Exploration drilling in Tongonan begun in December 1973 and by July 1977, the first deep well was connected to a 3 MW turbine. In 1978, it was confirmed that the Tongonan field represented an exploitable geothermal resource. Because of the reservoir potential, the power plant was expanded under Phase I of the project. Steam will be supplied by as many as 15 wells and will flow in 2-phase pipelines to separator stations. Fluids and steam will be separated in these stations. The fluids will then be disposed of through a waste water disposal system.

The operation of the power plant using the steam geothermal resources will produce residual geothermal waste fluids and gases. These residuals have chemical and thermal characteristics that may have adverse effects on the environment depending upon the rate and frequency of discharge and the scheme of waste disposal adopted.

The geothermal waste fuids contain large quantities of arsenic, boron and lithium. Arsenic can exert detrimental effects on fishery productivity by impairment of growth and other physiological functions. Arsenic can also reduce crop yields. Beyond a certain limit, boron in drinking water may interfere with the digestive processes of man. For plants and animals, boron can be very toxic. For lithium, it may have adverse effects on the delta and marine ecosystems. Although the geothermal fluids from Tongonan contain very low levels of mercury, its effects on the environment should also be

[6]Beta Balagot, "Tongonan Geothermal Power Plant Project in Leyte" In *Economic Valuation Techniques for the Environment: A Case Study Workbook,"* eds. John A. Dixon and Maynard M. Hufschmidt, (Baltimore: The Johns Hopkins University Press, 1986) pp. 83-101.

monitored. In humans, methelmercury is neorotoxic and is only slowly excreted from the system. On marine resources, studies indicate that the presence of mercury at very low levels in the aquatic ecosystem can disrupt the complex interdependency between phytoplankton and the population that feed them. Mercury concentration less than 0.01 mg/lt have caused sublethal effects such as growth retardation, reduction of egg production and hatchability and embryo deformities in fish. Low concentration of mercury can produce genetic aberrations in some animal species.

Procedures Used: The use of CEA in the given example is directed at arriving at the most cost-efficient solution to the waste disposal problem. As such, unlike the productivity technique which is applied in the estimation of environmental benefits, CEA addresses the quantification of environmental costs. In the Tongonan power plant, several alternative wastewater disposal schemes were evaluated. These included the following:

1. Reinjection – Geothermal fluids from separator stations will be piped to reinjection wells within the field.
2. Discharge to Mahiao River without treatment – Simply involves the retention of the waste fluids in a thermal pond for a few days prior to discharge.
3. Discharge to Mahiao River with treatment for arsenic removal – Same as alternative no. 2 except that the thermal pond is treated with chemicals to remove the arsenic.
4. Discharge to Bao River without treatment.– Same as no. 2.
5. Discharge to Bao River with treatment for arsenic removal – Same as no. 3.
6. Disposal at sea with outfall at Biasong Point – A 32-km pipeline will be constructed to the outfall site to be able to discharge the geothermal wastewater direct to the sea.
7. Disposal at sea with outfall at Lao Point – Essentially the same as no. 6 except that it involves the construction of a 22-km pipeline.

Conventionally, CEA will include only the capital costs (construction of pipelines, thermal ponds and the other components of the purification system) and operating and maintenance costs for each of the given alternative. When we consider the effects on the natural system, we then expand the conventional approach to include envrionmental costs. Without the treatment of the residuals, the discharge of the untreated geothermal waste fluids to the river system is expected to affect the productivity of the fields serviced by the existing irrigation systems due to the high levels of arsenic and boron. The loss in productivity represents part of environmental costs. An additional environmental cost is the risk to health of humans and livestock from using polluted river water. Another environmental cost is the adverse effects on the marine life in the area due to water pollution. The effects on the marine ecosystem may be estimated by using fishery productivity data. The procedures outlined under productivity or market value technique should be followed. Aside from the health effects which are difficult to quantify, the productivity losses may be easily quantified by getting the effects of varying levels of water quality on crop and fishery yields. A comparison of yields may be made based on with and without treatment and at varying levels of treatment. We are aiming at the waste disposal scheme which minimizes the environmental losses to the lowest possible level. In this case, alternative no. 5 (Discharge at Bao River with treatment for arsenic removal) was found to be the most cost-effective and environmentally sound.

IV. THE PROSPECTS FOR THE FUTURE USE OF EXTENDED COST-BENEFIT ANALYSIS

The incorporation of environmental considerations in development planning has not received strong support in most developing countries. This view may be atrributable to some misconceptions such as:

- The environmental degradation was principally a problem of rich countries, commonly referred to as the "effluents of affluence";
- Environmental problems in poor countries reflected a lack of development;
- There was an unfavorable trade-off between economic growth and the maintenance of environmental quality;
- Poor countries cannot afford to divert resources which are essentially scarce to environmental protection; and,

- The political view that focusing on the preservation of the environment may be a ploy of rich industrial countries to deliberately keep the Third World at primitive stages of development.[7]

In the decade of the 80's what confronts us even more vividly than in the past is the realization that we cannot sustain development if we continue to disregard the environment. For one, scarcity of resources in poor countries implies a very high value for such resources, hence, the need to judiciously conserve these. Secondly, economic production in developing countries particularly in agriculture, fishery and forestry requires that the productive capacities of natural systems to regenerate growth is insured.

