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# The PHILIPPINE GEOGRAPHICAL JOURNAL

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**PHILIPPINE GEOGRAPHICAL JOURNAL**

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**EDUCATIONAL PROGRAMS IN ENVIRONMENTAL  
SCIENCES AT THE UNIVERSITY OF THE  
PHILIPPINES SYSTEMS<sup>1</sup>**

by

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

The charter of the University of the Philippines which was granted by the Philippine Legislature on June 18, 1908, provides among others that the purpose of the University shall be to provide advanced instruction in literature, philosophy, the sciences and arts, and to give professional and technical training. While teaching has remained the primordial function of the University, research and extension services have become an integral part of its function. This is intended to extend the frontiers of knowledge and to apply such knowledge to the benefit of mankind. Thus, university education enriches not only the individual but also the society of which he is a part.

Conscious of its duties in instituting programs that are relevant to national needs, four academic units of the University have adopted educational programs in environmental studies. The environment is looked upon as the sum total of the surroundings and conditions that effect the growth and development of life, plants and animals including man. The total environmental concept considers all conceivable systems affecting man and society. The atmosphere (air), hydrosphere (water), and lithosphere (solid) represent the physical environment while plants and animals (biosphere) constitute the biological environment. Man and his works (homosphere) will comprise the socio-cultural environment.

The central theme in environmental studies is to safeguard the quality of the environment so that it will remain safe and wholesome as a human habitat. Human ecology is a special aspect of environmental study that emphasizes the relation of the environment to man as an individual or of society as a whole. Human ecology is closely related to the study of human geography for both treat of the influence of the surroundings to the manifold activities of man. Objectively, the quality of life may be considered as the 'Bill of Rights' for man, while the quality of the environment would be the 'Bill of Rights' for nature.

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<sup>1</sup> Paper presented at the 1974 National Science and Technology Week, 15-21 July 1974.

<sup>2</sup> Dean, College of Arts and Sciences, U.P. and Professor of Geology and Geography, U.P.

*Institute of Public Health.* — The Institute of Public Health is the first academic unit of the University of the Philippines that gives formal instruction and training to health workers in the Philippines and in neighboring Asian countries. The undergraduate program is a 4-year course leading to the degree of Bachelor of Science in Hygiene which aims to train medical technologists, sanitarians, and public health statisticians. The Institute offers also programs on the graduate level leading to the degrees of (a) Master of Public Health, (b) Master of Hospital Administration, (c) Master of Public Health Engineering, and (d) Master of Science in Hygiene. The aim of the program is to contribute to the knowledge of preventive medicine, public health, and the administration of health services. These degrees will be conferred upon the candidates who have satisfactorily completed the prescribed courses of study and have had at least one year of residence in the University. The admission requirements in the master's level are graduates of approved medical schools or graduates with professional training other than in medicine, such as in dentistry, engineering, and pharmacy and with at least a baccalaureate degree in science and at least one year experience or previous training in the field of public health.

*Institute of Planning.* — Population pressures, scientific and technological advancement in agriculture and industry, the mounting problems of urban areas, led the University of the Philippines to establish in 1965, the Institute of Planning which pioneered in advanced study of settlement and environment in Philippine milieu. The Institute offers training services in the form of seminars, in-service training, and a graduate program leading to the degree of Master in Environmental Planning. The course is designed to create a cadre of professional planners whose training and outlook will fit the needs of a developing country like the Philippines.

The program stresses the comprehensive nature of environmental planning. It covers the social, economic, and physical aspects of the planning process. It prepares the planner to be an effective agent of change for development in all scales of human settlement. Graduates of the University of the Philippines and other colleges and universities of recognized standing with a bachelor's degree in architecture, business administration, economics, engineering, geography, law, public administration, social sciences, statistics and environmental health are eligible for admission. The program requires the completion of 36 units of course work, of which 30 units shall be in environmental planning and 6 units of elective courses. While no thesis is required, the student must pass a comprehensive examination as a prerequisite for graduation.

