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# The PHILIPPINE GEOGRAPHICAL JOURNAL

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**PHILIPPINE GEOGRAPHICAL JOURNAL**

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**GEOGRAPHY — THE CORE IN ENVIRONMENTAL  
EDUCATION<sup>1</sup>**

by

DOMINGO C. SALITA<sup>2</sup>

The United Nations Conference on the human environment held at Stockholm in June 1972 focused world wide attention on the efforts of man to have better through the use of science and technology which ironically brought harmful effects in his life and well-being. Such effects include the degradation of the natural resources, pollution of air, water, and land, depletion and extinction of some flora and fauna, uncontrolled rural-urban migration, conversion of good agricultural lands into urban lands, population explosion and the problems of human settlements.

The term environment may mean differently to different people. One scholar defines the environment as the unique skin of soil, water, gaseous atmosphere, mineral nutrients and other organisms that cover the otherwise undistinguished planet earth. Another writer defines the environment as constituting the natural things that surround us from the essentials to sustain life such as air, water, and land to the non-essentials including the living space which nevertheless make life sustainable. As used in this paper, the environment is that aggregate surroundings that influence the growth and development of the life of an individual or population, especially man. It includes the physical, biological, and socio-cultural environment. The physical and biological environment represent the natural systems while the socio-cultural, the man-made aspects of the surroundings. Because of this broad concept, the study of the environment intersects many disciplines and involves

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<sup>1</sup> Presented during the 23rd International Geographic Congress held on July 27 — August 3, 1976 at Moscow, USSR.

<sup>2</sup> Professor of Geology and Geography, University of the Philippines and Vice-Chairman, National Committee on Geographical Sciences, National Science Development Board.

several branches of knowledge — the natural and social sciences as well as the humanities.

The Belgrade Charter published in the initial issue of UNESCO-UNEP Environmental Newsletter defines the goal of environmental education as follows: "To develop a world population that is aware of and concerned about the environment and its associated problems and which has the knowledge, skills, attitudes, motivations, and commitments to work individually and collectively toward solutions of current problems and the prevention of new ones." This goal laid down the basic guidelines for the worldwide environmental education which is applicable to both the developed and developing economies.

In the Philippines which is fast approaching an agro-industrial economy, the study of the environment has acquired a very significant role. It is observed that much of the damage to our natural resources the quality of our environment can be attributed to ignorance and because of this, the impetus of the movement in environmental education is getting accelerated momentum. In May 1974, the Philippine National Science Development Board and the United States National Academy of Sciences sponsored a workshop in Manila on education and training needs for the Philippine environmental program. The workshop underscored the importance of education and training in solving environmental problems and recommended that environmental studies be introduced in the elementary, secondary, and tertiary levels of education. The contemplated reform in the educational process is central to the promotion of a new socio-economic order. The basic cause of our environmental woes is man's lack of ecological sensitivity. Unless the youth receives a new kind of education that is ecologically oriented and until the environment is regarded as a responsibility rather than an economic opportunity, the programs and approaches to economic development will only be short term pallatives. The heated debate going on between economic development and the maintenance of environmental quality will only slow down the progress of mankind until man can become aware of his fellow organisms and the correspondence between their well-being and his own. Education moulds human values and this makes man more keenly interested not only in his own survival but also in the society where he lives.

Environmental education should consider the environment in its totality — the natural and man-made as well as the social and health sciences and aesthetics. No single discipline can cover adequately all aspects of the environment. The approach must be both inter-disciplinary in nature. The interdisciplinary approach means that disciplines are applied to a given problem which will complement and supplement one another in such a way that an integrated conclusion can be drawn

instead of the isolated findings of the different disciplines. In a multidisciplinary approach the findings of the individual disciplines are brought to bear on the problem in a cumulative manner. In the interdisciplinary approach there is interweaving of the disciplines whereas in multidisciplinary, the disciplines may overlap each other but they are all oriented toward the solution of a given problem.

How then is the discipline of Geography related to the study of the environment? In 1968 a joint inquiry by the International Bureau of Education and UNESCO noted that the study of the environment is an essential part of almost every subject and geography was ranked first in terms of its contribution. The geographer has not, however, taken the lead in focusing attention to the study of the human environment. To arouse his sensitivity it is pertinent to examine the nature and the role of geography in environmental education. Geography is a broad division of human knowledge which is concerned with the study of the surface of the earth and the relationship between man and his environment. The surface of the earth is in the nature of a thin shell that extends slightly above and below the surfaced proper. It is in this thin zone of contact between the gaseous envelope above and the solid and liquid spheres below that life in its various forms exists. This is in effect the human environment.

The surface of the earth is made up of two interrelated features: (1) those that are provided by nature such as climate, surface configuration, soils, economic minerals, surface and underground water, and native plant and animal life including the forest and fishery resources and (2) those which man has added through living on the earth and using its resources such as population, settlement, communications, transportations, farms, factories, irrigation, mines, and others. These two groups are designated as the natural and cultural features, respectively.

The surface of the earth can also be looked upon as being made up of the atmosphere, hydrosphere, lithosphere, biosphere and homosphere. Because of the broad and rich coverage in the study of the surface of the earth several disciplines participate in the study of the natural and cultural environment. Thus, the study of the atmosphere, the element and control of weather and climate and their ramifications is claimed to be the prerogative of the meteorologists and climatologists while the study of the hydrosphere including the marine, brackish, and fresh water as well as surface, ground and oceanic waters is staked by the oceanographers and hydrographers. The lithosphere which comprises the solid portion of the earth such as the soils, rocks, minerals including coal and oil is mainly the domain of the geologists. The biologists on the other hand claim as their territory

the study of the plants and animals. This include the grasslands, forests, agricultural crops, wild life, fishery and livestock resources. The study of the works and activities of man as a social being is the concern of the social scientists. This includes the institutions, social organizations, industrializations, urbanization, demography and other socio-cultural features of the earth.

Since the study of the surface of the earth has been partitioned by the various disciplines what is then the role and the portion left to the geographers? Obviously, then, the subject matter of the surface of the earth as it relates to geography must be studied in a special way. It is not the study of the features of the earth in isolation that concern the geographer. To him, it is the interrelationship of all those elements — physical, biotic, and human — that is significant. This is the very essence of environmental education. Geography synthesizes and integrates all the elements of the surface of the earth in an holistic way. By its nature, geography is environmental oriented and interdisciplinary in character for it makes use of the findings of other disciplines in integrating and arriving at a rational conclusion. It provides the connecting link between the natural and the social sciences as well as the humanities. It holds the distinction of being the "queen of the sciences" as well as being dependent upon the knowledge of sister sciences.

The main trust in the study of geography is earth and man. The earth provides the physical, biological, and socio-cultural environment. Such study is not limited to an examination of the natural and cultural features but include the analysis of the relationship and interdependence of the various elements. As one writer has put it, everything else is related to another. The tradition of studying the influence of the environment to man and inversely the influence of man to his environment including pollution and the degradation as well as the conservation of the natural resources has long been and is still the legitimate sphere of the geographer.

Because of the richness of its contents and the integrative as well as interdisciplinary nature of geography, it can very well serve as the core in environmental education. No other discipline can cover as much ground as geography in its treatment of the various aspects of man's relation to his environment — the inanimate and animate world including man himself. The geographer however, does not claim that he can cover the entire field of environmental science, rather it can provide the foundation in the understanding of the complex relationship of man to his environment. Because of this fact, the discipline of Geography should be studied in the elementary, secondary and tertiary levels of education.

In asserting this role, the geographer finds justification not only on the subject matter covered but also on the objectives and approaches in geographical study. The main objective in the study of geography is to picture man's habitat and to show his relation to it. Geography enriches the value of liberal and professional education by giving man a broad perspective of the physical, biological, and social environments. Specifically, geographical study provides the following meaningful objectives:

1. It promotes the study of environmental education and conservation of the natural resources to maintain a desirable quality of the environment. The growth of population, urbanization, and industrialization are affecting the quality of the human habitat and the survival of man. Man must consider himself as part of nature and not apart from it.

2. It interprets the interrelations and interdependence between the natural and human resources and how these can serve as the basis for socio-economic and political development. Progress is brought about by the proper conservation and utilization of the human and natural resources.

3. It stimulates the observation of natural and cultural patterns of the earth's surface which brings about better appreciation and understanding of the landscape. The cultural works of man are invariably influenced by the nature of his physical surroundings and inversely the cultural features affect man's thinking and behavior.

4. It provides the key to the promotion of international understanding among the peoples of the world on the realization that there is a global interdependence among men. No man is an island. Since the countries produce different goods and services, trade is necessary to satisfy human wants.

5. It fosters the appreciation of similarities and dissimilarities from one region to another, the haves and the have nots, the developed and less developed areas of the globe and to find causes and solutions therefrom. This will promote better understanding, tolerance and goodwill among men.

As in many other sciences, in geography, systematic and direct observations and descriptions are preliminary to the interpretation of the relation between the physical environment and man's activities. It also utilizes the holistic and ecological approaches in its study. The results of his observations are then analyzed, synthesized, and recorded in maps, graphs, or charts which are the tools of the geographer. This then will provide the basis in explaining the causes and interrelationship of the physical, biological and human spheres of the earth.

Geography with its emphasis on the study of man and his environment and with a view to understand the patterns and processes involved utilizes the following three methods of approaches:

1. Systematic Analysis — Geography, like any other science uses the systematic or topical approach in analysing and interpreting the interdependence among the various aspects of the natural and cultural features of the earth. The analytical study of the atmosphere, hydrosphere, lithosphere, biosphere, and human sphere is undertaken and their relations to man and society are evaluated. Man himself including his growth, development, distribution, settlements and works is examined to find his role in the man-environment complex.

2. Regional or Spatial Analysis — under this approach, a region such as a city, a country, or a continent is taken as a unit of study. The study of the world as a whole can also be considered under this approach. Moreover, some environmental problems such as marine pollution, food supply, and the energy crisis, among others, are not only regional but are also approaching global proportions. The various cultural and natural features of the region are studied in their spatial arrangement in a holistic way. The systematic approach is also utilized in studying the different geographic elements of the region with emphasis on their contribution to the economic, social, and cultural development or stagnation of the area.