In this context, economic analysis, especially extended cost-benefit analysis, can be used to determine optimum environmental control measures. The problem in the recent past is the difficulty in translating into monetary value some environmental damages avoided. As shown in the earlier sections, some gains have been achieved in this direction.

In the past development decade, developing countries have concentrated more on projects with high impacts or immediate economic benefits with some detrimental effects on the environment. However, environment and economic development should not necessarily be at odds against each other but rather, that each should support the other. In view of this, the move to fuse environmental economics and development planning has begun. With the recent action of international funding agencies particularly the Asian Development Bank in inputing environmental factors in project analysis, if sustained, we can hope to be a step closer at ensuring a healthy environment for our future generations.

V. CONCLUDING NOTE

For economists, the challenge is how to integrate economic analysis with scientific and technical analysis in the generation of natural system and environmental quality impacts of economic activity. We cannot stay just within the confines of our own discipline and remain oblivious to the detrimental effects of some development projects on the natural system. For the economist-planner, the challenge is even bigger inasmuch as our professional responsibility goes beyond economic planning to encompass land use planning. It is in the latter that environmental factors come significantly into play. Promoting environmental consciousness within our ranks is certainly a first step. Disseminating technical information on the environment is the next step. For us educators in planning and economics, these tasks become very urgent before time runs outs.

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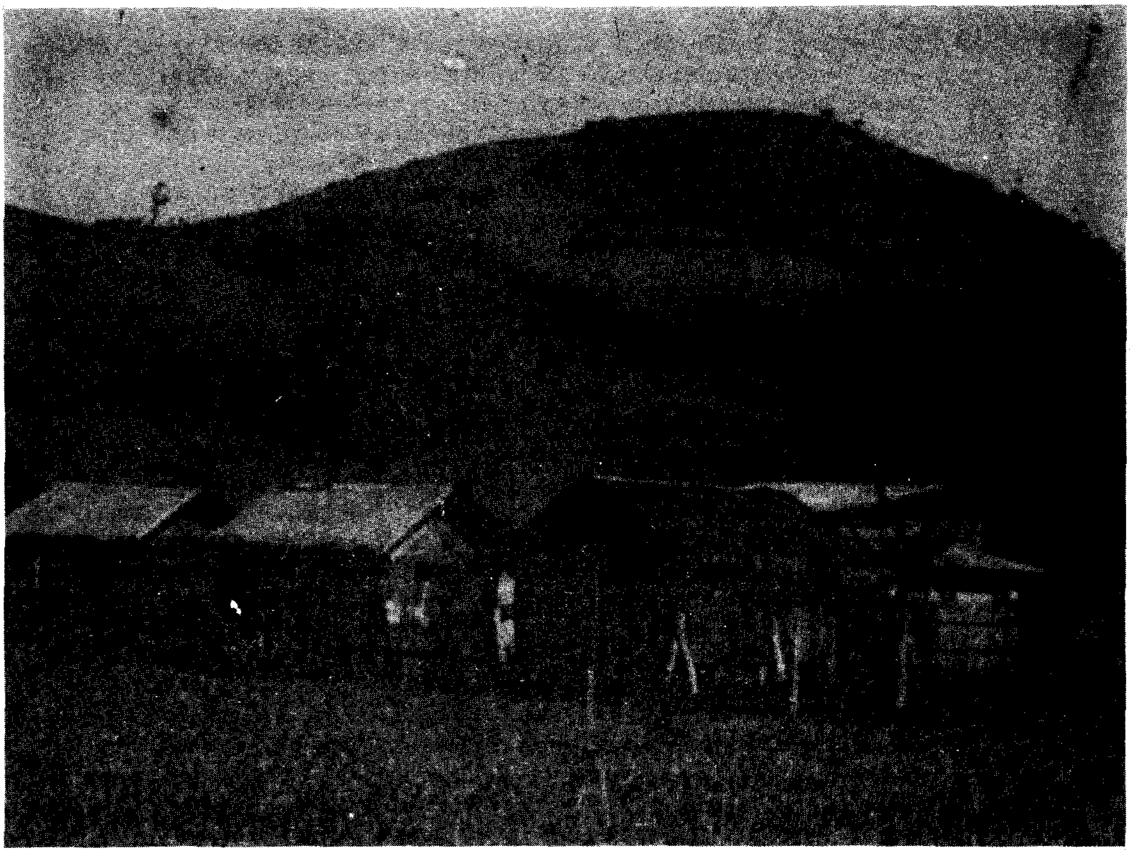
[7]Charles Pearson and Maynard M. Hufschmidt, *Incorporating the Environment in Development Planning: A Report of Work at the East-West Environment and Policy Institute,* (Honolulu: East-West Center, 1978), p. 2.



"We have to act fast! If we do not heed the pleas of the government and those concerned to safeguard our forests, where will we go?"

PHOTOGRAPHED BY PROF. ERNESTO M. SEROTE

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