*College of Engineering.* — The increased pollution of air, water and land coming from the factories and other industrial establishments has prompted the College of Engineering of the University to institute a master's program in Environmental Engineering. This course was first offered during the start of the academic year 1974-1975. Any holder of a bachelor's degree in engineering or its equivalent from a duly accredited institution may upon application, be admitted to the Graduate Division of the College of Engineering. If the student's academic and/or experience record indicate adequate preparation for graduate work in environmental engineering, he may be admitted as a candidate for a degree otherwise he will have the status of a non-degree student.

A minimum requirement of at least one year residence and 30 units of graduate course including 6 units of thesis must be fulfilled by its graduate student for the degree of Master of Science (Environmental Engineering). Those completing the minimum requirements of 30 units without thesis shall be eligible for the degree of Master of Engineering. Some of the courses include water quality control and management, waste water disposal and treatment, chemical and biological treatments, and plant design air pollution, abatements and control, solid waste disposal and management, and environmental engineering laboratory.

*College of Arts and Sciences.* — The latest educational program in environmental studies was instituted at the start of the present academic year by the College of Arts and Sciences of the University of the Philippines System, leading to a Ph.D. in Environmental Science. In the introductory statement, the proponents of the program pointed out that the doctoral program in environmental science was instituted as a multidisciplinary program that will be supported mainly by the departments of Botany, Chemistry, Geology, and Geography, Meteorology, Zoology and the Social Sciences of the College of Arts and Sciences. The study of the environment cannot be contained solely within the discipline of chemistry or biology, but it involves all the natural sciences as well as economics, sociology, political science, history, geography, and even arts and aesthetics. The vital need to advance knowledge on broad issues is the prime justification in adopting the multidisciplinary approach so as to integrate the efforts of physical, biological, and social scientists in a single project. For the problems of the environment are not only national in scope but international as well.

The 1970's has been called the decade of the environment, the time when man is to become fully conscious of his responsibility to his surroundings. The problem of the environment may involve its pollution which may be biophysical and chemical in nature and is now becoming more intense in our cities and coastal areas. The need for maintaining a balance between economic, political and social development and ecological integrity presents a complex problem of adjustment, regulation, and conservation which is at once relevant and timely. The objective of the doctoral program shall endeavor to provide responsible leaders in industry, government, and research institutions in the scientific work affecting man's environment. The demand for such services keeps on increasing as the country's program of national development is accelerated to meet the needs of a fast growing population.

Only holders of a master's degree or its equivalent may be admitted to this program. They shall comply with the general requirements for the Ph.D. program in the College of Arts and Sciences. A sufficient background in Statistics is likewise required which may be fulfilled before or during the course of the program.

Every student admitted to the program is assigned a program committee, the chairman of which is the adviser of the student. Prospective candidates for the degree are required to pass a minimum of 36 units of course work. Of the 36 units of course work, 24 units are specified broad based courses related to the environment and the remaining 12 units are directly related to the area of concentration elected by the student with the guidance and approval of the program adviser.

The specified twenty four (24) units shall be chosen from the following:

Environmental Chemistry .....	3 units
Marine Communities .....	3 units
Environmental Geography .....	3 units
Advanced Plant Ecology .....	3 units
Urban Systems .....	3 units
Environmental Geology .....	3 units
Physical Oceanography .....	3 units
Environmental Meteorology I .....	3 units
Environmental Meteorology II .....	3 units
Biology of Invertebrates .....	3 units
Man and His Environment I .....	3 units
Man and His Environment II .....	3 units

The electives of 12 units may be chosen from the graduate courses in Botany, Chemistry, Geography, Geology, Mathematics, Meteorology, Physics, Zoology, Social Science, Engineering, or Health Sciences. One foreign language to be determined by the program committee may be required.