3. Ecological Analysis — In ecological analysis, the concentration is upon man-environmental relationship within a geographic unit. The flow of matter and energy in and out of the structural unit called ecosystem is analyzed and the resulting effects on life are emphasized. An ecosystem is any unit that include all the organisms in an area interacting among themselves and with their physical environment. In the ecosystem, the flow of energy and materials lead to an understanding of the structure, biological diversity, and material cycles that take place in a natural or human community.

Considering that the subject matter and objectives of geography cover the broad spectrum of the human habitat and the systematic, spatial, and ecological analysis are utilized in its approach to the man-environment complex, it is reasonable to conclude that the discipline of geography can provide the core and the framework in the emerging field of environmental education. There is a strong congruence between the subject matter of environmental education and the field of geographical studies. Both study the surface of the earth and its relation to the manifold activities of man. In a nutshell the underlying objective, is to understand, protect, and conserve the quality of the environment. But in order that the geographer can take his proper place in environ-



mental education it is necessary that he asserts himself by taking more active role in national and international forums and in disseminating geographic knowledge involving the environment so that his worth can be given proper recognition. No other discipline can cover as much ground on the various aspects of man's relation to the physical, biological, and social environments than the field of geography. For geography is the study of the philosophy, the art, and the science of the earth as the home of man.

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# NATURAL RESOURCE CONSERVATION: GEOGRAPHER'S VIEW<sup>1</sup>

by

DOMINADOR Z. ROSELL<sup>2</sup>

## INTRODUCTION

The human race, down through the ages, has not only been breeding itself to extinction but also bringing about the destruction of all other forms of life on the earth planet as well. Man's insatiable love for physical well-being and convenience to the detriment of his environment had moved Alexis de Tocqueville to write 130 years ago. To satisfy even the least wants of the body and to provide the little conveniences is uppermost in every mind. The love of well-being has now become the predominant taste of the nation; the great current of human passions runs in that channel and sweeps everything along in its course.

But things now seem promising; for now, man, faced with the appalling population of 4 billion (2) and the wanton depletion of natural resources, is belatedly coming to terms with his possible sins of neglect in the decaying state of his environment. He can no longer run away from grim reality which is, if he has to survive, much less improve his standard of living, he must create for himself a healthy harmonious relationship with his total environment.

## ROLE OF THE GEOGRAPHER

What contribution can geographers possibly provide to the conservation of natural resources and the maintenance of environmental quality to ensure continuity of a good life in our planet?

By the year 2000, it is projected that the planet earth will have eight (8) billion people with Hong Kong, for instance, having 8 million. It is well and nice if we are all chummy, and the carrying capacity of the area and community is not strained beyond the point where it can maintain the biotic potential and the environmental resistance. It is the purpose of this paper to present the principles and concepts of the conservation of natural resources on the basis of the geographer's

<sup>1</sup> Paper read during the Jubilee Symposium on Geography and Environment in Southeast Asia, Hong Kong University, Hong Kong, June 21-25, 1976.

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view point. Since I have no idea of the extent of the natural resource of South East Asia, much less of their utilization, my presentation will be anchored to the area of the Philippine setting.

### GEOGRAPHICAL SETTING

*Geography and Environment in Southeast Asia*, as theme of this Jubilee Symposium of the University of Hong Kong, is indeed a very timely subject for discussion in this time of rapid changes. While this occasion celebrates the 25th year of the Department of Geography of the Hong Kong University, it becomes doubly meaningful that Hong Kong University sponsored this symposium because of another valid reason. It is because Hong Kong University has a very strong faculty in Geography in this part of the SEA (1). The Philippines being within the SEA region naturally shares with Hong Kong University's thinking regarding the importance of a study of the Geography and Environment in this area, which we are going to do.

Table 1 shows the population data of the countries within the region. There are twelve (12) countries in SEA, with Hong Kong considered by the World Bank Atlas as within the region of East

TABLE 1. WORLD POPULATION DATA, SOUTHEAST ASIA AND HONG KONG<sup>3</sup>

	Estimate As of Jan. 1, 1973	Urban Pop. %	Rural Pop. %	Area in Sq. Km.	Density Per Sq. Km.
1. Brunei	142,000	56	44	—	—
2. Burma	29,213,000	19	81	678,033	39
3. Cambodia	7,659,000	13	87	181,035	36
4. Indonesia	128,121,000	18	82	1,491,566	76
5. Malaysia	11,681,000	43	57	332,000	75
6. Laos <sup>4</sup>	3,163,000	16	84	236,800	17
7. Philippines	41,288,000	35	65	300,000	120
8. Portuguese Timor	632,000	11	89	—	—
9. Singapore	2,201,000	110	0	581	3,422
10. Thailand	39,075,000	15	85	514,000	66
11. North Vietnam	19,743,000	18	82	158,750	30
12. South Vietnam	19,561,000	25	75	173,800	100
Total for Southeast Asia	302,479,000	22	78	—	—
Total for Hong Kong (East Asia)	4,140,000	92	8	1,024	4,043

<sup>3</sup> From World Population 1973, U.S. Department of Commerce, Bureau of Census; World Bank Atlas, 1972; and Political Geography by Norman J.C. Pounds, 1972, 2nd Edition.

<sup>4</sup> Includes West Malaysia, Sabah and Sarawak.

Asia. The countries making up Southeast Asia are: Brunei, Burma, Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, Portuguese Timor, North Vietnam, and South Vietnam.

## NATURAL RESOURCES AND CONSERVATION

What are Natural Resources? And what is meant by Conservation? How are they related to each other?

Natural resources are naturally occurring substances and considered material things. These include: (1) on the surface as land and soil, water, natural fauna, and natural flora; (2) underneath as minerals and underground water; and, (3) below the sea as fishes and other marine flora and fauna upon which man derives his livelihood and well-being. These resources together with climate and landforms or topography comprise the earth resources that are considered elements of the natural environment that affect or control the activities of man.

*Semantic Problem of the Word Conservation.* — During the last half century, the word conservation is one of the most controversial and misused word in English Language. Schoenfield Clay said that the term conservation was "invented" 60 years ago and has become one of the most comprehensive, evocative and contradictory word in American Lexicon. Conservation can carry connotation of birth control or contour cropping of land, tempest in teapot or quiet of wilderness areas or tourist traps. So diffused and shop-worm has conservation, as a word, become that we are seeing the term increasingly replaced by such phrases as natural resources management, environmental control, quest for quality manland ethic, and so on, in an effort to lend new prestige, if not precision. (11)

Since President Theodore Roosevelt, Gifford Pinchot and others defined conservation as wise use of natural resources, "all sorts of people must have crawled under the blanket and snuggled down. People with many interests to promote and people with various conservation philosophies have adopted the term to their own devices, until today it is in danger of becoming one of the glittering generalities. The number of definitions of the word "conservation" is directly in proportion to the number of scientists and interest groups concerned with natural resources."

Conservation, as defined by Webster Dictionary, means, the act of keeping or protecting from loss or injury. The dictionary further quotes W.H. Taft's Speech on September 5, 1910 before the conservation congress in Saint Paul, Minn. as follows: "Conservation as an economic and political term means the preservation of our natural

resources for economic use so as to secure the greatest goal for the greatest number." This definition sounds too idealistic and unless further explained would only mean the keeping of the natural resources for somebody else. On the other hand, that definition established the subject for discussion which challenges others whose philosophies of life in this world are for the establishment of a better place to live in. The geographer, agricultural economist and sociologist advanced their definition. (6)

The geographer defines conservation as the wise utilization of natural resources which would minimize loss and avoid waste. This also means the employment of all faculties of good judgment for the efficient utilization of certain resources in question. The economist, on the other hand, defines conservation as "conservation in practice as in public policy is to increase the productivity of our natural resources and to heighten social values." Thus, conservation may be characterized as a prudent administration of the natural agents of production enforcing reasonable strain and efficient utilization in the appropriation of the physical resources of the earth, and when feasible, promoting their reclamation to the end that productive capacity shall be economically developed and maintained and the natural inheritance of the earth shall be improved. Following the trend of this definition, it seeks to provide for a well-balanced production and consumption of resources for indefinite time. (3)

In the Philippines, especially the Philippine Geographical Society, National Committee on Geographical Sciences, the College of Arts and Sciences of the University of the Philippines and recently the newly established Department of Natural Resources of the Government have a big stake in the correct meaning and the application of the word conservation. When we talk of conservation, we are concerned with natural resources and vice-versa.

### EXPLOITATION vs. CONSERVATION OF NATURAL RESOURCES

To an engineer, exploitation is a perfectly respectable term, meaning to develop for use and benefit. It comes from a word meaning to unfold. To the conservationist, it has an evil meaning: Wrong, destructive and selfish use. Here is where the word exploitation differs from conservation, both economically and morally. Conservation as applied to land and to other resources means wise use. (10)

To illustrate — let us consider the natural drainage arteries of an urban area. In the Philippines we call these drainage arteries "Esteros" of which we have quite a number in the City of Manila. For conservation of these esteros, we keep them clean and dredged as often

as possible to keep the rain water flow freely and avoid flood during the rainy season of the year. Other people, however, especially the affluent and the capitalists or the oligarchs exploited these channels by constructing commercial and business buildings on these esteros, thus obstructing the flow of water. The volume of flowing water particularly during heavy and continuous rain that occur during the monsoon seasons of the year rises in great proportion and causes floods. This kind of exploitation of a natural resource is a clear violation of the Constitution of the Republic of the Philippines.

### NATURAL RESOURCES AND THEIR CONSERVATION

The Philippines is rich in natural and earth resources. The total soil cover is 300,000 square kilometers or 30 million hectares. The mountains, hills and rolling lands are replete with vegetation of forest trees and grasses, of wildlife and comparatively rich in minerals and mineral fuel. The lush forest cover constitutes 52.2 per cent while the non-forest land is 47.76 per cent or 14 million hectares. There are 15 principal metallic and 20 non-metallic minerals in 25 million hectares of geologically surveyed land.

The territorial water is composed of 180 million hectares with 2,200 known species of fish with mollusk life known to be most abundant.

The landforms or topography is generally mountainous, hilly rolling to level with 30 per cent of the area level to slightly rolling as high as 20 per cent slope.

The climate provides abundant rainfall and sunshine giving the whole country twelve months of growing season in the year. Rice and corn can be planted the year round and where irrigation is available, rice crop is grown in three crops in one year. (9)

"The wants of people must be met out of land or go unsatisfied. Of course, different groups of people want different things at anytime. And the wants of individual groups change over periods of time. Conservation insists that land and other natural resources must be used for supplying present wants and maintained in a condition to supply future wants."

### CONCEPTS OF NATURAL RESOURCE CONSERVATION

Professor Behan, in his exposition of the "Litany of Scarcity versus the Challenge of Abundance" presented provoking exposition that lead to various concepts in the conservation or wise use of natural resources. (12)

He started with a paragraph from the book sent to him for review from an obscure professor of an obscure university. Behan said, he is another obscure professor from another obscure American University.

This book, *Natural Resources Conservation: An Ecological Approach*, in its introduction has this to say and I quote:

"America is on the sharp edge of crisis (1973). She is degrading her natural environment. She prides herself on conquering outer space, yet after two centuries she still does not know how to manage her "inner" space here on earth. This environment dilemma is the result of four major factors, namely: rapid population increases, pollution, excessive consumption of resources and the gradual deterioration of land ethics," unquote.

Professor Behan further said: "We all know that the natural resources are fixed and finite. There is just so much, quantitatively of our stock resources of iron ore, petroleum, sulfur, etc. And there is a fixed limit on how much we can grow of the renewable resources — timber, forage, and wildlife. Natural resources are fixed and/or limited." It is on this basis that he called this inventory concept of natural resources conservation.

The other concepts of natural resources conservation that I proposed to present are functional concept, multiple purpose use concept, watershed concept of water conservation and environmental concept.

1. *Inventory Concept*. — The utilization of our forest resources within the context of inventory concept has been going on year after year especially after the World War II when the Philippines went into massive reconstruction program of the economy. With the help of the US dollars and army surplus equipment such as trucks, bulldozers, and such other heavy equipment for road construction, Mindanao island rich in forest resources was the first victim to the unrestricted exploitation.

Conservation of the forest resources within the context of inventory concept, demands that while these resources are being utilized, provision for future generation and use must be programmed. As a tree is cut down for logs and lumber, seedlings of trees must be planted to replace the trees cut and other trees destroyed during the operation. Logged over areas must be planted either with fast growing soft-wood trees that can be harvested in 8-10 years or with other dipterocarp species for a long term period. In this way, deforestation of forest areas will be avoided and therefore, kept evergreen for generation.

This concept of conservation of natural resources especially forest resources if followed strictly will provide our children and grand-

children with forest trees, quality watersheds and refreshing climate for all time.

2. *Functional Concept.* — The conservation of natural resources within the context of functional concept make use of technology as an important component of conservation. In this concept, a resource is more than just the tangible, physical substance. A resource is also defined by the utility we perceived in the substance and by the technology of transforming the potential of the substance into the actuality of satisfaction. "The equation to express this concept is:

$$R = f \text{ (U.S.T.)}$$

therefore a resource is the function of utility, substance and technology. The substance factor, for all practical purposes and orthodox minds is indeed fixed and finite. But the utility factor and the technology factor are not limited at all. We find new ways for and new ways to use, many new substances all the time, and for many old substances too. The logical conclusion here is as simple as it may be startling: Natural resources as function rather than inventories are not the least bit limited." (12)

In the Philippines we find this concept very practicable, effective and constructive. After the great flood in Central Luzon in July 1972, the forest concessionaries of the whole country were given new directives in the logging operations. Only those concessionaries who have equipment and machineries to process the logs into finished lumber and who can use the waste materials in logging operation into useable products like wallboard called "lawanit" and similar products are allowed to continue to operate their concessions. These directives remove the operators whose aims are to exploit the forest resources for few dollars and denude the hills and mountains of forest trees and that their concept of development of our economy is increased exportation of logs and increased the dollar income without thinking of future conditions of the forest resources for the next generation. This is really exploitation of the first degree, and not conservation.

3. *Multiple Purpose Use Concept.* — The utilization of natural resources within the context of multiple purpose use concept makes use of some of the components of the functional concept. Here technology go one or two stages farther the usual transformation of a substance into the actuality of satisfaction.

This concept is being applied more and more on forest and range lands, in watersheds, on water impoundments and water courses. As recreation-use soars, there is a greater need to protect the many fragile scenic and aesthetic areas. Conservation have known and applied the skills and technology necessary to safeguard and improve our resource base. (14)



A good illustration of multi-purpose use concept is the conservation of water. Water, a natural resource, can be utilized to serve many purposes to satisfy human wants. This is besides its use directly for human consumption. Such water uses as recreational, fishery, irrigation and water power all in one system is exemplified in our Upper Pampanga River Project (UPRP) of the National Irrigation Administration (NIA) of the Republic of the Philippines. Completed recently at the cost of about 1 billion pesos, the project irrigates 770 sq. kms. of rice lands during the wet season and 729 sq. kms. during the dry season with an annual production of 570,000 metric tons of rice. The water supply of 2.5 billion gallons (1 gal. = 3.79 liters) in this project will generate 100,000 kw. of hydroelectric power, besides controlling floods, production of fish and promote ecological balance and tourism in the region. Here is water resource conservation under the multiple purposes use concept.

4. *Watershed Concept of Water Conservation.* — Water is an important element of nature and of the human body. Its relation to land is that 71.7 percent of planet earth is water and 28.3 percent land. According to the data produced by the International Hydrologic Decade the total amount of water of this planet is 326,071,000 cubic miles.

1. In the Ocean .....	317,000,000 cu. mi.	
2. On the Surface		
river & streams .....	300 cu. mi.	
fresh water lakes .....	30,000 "	
salt lakes & inland seas ..	25,000 "	
3. Underground Water		
soil & moisture seepage .	16,000 "	
groundwater 1/2		
mi. deep .....	1,000 "	
groundwater 1/2		
more mile .....	1,000 "	2,016,000
4. Glacier & Ice Cap .....		7,000,000
Grand Total .....		<u>326,071,000</u>

(1 cu. mi. of water = 1,101,117,143,000 gallons)

The distribution of water of the world and the amount any country has depends upon many factors, such as climate, soils, topography of the land, natural flora and fauna, and the location and space within the surface of the globe. The Philippines and the countries in Southeast Asia are within the torrid zone north and south of the equator; rainfall is abundant and temperature is warm to hot. As part of the monsoon region of Asia the rainy season is influenced by the monsoon winds. Most of the time torrential rains come sometimes by nine continuous

days at a time. These continuous rainy days cause disastrous floods and destroy lives and properties by the billion of pesos.

The conservation of water where we avoid or minimize floods is one of our problems in the Philippines especially in low and level areas of the country. We are aware of the fact that water seeks its own level. So, wherever the rain water drops or occurs the tendency is to accumulate in the low places. And when the input of water in the area is more than the output, flood occurs. Water accumulation in the area during the rainy days due to lack of passage way to the sea is bound to increase in volume and flood the surrounding area.

The solution would be the construction of a catchment basin big enough to accumulate all running water that come from the watersheds. To illustrate: we construct a basin as big as eight kilometers long, five kilometers wide and ten meters deep in the Candaba swamp. This does not need concrete wall since the excavation will create a natural basin big enough to accommodate 400 cubic kilometers of water.

5. *Environmental Concept.* — To the conservationist, this concept has several implications. To the bird watcher, it is the protection of the bird sanctuaries. To the hunter, it is the preservation and increase of game in the hunting ground. And to the pastoralist, it is living in harmony with nature. About the only group of people who came close to doing this was the American Indians of the early days.

The utilization of natural resources within the context of environmental concept is well exemplified by the projects of the Parks and Wildlife Office of the Department of Natural Resources of the Republic of the Philippines. This concept is not well known by the public because it is being taken for granted.

However, in the case of the famous Rizal Park in Manila, you find the concept being applied and fully appreciated by thousands of people. Trees are planted not for the logs or the pulp they produce but for the shades and the beauty the trees impart to the whole park complex. A hill is constructed to simulate a water fall for the park visitor to see, a long pool of water and fountain create a make-believe of wilderness.

Animals of local and foreign species are kept in well-constructed cages for the park visitors to see and venture into the study of their existence and origin. Flowers of different varieties are planted not to be picked-up but to be admired by park visitors.

The environmental concept can be considered as the results also of the application of the combination of inventory concept, functional concept, and the multi-purpose use concept of natural resource conservation.

In sum, the geographer, as a generalist, makes use of a variety of disciplines to achieve man's desire in the satisfaction of human wants. His concern for the future generations makes him a citizen of the world, not only of an individual country. If man really learns and understands that natural resources are not infinite, he may yet be able to live in harmony with our planet millenia.

It is obvious therefore, that the most urgent need is to find some ways of making conservation education into a law for the young and old to see that the future is still there as good if not better. The law should be instruction, study and discussion of current problems and needs in the conservation of natural resources; included but not limited to air pollution, water pollution, the effects of excessive use of pesticides, the preservation of wilderness areas, forest management and protection of wildlife and humane care of domestic animals, wise use of soil and water, timberlands, forests, minerals, fish and wildlife and the scenic and recreational resources. (15)

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# DEVELOPING SMALL TOWNS IN THE THIRD WORLD

by

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This paper tries to point out the importance of developing a spread of economically viable small towns as minor growth centers in the development of regions in developing countries. In most of the Third World, there is a tendency to allocate scarce resources for the development of the primate cities and a few big urban centers to the neglect of the small country towns and the farm areas. Partly diverting attention away from the big cities to the small towns should help lessen massive rural-urban migration and work more towards an equitable areal distribution of economic and human resources. Small towns, if properly planned and developed, can reduce rural-urban disparity or dichotomy, act as minor growth poles or minimize social dislocation that results from rural-urban migration.

## SPATIAL, POPULATION AND ECONOMIC IMBALANCE

Many writers have observed that the urban systems of most underdeveloped or developing countries in Asia, Africa and South America are characterized by the existence of primate cities in a rather centralized politico-economic structure. More specifically, one characteristic of these urban systems, which is easily discernible from maps, is spatial imbalance, i.e., there is a lack of geographic dispersion of the few urban centers in relation to the primate city. Many parts of the national hinterlands are out of reach of the services emanating from the cities.