After the completion of the course work and the foreign language requirement, the student may apply for comprehensive examination. The comprehensive examination is given to test the student's ability to integrate and apply knowledges that he has acquired in his program of studies.

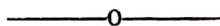
After passing the comprehensive examination, the student shall be considered as having been advanced to candidacy for the degree. The student is given a dissertation committee composed of an adviser who shall be chairman and two readers who shall be members. The committee shall guide the student in the preparation of the dissertation which shall be a worthy contribution to scholarship.

After the doctoral committee shall have approved the dissertation, an examination panel of not less than five members will be appointed to conduct an oral examination on the dissertation which shall last from three to five hours. At the request of at least half of the panel members, the oral examination may be opened to the public. All requirements for the degree must be completed in not more than six (6) calendar years.

*Private Colleges and Universities.* — Aside from the educational program in environmental studies being given at the University of the Philippines, some eight (8) private colleges and universities are offering programs leading to the degree of Bachelor of Science in Sanitary Engineering. These include the National University, Cebu Institute of Technology, University of Southern Philippines, Cebu City, Mapua Institute of Technology, Feati University, Colegio de San Jose, Cebu City, University of Pangasinan, and Central Philippine University, Iloilo City. Among the schools mentioned, only the National University, Manila, offers a master's program in Sanitary Engineering. A two-year course in Hygiene and Sanitary Science is offered at the University of Nueva Caceres in Naga City and Liceo de Cagayan, Cagayan de Oro City, respectively. A four-year course leading to the degree of Bachelor of Science in Sanitary Technology is also being offered at the National University.

The objective of the course in Sanitary Engineering is to prepare the students in the proper management of the environment so as to make it safe, healthful, and pleasant to live in. The courses deal with the theories and the application of the principles involved in the control of the physical, chemical and biological elements in water, air, food or in sewage. The program covers also the design and maintenance of engineering structures such as water purification plants, sewage treatment plants, and mechanical equipment to control or abate air pollution.

The holding of this Symposium on Human Ecology is very timely as it focuses on the problems of the environment brought about by population explosion, urbanization, and industrialization. The Philippines lies at the vortex of the stage of modernization and development. It is therefore, necessary that educational programs be instituted in order to awaken our interest in the study of the environment and to provide competent manpower to attain the goal of conserving the quality of the environment so as to insure man's survival as a permanent inhabitant of the planet earth.



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# TERRITORIALITY IN COUNTERINSURGENT OPERATIONS: GEOGRAPHICAL THEORY IN PRACTICE

by

PATRICK W. NAUGHTON<sup>1</sup>

The defeat of the guerilla depends on the control and defense of the civilian population. In counterinsurgent operations, it is necessary not only to defeat the insurgent on the battlefield but also to beat him in his own backyard. Distinct territories must be created that are exclusively either friendly (government controlled) or enemy-held. The concept of territoriality reduces the area of contact between the enemy and the civilian population to a well defined area.

*Territoriality.* — The concept of territoriality has been defined by SOJA (1971, p. 19) as:

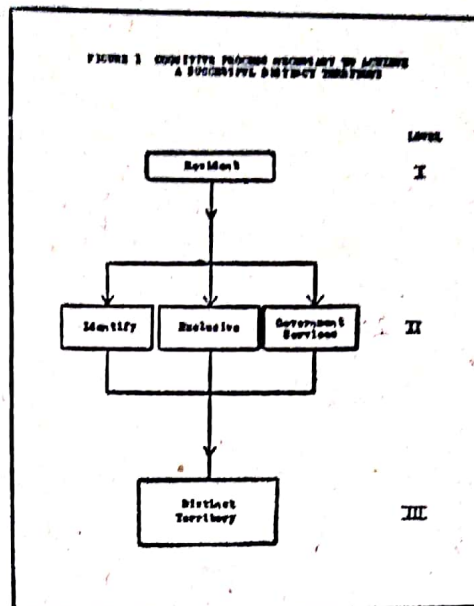
...a behavioral phenomenon associated with the organization of space into spheres of influence or clearly demarcated territories which are made distinctive and considered partially exclusive by the occupants or definers.