Another characteristic is imbalance or irregularity in the distribution of the urban population, manifested in the primate city size distribution of cities<sup>2</sup> wherein the largest city in the country is four, five or more times as large as the next largest city or, according to Breese, when there is "one surpassingly large city in a country as compared with all other urbanization" (1966:48). Thus Mark Jefferson (1939:

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<sup>2</sup> With economically developed countries, the hierarchy of urban settlements is gradual, with the rank-size or logarithmic city size distribution operating, i.e., there is a regular or pyramidal distribution of cities according to size. In Zipf's version, for instance, the rank-size rule states that "if all towns in a region are arranged in descending order by population, the size of the *r*th town is  $1/r$  the size of the largest town, according to the series, 1,  $1/2$ ,  $1/3$ ,  $1/4$ ....,  $1/r$ " (Berry 1964:138; Stewart 1959:240).

231) states his law of the primate city: "A country's leading city is always disproportionately large and exceptionally expressive of national capacity and feeling." Logan observes that smaller urban centers are linked to the primate city through a corridor type of transportation network that services only the cities involved in the "specialist" type of economy (1972:232). Primate cities are usually associated with countries that have until recently been colonized or have been politically or economically dependent on some outside country and are presently the "national capitals, cultural and economic centers, often the chief port, and the focus of national consciousness and feeling" (Berry 1964:147).

Aside from areal and demographic imbalance, the third related characteristic is economic imbalance, which is reflected in a centralized (though poorly administered) economy that specializes in the production of only a comparatively few commodities in an oligopolistic set-up of few controlling firms. Most Third World countries have inherited this centralized economic structure from colonial times, an economic structure that was then characterized by an excessive specialization in the production of materials for feeding the mechanized industries of the colonial powers. As with population bulk, economic transactions since then have been centered again in the primate cities (Logan 1972:232; McGee 1967:16) and, in the present early stages of national development, these cities exhibit a parasitic or non-generative nature. They siphon off investment, absorb rural manpower, have a deleterious effect on the development of other cities, tend to have a higher consumption rate compared to production rate, and dominate the cultural milieu (Hoselitz 1955:278-294).

To correct the above imbalances, there is a post-colonial flurry of activities involving the planned development of more or less dispersed intermediate or secondary urban centers within delineated national regions in order to counterbalance the economic centripetal forces in the primate city (Hansen 1967; Logan 1972; Harvey 1972; Richardson and Richardson 1975). In this, the use of the growth pole model, first propounded by Perroux and later elaborated to model form by other writers, found extensive application (Keeble 1967:282). We see today in most developing countries policies that try to focus a narrow attention on the development of major urban centers despite allocation problems, with a majority of investment resources being channeled to the cities at the expense of the rural hinterlands (Breese 1966:44-45). There is manifested a strict adherence to Hirschman's view that in transitional societies resources should be concentrated in the more promising and dynamic urban centers, allowing the growth spiral mechanism of development to operate and spill over to other regions (Friedmann and Alonso 1964:492).

Although it has been observed, however, that in developing countries urban-industrial centers have a non-generative and exploitive character only in the initial stages of development (Logan 1972: 238-240), there is the temporal question of when the "spread" and/or "trickling down" effects that Myrdal (1957) and Hirschman (1964) speak of respectively will occur. Planners can only hope for the sustained occurrence of these effects as they try to eliminate obstacles in the process. The question of when the urban spillover of the factors of production will "take off" is a crucial one for developing countries which are feverishly grappling with food and population problems.

Witnessing the lopsided set-up in which the primate city and the other big cities receive greater incentives than their hinterlands, there appears to be merit in the simultaneous concentration of development efforts in small towns selected according to their potential for growth over the geographic landscape of settlement hierarchies. Before delving into this topic, a side glimpse into the state of urbanization in cities of developing countries is necessary in order to bolster the need for giving due attention to small towns in national schemes for development.

### URBANIZATION IN DEVELOPING COUNTRIES

In the meantime that planners wait for the non-generative "backwash/polarization" effects (Myrdal 1957; Hirschman 1964) in the big cities to abate, there is the alarming exodus of rural migrants into few urban areas. What has been termed by Mumford as "urban implosion" in the Third World is due mostly to the "pull" of job and educational opportunities in the cities and the "push" of economic hardship in the hinterlands (Hendershot 1969; UNESCO 1956). Labor is being expelled too rapidly from the traditional sector due to the large differential incomes between the two sectors. But when the migrants arrive in the city they cannot all be absorbed by the modern sector since it is highly capital-intensive<sup>3</sup> (Lewis 1965:12).

While the effect of migration on the rural area could be depletion of much-needed manpower,<sup>4</sup> in the city the effect is unemployment and congestion. But for certain socio-psychological reasons the lower class

<sup>3</sup> Reissmann (1968) has commented that the inability of the city to provide for its rural migrants is very true of what he calls "urbanizing" societies. In these societies, the process of change was begun through increase in city population and not through industrial development. Rapid urban population increase has not been matched by industrialization, high per capita income or high literacy rate.

<sup>4</sup> In the more developed countries where mechanized farming is pervasive, rural-urban migration may be beneficial to rural areas as the process will increase the rural capital-man ratio. On the other hand, it may not always be the case if say age and educational attainment selectivity in migration occur in favor of the city, in which case there is no adjustment of resources in the farm economy (Hathaway 1964).

migrants do not leave the urban area. Meanwhile, the city's resources are drained by coping with what Turner calls autonomous or uncontrolled urban settlements (1966:507-531), with traffic congestion, and with shortage of essential services like housing, water, power, drainage and sewage facilities, etc. The city can now hardly perform its function as catalyst for growth from the standpoint of both the government and private sectors. The private sector feels the effects of the government's increased welfare expenditures in the form of hiked taxes and licenses and other fiscal measures.

### DEVELOPING SMALL TOWNS

Where the city becomes congested such that it can no longer provide decent living and job opportunities for its unskilled rural migrants as well as for its established citizens whose numbers also tend to increase with financial stability and better nutrition and hospitalization opportunities, there is an urgent need to apply a strategy for relieving the city of its pressure and for infusing new impetus in the farms. The strategy involves the development of small country towns, within the city-town-village central place hierarchy, as counter magnet to draw new migrants and capital from both the cities and the hinterland.<sup>5</sup> By "town" here is meant an inhabited place larger in area and population than a village or agricultural settlement (Stamp 1966:421). "City" would mean a highly urbanized settlement which is larger in area and population than the town.<sup>6</sup>

*Factors in selecting suitable towns.* — The point is that the places or towns to be selected for development or expansion should exhibit a mild degree of urbanization, i.e., should exhibit rural-urban migration and should partly engage in non-agricultural pursuits. Related to this is the size of the towns to be selected for expansion. It is difficult to prescribe an optimum population size but, on the whole, the town should not exhibit signs of congestion nor should it be too small to be unable to support even the small-scale industries. Thus certain threshold population sizes may be considered depending on the initial economies of scale to be set up.<sup>7</sup>

Seeley (1968:222), after investigating expanding towns in Great Britain, feels that a settlement of from 15,000 to 30,000 population has a better growth potential than a town of say 5,000. The former would

<sup>5</sup> Expanded or improved towns as a planning strategy also provide an answer to the proliferation of ribbon or arterial developments, ill-planned small housing subdivisions, and improper land uses that usually characterize suburban expansion (Ocampo 1975:4).

<sup>6</sup> A more elaborate central place hierarchical set-up would be: regional city/metropolis-city-town-village-hamlet (Berry 1967:13-16).

<sup>7</sup> In general, there should be a diversity of industrial units in order to insure a wider range of occupations and to promote economic stability.

be able to provide more services and amenities and would therefore be more economically viable. Planners, however, should still examine whether there is an urban core which provides sufficient services and amenities for the new residents.

Another factor to be considered when deciding upon the degree of suitability of a town for expansion is location. Towns should be strategically located between big cities and depressed hinterlands and so help as service centers in knitting the lagging areas within a region into a dynamic interdependent whole.

Factors related more to economic viability would be resource endowments, availability of production factors, and communications. A town endowed with certain natural resources has a decided advantage over others despite the fact that natural resources may only aid or stimulate but offer no assurance for sustained development (Perloff and Wingo 1964). Also eligible for selection would be towns that have an industrial tradition or that have a relatively higher supply of production factors like capital, skills, goods, information, etc. Communications, particularly transportation networks, if available, should make initial development moves less difficult.

Other important factors to be taken into account are a town's past history and the wishes of local authority and residents. Expansion must of course try to preserve the beauty, character, charm or outstanding features of a town, i.e., the new town features should be integrated with the old. A survey of wishes and attitudes of local people should also be made prior to development moves from outside, the reason being to avoid the dislocation or disorganization, either physically or socially, that expansion usually brings (Seeley 1968:1, 222).

There is actually a growing body of thought which stresses the need for the development of carefully selected small towns as urban centers of limited size in developing nations (Church 1969:62). Lewis (1965:1-16) in particular has criticized the excessive rate of growth of a few cities in most countries of the developing world. He says:

There is a disproportionate concentration of development and welfare expenditures in towns [cities], a fallacious identification between industrialization and urban size, which leads people to concentrate their factories in one or two very large cities, when it would be more economic [sic] to develop a large number of small country towns, each with some factories and adequate amenities.

*The small town as an integrating force.* — In the city-town-village spatial hierarchy, the intermediate location of the town can work towards the creation of a more socially and economically viable rural-urban continuum rather than a rural-urban dichotomy which only mag-



nifies the disparity between the city and the village. The point being stressed in the focus on intermediate nodal points such as towns is that "rural" and "urban" should not be viewed as polarities. In the words of Adams, they are, from the ecological perspective, related parts of a "single, embracing cultural-environmental system, each changing in close response to changes in the other" (1968:41-59).

In developing countries, during the early stages of a region's growth, there are significant "gaps" in the hierarchical structure of communities, with the disproportionate growth of a few cities in relation to the rest of the economy and with wide areas remaining outside the sphere of any urban influence (Friedmann 1964:349). The development of the small intervening towns will help achieve the integration of these hierarchical gaps or the organization of geographic areas into their component social, political-administrative and economic spaces. In the geographer's language, these small towns can act as minor service or trade centers for the depressed hinterlands such that amenities heretofore out of the reach of rural populations may be provided (Berry 1967:15). In this integrative function the small towns are actually sharing in the larger integrative function of the capital or larger city, as what happens when "the influences spreading outward from cities accomplish both the disruption of traditional social patterns and the reintegration of society around new fundamental values. The city acts as a coordinating, space-creating force, thus achieving the integration of the social order in its spatial dimensions" (Friedmann 1964A:351, 359). In operation here is the idea of functionalism or interdependence between city and region which was popularized by Wirth in the early 1950's (Friedmann 1964B:508-509).

*Viable towns as small growth poles.* — An important rationale for developing towns in the city-town-village spatial continuum is the greater economic viability that towns have achieved as compared to the villages, for instance. Towns which are neither congested nor overly lagging have a decided advantage over villages in the sense that certain requisite factors of production are already present to lower the cost-benefit ratio of development investments. Compared to cities again, towns usually provide important production factors that cities traditionally lack, to wit: raw materials, cheap and fairly qualified labor, nearness to rural markets, cheap site cost or easy leasehold terms, and a pollution-free environment for workers.

By way of elaborating on their role as an integrative element, the small towns can act as small-scale growth poles that will divert and absorb the flow of farm-city migration as well as attract also migration and development impulses from the city. Growth pole models are based on the assumption that the concentration of public

investment and industries in a more or less narrow region will ultimately stimulate the formation of a center of growth to which labor, raw materials or foodstuffs are drawn (Keeble 1967:283). As mentioned before, the few large urban areas in developing countries strongly exhibit this "parasitic" or non-generative character wherein the city grows at the expense of the surrounding hinterland (Hoselitz 1955:280). This negative magnetic character of the city, however, can be applied as a strategy to work positively for the small towns. These towns can act in the same manner, as magnets to draw incentives from the city and transmit these to the farmlands through a spread-trickling down process which is facilitated by the proximity of the two areas to each other and by increased and improved transportation linkages.

This conversion of the growth pole process into a positive role for secondary urban centers can be seen in South American countries (Richardson and Richardson 1975:163-175), and appears to work there as well as in Africa (Keeble 1967:282). In the United Kingdom the popularity of the growth pole concept is shown by the deliberate planning of certain "new towns" as growth centers, although these are actually satellite cities with large populations ranging from 600,000 to 100,000 and spaced at a minimum distance of 20 miles from the mother city (Keeble 1967:283; Beaujeu-Garnier and Chabot 1967:253-254).

*Socio-demographic rationale for developing small towns.* — Against the backdrop of migration that cannot and in some instances should not be stopped (Callaway 1966:18), a very important function of towns would be to prevent the abrupt disruption of the existing framework of social interactions in the village arising from the separation of farm migratory workers from their kin, friends and neighbors as the farm workers move to urban places. If work is in the nearby town, daily commuting or visiting is possible without the village social institutions being disturbed. More important, on the other hand, would be saving the individual migrant from the ill effects of being uprooted and in turn immersed in a new unfamiliar social environment such as the big city. If the worker chooses to reside permanently in the town, the place with its partly rural and partly urban mode of life offers easier adjustment, whereas if he moves to the city he may experience the bewilderment and possible subsequent maladjustments many rural migrants are prone to experience upon being thrust into the urban life style. For as Wirth says, the city with its big size, high population density and heterogeneity only fosters secondary contacts (vis-a-vis primary relationships) — contacts which are "instantaneous self-expression, morale and sense of participation that results

from such a relationship may be the source of what Durkheim calls "anomie" or social void, which may find expression in "personal disorganization, mental breakdown, suicide, delinquency, crime, corruption and disorder . . ." (1968:53,61). The town will soften up the possible undesirable impact resulting from being uprooted in the case of permanent movers since primary contacts are still in operation in the small, albeit developing, town. And, as in the Philippines, there are always relatives and friends living in the "poblacion" or town center to provide the feeling of security and belongingness.

### THE ROLE OF GOVERNMENT

In the context more or less of democratic institutions, it is the government sector that should play the major role in conceiving, implementing and coordinating the complex operations involved in creating spatial, economic and social balance in a region. It should take bold positive steps using its latent power rather than play a passive role or simply leave development to the market mechanism.<sup>9</sup> In fact, social scientists urge that small developing countries should have a centralized economy which should be strict enough to ensure that essential priorities are observed or authoritative enough to intervene against interests inimical to the development process (Meynaud 1963:21; Spengler 1960).

At the outset, there is of course the need to relate the specific programs in the towns to national plans (Rodwin 1964:58; Leven 1964: 595-596). Or if there is a planned system of very large growth poles, the selection of target small towns should be spatially and economically related to these large regional centers.

One obvious strategy the government should start in small towns is to invest in labor-intensive industries in order to absorb rural migrants. To attract similarly oriented private businesses, liberalized credit policies, moderate taxes and other investment inducements may be programmed. To discourage the overconcentration of agglomeration economies in the big cities, stringent fiscal policies such as increased taxes or high interest rates may be resorted to, although these measures should be used with caution as they create certain problems in the context of a market economy. One problem that may arise, for instance, is that tight fiscal procedures may dampen or inhibit entrepreneurial ventures. The propulsive industries that will be set up in the towns will

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<sup>8</sup> There are sociologists who point out, however, that social integration does operate in the neighborhoods of the city. In the Philippines, for instance, we see a case of a high frequency of personal ties in lower class neighborhoods such as Tondo (Hollnsteiner 1969).

<sup>9</sup> To wait, for instance, for wages or other costs to rise unduly in the city so as to force factories out to profitable regions may take time or involves the element of uncertainty.

attract the non-farm workers in the big cities as well as the farm workers in the villages. Part of the farm work force may not entirely abandon farm work but may seek employment in the town only during slack agricultural periods. This would work towards lessening the commonly reported gap between non-farm and farm incomes that exist not only in developing but even in developed countries.

A strategy which sorely requires the use of government power is relocation. When economic and other attractions are weak in the smaller growth centers, the government can always step in to decongest the big cities through resettlement of urban squatter residents in the small towns to be developed.

Another policy action that does not involve so much the coercive powers of government is to increase public expenditures on economic and social overhead capital in small towns. As has been stated, the tendency of the government in newly developing countries is to allocate the majority of infrastructure funds in the big urban centers,<sup>10</sup> partly with the objective of making these centers showpieces to nurture national pride. However, more considerations along the lines of social equity, which should be the real goal of regional development, should enter into government programs. The physical infrastructures and services that must be initially provided are: roads, electricity, water supply and waste disposal, medical facilities, educational amenities, communications services and recreational facilities. Further, according to Rodwin (1964:56), town infrastructures should always be tied up to whatever national or regional infrastructure programs are in existence, for a planned infrastructure program is essential to the creation of a national market as the non-monetized regions are closely knit into a single unified economy, culture and urban system.

The transportation network is particularly important in bringing about what Logan calls the "structural transformation" of ex-colonial developing countries, i.e., the breaking down of the spatial, economic and institutional barriers that limit a country's capacity for growth. It is in facilitating the transmittal of development incentives (capital, entrepreneurial skills, goods, information, etc.) from city to town and from town to village that the value of arterial roads come in (1972:230-231). But planners should always bear in mind that transportation facilities may not always encourage the flow of demand and other incentives toward the town as when economic centripetal forces are stronger in the city.

<sup>10</sup> The idea of equal allocation of public funds among regions for economic development is of course by practice not recommended in regional planning; the needs of specific regions should actually be considered (Stuart 1967:421-473).

In the process of bridging the economic gap between the city and its hinterland, much government effort should also be channeled towards increasing production in the agricultural sector through informational drives in the use of improved farm practices, introduction of innovational ideas like labor-intensive "intermediate"<sup>11</sup> technology, and provision of liberalized credit opportunities. More important than mere direct and sudden introduction of improved farming methods is, according to Meynaud, changing traditional attitudes in the village or breaking the socio-psychological barriers to economic progress, an objective which can be realized only with time and concerted effort (1963:12). Green Revolution programs should all the more be encouraged, especially along lines of intensive cultivation instead of increasing cultivated acreage, and the building of quality farm-to-market roads should perfectly dovetail with this program in increasing mobility and cash flows. Also, a satisfactory approach to the continued fragmentation of land, which from the economic standpoint usually reduces farm production, should be arrived at.<sup>12</sup> All of these projects will tend to increase rural incomes which in turn will increase demands that will help nurture the multiplier process of development starting from the initial town residentiary industries which will produce non-basic goods for local consumption on to eventual external economies which will produce basic goods for export.

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<sup>11</sup> This means using techniques that employ indigenous labor, resources, folkways and a teachable know-how (Goodman 1970:109). Using less automated technology is not only labor-intensive but minimizes environmental pollution as well.

<sup>12</sup> There are studies contending otherwise that there is no direct relationship between farm size and productivity. Even if this were not the case and land reform programs that result to land fragmentation have to be carried out, technocrats circumvent the problem of reduced productivity anyway through such measures as cooperative and corporate farming.

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# MUSA SAPIENTUM AND MUSA PARADISIACA: THEIR NUTRITIVE VALUE, ORIGIN, AND DISTRIBUTION TO 1600

by

LARRY N. GARRETT  
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## INTRODUCTION

The "fruit of the wise men" (*Musa sapientum*) and the "fruit of paradise" (*Musa paradisiaca*) have a history dating from prehistoric times. The banana was one of man's earliest foods and the banana plant one of the first he cultivated.<sup>1</sup> In contemporary times the story of the banana's distribution across deserts by caravan and the seas by caravel is truly the history of modern man. This paper examines the nutritive value of the banana (*sapientum*) and plantain (*paradisiaca*), investigates the herbs' origins, and their world wide distribution in the pre-Iberian and Iberian periods. The Iberian phase of West European Expansion is generally considered to encompass the period 1500-1600.<sup>2</sup> Although not introduced to North America until 1690, the primary distribution of the plants were accomplished by the close of the Iberian phase.

The *sapientum* and *paradisiaca* are two distinct plants. Bananas belong to the genus *Musa* and to the family *Musaceae*, but the botany of the various cultivated forms is confused. There are over 67 species and more than 200 varieties of bananas,<sup>3</sup> and diverse names are applied to the same variety in different parts of the world.

To add to the confusion, investigators often do not differentiate between the banana and the plantain. The plantain (family *Plantaginaceae*) is somewhat longer and thicker than the banana, and it is less sweet and more starchy. It is eaten like a vegetable and is cooked before being eaten. Some contemporary investigators view *Musa paradisiaca* as a subspecies of *Musa sapientum*, while others hold the opposite to be the case.

The banana, a large herbaceous plant, is perpetuated by sprouts or suckers from the perennial root, rhizome, or rootstock. (Some banana

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<sup>1</sup> "Bananas Versatile in Health or Illness" (1959): 5, United Brands Company, with special cooperation of Deborah A. Hale, Manager Consumer Services. Hereafter United Brands Company materials will be noted UBC.

<sup>2</sup> Stavrianos (1966:87).

<sup>3</sup> Martin (1966:28).



fruit does have small light-brown abortive seeds.) This rootstock grows just below the surface of the soil and soaks up moisture and nourishment. Each rhizome has many buds, and to plant new bananas the rhizomes are cut into bits, each with several buds.<sup>4</sup> These buds sprout quickly, and after the first leaf appears (in three to four weeks) the plants may grow 25 mms or more overnight.<sup>5</sup> The fruit is usually ripe within nine to eleven months after planting the offsets.

The fruit stem, or "trunk," attains a height of 3-12 ms and bears a crown of leaves, 1.8-3 ms long and .6-.9 m broad, with a strong fleshy footstalk and midrib. "Trunk" as applied to the banana stem is a pseudostem of layers of leaves wound tightly around one another. This stem is soft and pithy and composed of about 85 percent water. This gigantic herb is the largest plant on earth without a woody stem.<sup>6</sup>

Flower clusters of yellow blossoms spring in a great spike from the center of the leafed crown, and when the petals fall rings of small banana fingers are left dangling about the stem. These finger clusters, or hands, are composed of from ten to twenty small green fingers, and as the fingers grow, they begin to turn outward and then up. Within a year a stem of about 150 bananas is ready for harvest, then the stem is cut or withers and a new plant will grow into production in about 18 months.

### NUTRITIVE VALUE AND MEDICAL USAGE

*Nutritive Value.* — The banana has long been noted for its generous store of vitamins which make it an excellent nutritional supplement.<sup>7</sup> It is a good source of vitamin A, ascorbic acid, thiamin, riboflavin, niacin, pyridoxine, panthothenic acid, and folic acid. The banana also supplies potassium, magnesium, phosphorous, calcium, copper, iodine, and other required minerals. The iron content is about double that of an apple and is 100 percent available.<sup>8</sup> Table 1 provides additional detail.

To add to the mineral and vitamin value of the banana, it is low in sodium and fat and contains no cholesterol.<sup>9</sup> In composition, the banana contains 1.2 percent protein, 74.8 percent water, and 23 percent carbohydrates which are from 96 to 99.5 percent utilizable. Starch content differs, being higher in green bananas. As they ripen, their carbohydrates consist entirely of easily digested fruit sugars. Banana composition is further detailed in Table 1.

<sup>4</sup> UBC (1969:4-7).

<sup>5</sup> UBC (1969:7).

<sup>6</sup> UBC (1969:4).

<sup>7</sup> UBC (1959:9).

<sup>8</sup> UBC (1959:11).

<sup>9</sup> UBC (1959:9).

TABLE 1. NUTRIENT COMPOSITION OF BANANA AND PLANTAIN  
100 GRAMS RAW, EDIBLE PORTION.

Composition	Banana	Plantain
water, %	76	66
calories	85	119
protein, g	1.10	1.10
carbohydrate, g	22	31
fat, g	.20	.40
sodium, mg	1	1
vitamin A, I.U.	190	10-1200
vitamin C, mg	10	14
thiamin, mg	.05	.06
riboflavin, mg	.06	.04
niacin, mg	.70	.70
calcium, mg	8	7
iron, mg	.70	.70
phosphorus, mg	26	30
potassium, mg	370	385

Source: United States Department of Agriculture, Agricultural Research Service and United States Department of Agriculture, Athens, Georgia.

TABLE 2. PERCENTAGE OF U.S. RECOMMENDED ALLOWANCES.

Nutrient	U.S. RDA	100 grams raw, edible portion	
		Banana % U.S. RDA	Plantain % U.S. RDA
Protein	65 g	1.7	1.7
Vitamin A	5,000 I.U.	4	2-24
Vitamin C	60 mg	17	23
Thiamin	1.5 mg	3	4
Riboflavin	1.7 mg	4	4
Niacin	20 mg	4	3
Calcium	1,000 mg	.8	.7
Iron	18 mg	4	4

Source: United States Department of Agriculture, Agricultural Research Service.

Table 2 illustrates the percentage of US Recommended Daily Allowance contained in the banana and the plantain. The US RDA are values which the Food and Drug Administration established for nutritional labeling. The US FDA derived the US RDA from the 1968

recommended dietary allowances established by the Food and Nutritional Board of the National Academy of Sciences.<sup>10</sup>

*Medical Uses.* — The banana is adaptable to many therapeutic diets. Because it is purine-free and almost completely allergy free and because it is tolerated in many cases of disease and under many conditions, the banana is widely recommended for special diets. It provides not only a palatable and easily digestible source of food energy but important vitamins and minerals as well.

The versatile banana has long been the basis of many varied diets, ranging from diets for the undernourished to those recommended for the obese. It has been recommended for malnourished infants and for underweight children and teenagers. Dieters recommend the banana because of its satiety value.

Digestive disorders can be successfully treated by a diet containing bananas. Bananas are used for the control of simple diarrhea and for the dietary management of chronic constipation. Their ability to neutralize hydrochloric acid makes the banana useful in many ulcer diets as they prevent mechanical and chemical trauma to ulcers. They are recommended as a sustaining nutrition for patients suffering from ulcerative colitis and peptic ulcers. Because of their blandness and digestibility, they also can supplement the dietary treatment of an irritable colon or bowel, gastritis or gastroenteritis.

The banana is useful in dietary treatment of a diversity of diseases not directly involving the digestive tract.<sup>11</sup> Because of its digestibility and composition, the banana answers the needs of febrile patients, such as those who suffer from typhoid fever. It also serves an important role in the treatment of anemia and other illnesses linked to dietary deficiencies. It is well adapted to diets for kidney disease, uremia, gout, gouty arthritis, high blood pressure, and heart disease.

The light and easily digestible banana is included in the menu for patients undergoing operations, both before and after surgery, as a supplement to regular diet. Its blandness and appetite appeal make the banana perfect for soft diets and for low residue diets as well.

### ORIGINS, MIGRATIONS AND DISTRIBUTION

*Origins.* — While man has long cultivated the banana (perhaps since prehistory), the precise origin of the herb in its wild state is uncertain. Fraser cites its origin as India "... at the foot of the Himalayas where it has been cultivated since remotest antiquity."<sup>12</sup> Ancient Chinese manuscripts referred to the fruit, and it is most probable that

<sup>10</sup> United States Department of Agriculture, Beltsville, Maryland (1974).

<sup>11</sup> UBC (1959:45).

<sup>12</sup> Fraser (1912:713).

the first edible banana grew in the humid tropical region of Southern and Southeast Asia. (See Figure One).



FIGURE 1. ORIGINS. MAP DRAFTED FROM DENOYER-GEPPERT OUTLINE MAP OF THE WORLD #22009 (7009): ADAPTED BY PERMISSION OF THE PUBLISHER, DENOYER-GEPPERT, CHICAGO, ILL.

Source: Extensive review of literature; special emphasis de Laubenfels (1970): 22 and 44-45.

Specifically, the fruit probably developed in the Malesian rainforest (malesian flora or humid austromalesia) of the Laubenfels' Austromalesian floristic realm.<sup>13</sup>

*Migrations and Distributions.* — At about the time of Christ the first Polynesian migration is credited with bearing bananas far into the Pacific.<sup>14</sup> Lehner and Lehner attribute these migrations to the "over-population and the exhaustion of the soil in these parts of south Asia . . ."<sup>15</sup> Asian peoples carried the banana rootstocks, along with other agricultural products, to Sumatra, Borneo, Java, Formosa, the Philippines, and even Hawaii and the Easter Islands (Rapa Nui),

<sup>13</sup> de Laubenfels (1970:27 and 44-45).

<sup>14</sup> UBC (1959:5).

<sup>15</sup> Lehner and Lehner (1962:68).

"... a mere dot of earth almost 2,000 miles (3,218 kilometers) from the nearest inhabited land."<sup>16</sup>

White<sup>17</sup> has written an interesting paper concerned with whether it was the stem or the fruit of the early banana which was eaten by man. He notes that one of the earliest written records of the banana, provided by Megasthenes (303 BC), "... speaks only of the pseudostem as being eaten." Another early source for botanical knowledge is the Greek philosopher Theophrastus (c. 372-287 BC). Theophrastus described the banana in his *History of Plants*, which with the *Etiology of Plants* presented the first thorough treatment of the science of botany. While it is commonly acknowledged that the first non-Asian contact with the fruit came in 327 BC during Alexander the Great's invasion of India,<sup>18</sup> it was only in 79 BC that the Roman encyclopedist Pliny referred to the banana as "the fruit of India upon which the sages live."<sup>19</sup> White<sup>20</sup> examines Pliny's interpretation of Theophrastus' statements and takes a liberal translation concluding: "... Though using the name *Musa*, (Pliny) does not say whether the fruit or stem was eaten." Humbolt, in discussing Pliny's inferences, points out that among the many Sanscrit names for the fruit are *varanabuscha*, *bhanuphala* (sun fruit), and *moko*, from which the Arabic *mauza* is derived." "*Phala* (*pala*)," he continues, "is fruit in general, and it is therefore only by a misunderstanding that it has been taken for the name of the plant."<sup>21</sup> Interestingly, Serpenti<sup>22</sup> reported one species, *Tèpijie*, as the "sweet-tasting stem of a banana," and this species was eaten in New Guinea as late as 1965.

It was only in the 18th century that the naturalist Linnaeus used Pliny's concept of the "fruit of the wise men" to term the banana *Musa sapientum*. He named the plantain *Musa paradisiaca* or "fruit of Paradise," and his choice here may have been influenced by the Spanish. In 1745-1747, Thomas Astley<sup>23</sup> noted that the banana "... contains a yellow pulp, of the consistence of fat cheese, without any seeds, but only some gross fibres, which represent a sort of ill-shaped cross, when the fruit is cut in two." He continued that the Spanish often called the fruit Adam's Apples, "... supposing them to be the forbidden fruit; and that Adam, on cutting it, saw this cross, as the Mystery of the Redemption." Astley concluded that while some investigators may consider the banana leaves as the clothes worn in the Garden of Eden "... they seem very unfit for clothing (*sic*)

<sup>16</sup> UBC (1959:5) and Lehner and Lehner (1962:68).

<sup>17</sup> White (1930:461).

<sup>18</sup> UBC (1959:5), Conder (c.1828:54).

<sup>19</sup> Atlanta, Georgia, *Journal*, December 5, 1973: 23-F.

<sup>20</sup> White (1930:461).

<sup>21</sup> Humbolt (Otté, translator) (1855:159).

<sup>22</sup> Serpenti (1965).

<sup>23</sup> Astley (1968 Ed.:337-338).

or covering, as a touch of the finger makes a hole in them."

Arabs, trading in slaves and ivory, appear to have introduced bananas from India into Africa<sup>24</sup> (Map Two). "Banana" is adapted from the native word for the fruit in the Congo. Chinese traders helped spread the rootstock in the Pacific. In 650 AD, the banana came to northern Egypt with the Mohammedan conquerors, and from there along the Mediterranean coast to West Africa.<sup>25</sup> Masudi, a poet who died in 956 AD, was responsible for one of the earliest Arabic references to bananas. Masudi praised Kataif, an Arabian confection consisting of almonds, honey, bananas, and nut oil that was popular in Damascus, Constantinople, and Cairo.<sup>26</sup>

In 1460, Portuguese navigators took the banana rootstock, along with black slaves, from Guinea to the Canary Islands (Islas Canarias).<sup>27</sup> It is generally agreed that the banana rootstock was introduced to the Americas in 1516 by Friar Tomás de Berlanga,<sup>28</sup> who brought the fruit plants from the Canary Islands to Santo Domingo (Map Two). From here, in 1531, the Spanish conquistadores took the banana to Mexico, and, as noted the Portuguese introduced the herb to Brazil. During the 17th and 18th centuries it was cultivated in practically all of tropical America. Fraser<sup>29</sup> adds an interesting note to the banana's American history. This investigator reports that "... some authorities include the banana among the articles that formed the base of the food supply of the Incas and the Aztecs before the arrival of the Spanish. . . . Throughout the whole meridional America there is a strong tradition that at least two species of the plantain were cultivated long before the coming of the Europeans." He concludes that "... in all the languages indigenous to the region where the banana appears, that plant has a special name, not proceeding from the conquerors . . ." While Fraser's theory is interesting, it is highly questionable, based largely on tradition, and, at this date, not supported by sound corroborating documentation. However, current research is underway, with underwater archaeological investigation off the North American West Coast, which may shed more light on the possibility of pre-Iberian New and Old World contacts.

During its long history, the banana has known many uses. It is recorded in *The Modern Traveller* (1830) that in Mexico the ripe musa fruit was sun preserved like figs, and the resultant *platano pasado* (note: Spanish "plantain" is *plátano*) was an article of commerce in Mechoacan. This text continues: "Meal is extracted from the musa,

<sup>24</sup> UBC (1959:5).

<sup>25</sup> Lehner and Lehner (1962:68).

<sup>26</sup> UBC (1959:5).

<sup>27</sup> Lehner and Lehner (1962:68); see also Prestage (1933).

<sup>28</sup> UBC (1959:6), Lehner and Lehner (1962:68), and Fraser (1912:713).

<sup>29</sup> Fraser (1912:713).



Cultural Diffusion (plant not transferred by conscious migration but by slow process of cultural diffusion)

Chinese traders

Polynesian (Asian)

Arab traders

Portuguese

Spanish



FIGURE 2. DISTRIBUTION AND MIGRATIONS. MAP DRAFTED FROM DENOYER-GEPPERT OUTLINE MAP OF THE WORLD #22009 (7009): ADAPTED BY PERMISSION OF THE PUBLISHER, DENOYER-GEPPERT, CHICAGO, ILL.

by cutting the green fruit in slices, drying it in the sun on a slope, and pounding it when it becomes friable. The flour, less used in Mexico than in the islands (Caribbean), may serve for the same use as flour from rice or maize."<sup>30</sup> Fraser found such flour used as late as 1912, and noted that local women valued it as a baby food and an aid to indigestion and other stomach disorders.

Another volume of *The Modern Traveller* (1830: Vol. VII) noted that the *musa* formed a principal item of commerce, and in 1768, on the opposite side of the world, in the Button (Bouton) Islands near the Celebes, de Bougainville wrote: "On the 13th (of September), a great many periaguas (?) with outriggers, surrounded the ships. The Indians brought us fowls, eggs, bananas, perrokeets (sic.) and cockatoes (sic.)"<sup>31</sup>

Besides serving as a valuable item of commerce for many cultures world wide, and rather commonly as a flour or meal, the *musa* has been consumed in a number of rather bizarre manners. For example, ". . . plantains, dried in an oven, then peeled and pounded to a paste, and pressed into (a) vessel, may, after being kept for about a fortnight, be dissolved in water and strained, and the liquor will make a sort of wine, not to be distinguished from that which is called Ojo de Gallo."<sup>32</sup> The *musa* may also produce vinegar and brandy.<sup>33</sup> Other strange uses of the herb include the use of banana leaves for paper (adapted by Turks), and the application of the fruit pulp to sanious ulcers.<sup>34</sup> Sanies is a thin blood-tinged discharge from ulcers or infected wounds.

Bananas have thus pervaded the culture, life styles, and commerce of varied peoples on an international scale. It is curious to note, therefore, a remarkable absence of banana-related religious ceremony. An extensive review of available literature fails to reveal the ceremonial use of banana. However, on Frederik-Hendrik Island West New Guinea, Serpenti<sup>35</sup> observed ". . . eight varieties of this fruit are known. They form an important supplementary food and no feast is held without bananas." And on August 22nd, 1878, at Uakinumu, South Eastern New Guinea, Chalmers recorded: "I was eating a banana this morning, when I was told not to throw the skin away, but hand it to them (local natives), which I did, when it was passed round and kissed by all with short ejaculations. I asked what it meant, and was told it was their manner of thanking the spirits for ripe bananas."<sup>36</sup>

<sup>30</sup> *The Modern Traveller* (1830: Vol. VI:170).

<sup>31</sup> Forster, Translator (1967 Ed.:387).

<sup>32</sup> *The Modern Traveller* (1830:193).

<sup>33</sup> Fraser (1912:330).

<sup>34</sup> Astley (1968 Ed.:337).

<sup>35</sup> Serpenti (1965).

<sup>36</sup> Chalmers (1885).



## CONCLUSION

Banana: from wild plant of Southeast and South Asia to modern profitable money crop. Its migration, distribution, and assimilation into the cultures of four continents from the fourth century BC to the end of the Iberian period reflects the migrations, commerce, and national power of many nations. The banana has wide medicinal usage, is a useful dietary adjunct, and is high in nutrition. This paper has been limited to these aspects of the herb, and yet equal research could trace the development of the fruit as a money crop. Modern transportation and refrigeration have made the banana one of the few fruits available year round in most areas of the world.

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*THE EARTH FOR THE PEOPLE*

ACADEMICIAN I. GERASIMOV,  
CHAIRMAN OF THE ORGANIZATIONAL COMMITTEE OF  
THE 23/23RD INTERNATIONAL GEOGRAPHICAL CONGRESS

PAGE 1

THE 23/23RD INTERNATIONAL GEOGRAPHICAL CONGRESS WHICH OPENED IN MOSCOW ON JULY 28 IS HELD UNDER THE MOTTO "SCIENTIFIC-TECHNICAL PROGRESS AND MODERN GEOGRAPHY". IT IS ATTENDED BY MORE THAN 3,000 GEOGRAPHERS FROM OVER SEVENTY COUNTRIES.

GEOGRAPHICAL RESEARCH IS NOW CALLED UPON, ABOVE ALL, TO PROVIDE A SCIENTIFIC BASIS FOR THE EVER MORE INTENSIVE USE OF NATURAL RESOURCES, THE DEVELOPMENT AND DISTRIBUTION OF SOCIETY'S PRODUCTIVE FORCES.

THE SUBJECT MATTER OF EVEN A FEW OF THE SCIENTIFIC SYMPOSIUMS WHICH PRECEDED THE CONGRESS GIVES AN IDEA OF THE SCOPE OF THE GEOGRAPHERS' INTEREST. SPECIALISTS IN THE GEOGRAPHY OF INDUSTRY, FOR EXAMPLE, ASSEMBLED IN NOVOSIBIRSK. QUESTIONS CONNECTED WITH THE DEVELOPMENT OF VARIOUS ECONOMIC AND GEOGRAPHICAL REGIONS WERE DISCUSSED IN DUSHAMBE, THE DEVELOPMENT OF DESERTS WAS THE SUBJECT OF A DISCUSSION IN ASUKHABAD, THE GEOGRAPHY OF POLAR COUNTRIES WAS STUDIED AT THE LENINGRAD ARCTIC AND ANTARCTIC INSTITUTE, AND THE GEOGRAPHY OF TOURISM AND THE DEVELOPMENT OF MOUNTAIN REGIONS WERE EXAMINED IN DOMBAL.

INTERESTING SCIENTIFIC SYMPOSIUMS WILL BE HELD IN MOSCOW ON ENVIRONMENTAL PROTECTION AND SCIENTIFIC FORECASTS OF MAN'S INFLUENCE ON NATURE, SCIENTIFIC FOUNDATIONS OF THE DEVELOPMENT OF REGIONS AND THE RATIONAL DISTRIBUTION OF PRODUCTION, AND THE GEOGRAPHICAL ASPECTS OF URBANIZATION AND TOWN PLANNING. THESE SYMPOSIUMS WILL BE SUPPLEMENTED BY SCIENTIFIC AND METHODOLOGICAL SEMINARS FOR DESIGNING NATURAL AND NATURAL-TECHNICAL SYSTEMS, TERRITORIAL-PRODUCTION COMPLEXES AND THE CREATION OF GEOGRAPHICAL INFORMATION SYSTEMS BASED ON OBSERVATIONS MADE FROM SPACE, AND THE USE OF COMPUTERS.

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THE SOVIET ORGANIZATIONAL COMMITTEE DID ITS BEST TO IMPART TO THE CONGRESS A MORE TOPICAL NATURE. THIS WAS EXPRESSED, IN PARTICULAR, IN THE INCLUSION IN THE PROGRAMME OF SPECIAL

SYMPOSIUMS ON INTERNATIONAL COOPERATION BETWEEN GEOGRAPHERS AND THE TASK OF GEOGRAPHICAL SCIENCE IN CONDITIONS OF THE SCIENTIFIC AND TECHNICAL REVOLUTION. REPORTS HAVE BEEN PREPARED FOR THE LATTER BY FIVE NATIONAL GEOGRAPHICAL COMMITTEES — IN POLAND, FRANCE, SWEDEN, THE USA AND THE USSR — ON THE BASIS OF WHICH AN EXTENSIVE SCIENTIFIC DISCUSSION WILL BE HELD.

THEY WILL HAVE, AMONG OTHER THINGS, TO WORK EFFECTIVELY TO PROVIDE THE COUNTRY WITH NECESSARY RAW MATERIAL RESOURCES THROUGH CONDUCTING RESEARCH AND ASSISTING IN THE IMPLEMENTATION OF MAJOR COMPREHENSIVE PROGRAMMES OF THE UNION. FURTHER DEVELOPMENT OF PRODUCTIVE FORCES OF THE SOVIET

THE CONGRESS WILL HEAR AND DISCUSS A NUMBER OF REPORTS ON THESE PROBLEMS TO BE PRESENTED BY SOVIET SCIENTISTS.

THE ENHANCEMENT OF THE EFFECTIVENESS OF ECONOMIC MANAGEMENT ALSO HINGES LARGELY ON GEOGRAPHICAL RESEARCH. OF GREAT IMPORTANCE IN THIS IS THE RATIONAL UTILIZATION OF NATURAL AND MANPOWER RESOURCES, THE OPTIMAL DISTRIBUTION AND FORMATION OF TERRITORIAL AND PRODUCTION COMPLEXES AND INDUSTRIAL CENTRES, THE ENSURANCE OF THE FURTHER GROWTH AND STABILITY OF AGRICULTURAL PRODUCTION ON THE BASIS OF LAND IMPROVEMENT AND THE DEVELOPMENT OF AGRARIAN-INDUSTRIAL COMPLEXES. SOVIET GEOGRAPHERS WILL TELL THEIR FOREIGN COLLEAGUES AT THE CONGRESS ABOUT THEIR EFFORTS IN THIS FIELD.

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IN CONDITIONS OF THE SCIENTIFIC-TECHNOLOGICAL REVOLUTION THE QUESTIONS OF NATURAL RESOURCES AND THEIR USE IS DIALECTICALLY LINKED WITH THE PROTECTION AND IMPROVEMENT OF THE ENVIRONMENT. THE STUDY OF THESE QUESTIONS IS AN IMPERATIVE CONDITION FOR A CORRECT SOLUTION OF ALL REGIONAL PROBLEMS, AND AN IMPORTANT COMPONENT OF THE ORGANIZATION OF ECONOMIC MANagements.

THE DEVELOPING NATIONAL ECONOMY IS EVER MORE INTENSIVELY USING MINERAL, LAND, WATER AND BIOLOGICAL RESOURCES THUS TENDING TO CHANGE THE ENVIRONMENT TO A GREAT EXTENT. THE DIVERSE CONSEQUENCES OF SOCIETY'S IMPACT ON NATURE ARE ONE OF THE MOST TOPICAL PROBLEMS OF OUR TIME — PROTECTION, PRESERVATION AND AND IMPROVEMENT OF ENVIRONMENT FOR THE PRESENT AND FUTURE GENERATIONS. ITS SOLUTION IS BECOMING ONE OF THE PRESSING TASKS OF RESEARCH DEMANDING THE EFFORTS OF SCIENTISTS AND SPECIALISTS IN MANY SPHERES OF SCIENCE AND TECHNOLOGY. IT IS ALSO CLEAR THAT IT IS POSSIBLE TO TACKLE THIS PROBLEM SUCCESSFULLY ONLY IN CONDITIONS OF PEACEFUL COEXISTENCE AND BROAD INTERNATIONAL COOPERATION.

(PRAVDA, JULY 28/28)

THE END

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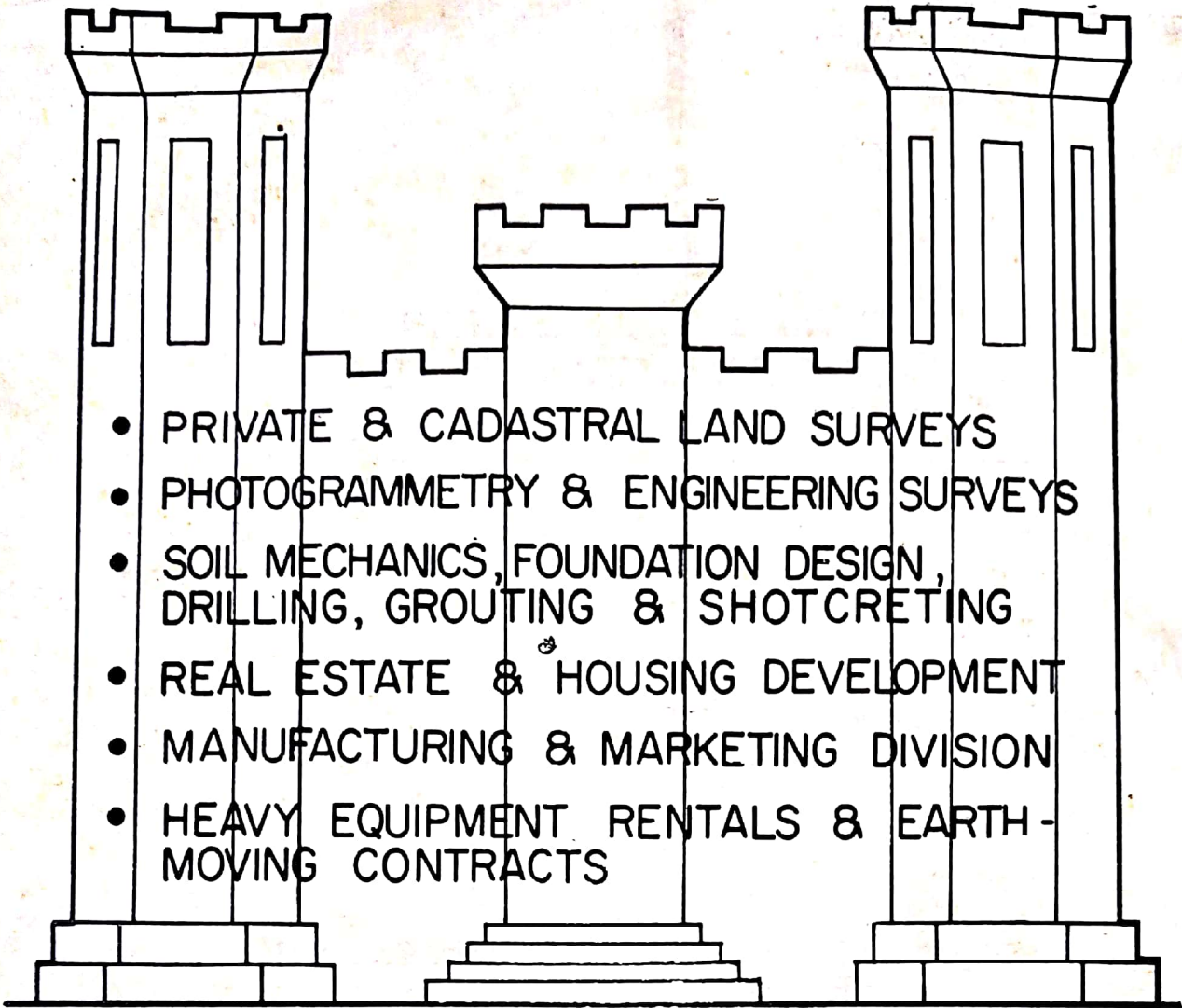
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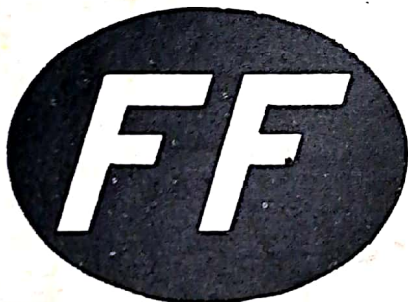
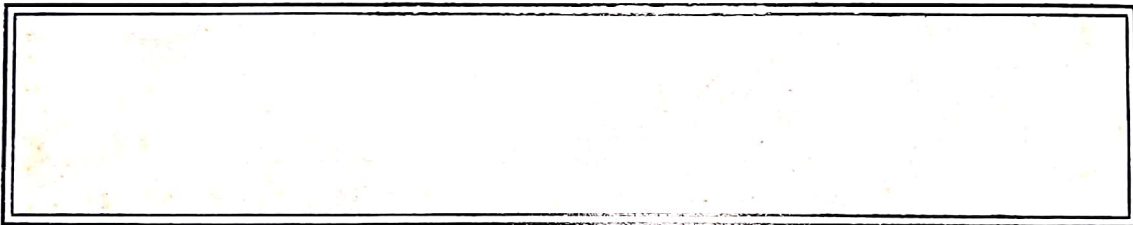
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