There must be three elements (Fig. 1) present in order to successfully establish a single area as a distinct territory, in the minds of its resident. (1) The residents must identify with the territory. It is a rare instance when an individual does not share a sense of belonging to an area (either real or imagined) with other individuals. This identity may be his home location or a symbol (such as a flag, insignia, or ideal). (2) There must be a feeling of exclusiveness in the territory — the resident should perceive that this area is endangered by the threat of an outside 'invasion.' The invasion may only be imagined but there should be a defensive mechanism present, a method by which only certain persons are allowed to reside in a location — this produces an impression of exclusiveness. (3) Of importance to an authority who wishes to control an area is that the chosen territory must channel or compartmentalize all activities and communications into the designated location. This necessitates the population having to utilize these services within the defined territory and, hence, allows for greater control. The chosen territory thereby creates a 'core' area for the region. SALISBURY (1971, p. 109) stated that the core area "...is found where the people conduct most of their activity, have most economic dealings, look for leadership, feel more secure, and where they turn in time of need or crisis." In simplified terms one may say that he who controls the core area controls the population.

It must be emphasized that all three elements (Fig. 1) must be present in the residents' cognitive processes. If one of the elements

<sup>1</sup> Editor's Note: The author is Professor of Geography at the University of the West Indies, Mona, Kingston, 7 Jamaica.





is missing, or should the residents not perceive an element (though it may, perhaps, be present), there will be a stress produced upon individuals which will cause the disintegration of the distinct territory. It is, therefore, necessary for the definer of a distinct territory to emphasize the three elements, he cannot permit the residents to not be aware of any element as this would break the thought processes that would establish the reality of the distinct territory in the minds of the residents.

The question that must arise at this point is, 'who defines the territory?'

In geographic space perception the definer of a territory can either be the people residing within the territory or it can be an authority within or outside the territory. In counterinsurgent operations the definition of a territory should arbitrarily be imposed by the government (the outside authority), though it is necessary to follow closely the elements that must be included in a territory in order to establish a successful community. That is to say, the government must not force residents into specific territories, thus jumping from Level I to Level III (Fig. I) thereby disregarding the necessary cognitive steps provided by Level II; necessary, that is, in providing residents with a distinct territory that they can call 'home.' The concept of territoriality has been successfully applied in South Vietnam and other countries through the use of the central village. Population control forms the basis of the use of the central village in the concept of territoriality as applied to military operations.

*Population Control.* — Population control has two major goals in counterinsurgent operations: (1) to limit and interdict the insurgent's movements and (2) to separate the insurgent from the indigenous population. Several techniques have been used, historically, to establish control in areas involved in guerilla warfare. These include collective responsibility, registration, and resettlement.

The practice of collective responsibility utilizes the idea of holding the entire population responsible for anti-government activities. Collective responsibility was implemented by the Chinese Empire in 221

B.C., by the U.S. Army during the Philippines Insurrection of 1901, and by the Nazis and Japanese during the Second World War (MOLNAR, 1966). It has also been attempted independently by small groups of soldiers throughout history, as illustrated in the My Lai incident of 1968 in Vietnam which involved one platoon of U.S. Army Infantrymen.

Various forms of registration have been utilized successfully as methods of government control. It produced excellent results for the British in the Malayan Insurrection of the 1950's and has been successfully used in populated sections of South Vietnam. Food control, along with registration, was also used as a method of population control by British in Malaya and during the Mau-Mau Uprising in Kenya.

The most effective population control measure is that implied in the military use of the concept of territoriality, the use of resettlement.

When successful, resettlement effectively seals off the insurgents from the populace and denies them material or intelligence support. Close surveillance in the resettlement projects also protects the populace from terrorist retaliation and coercion by underground groups. (MOLNAR, p. 260)

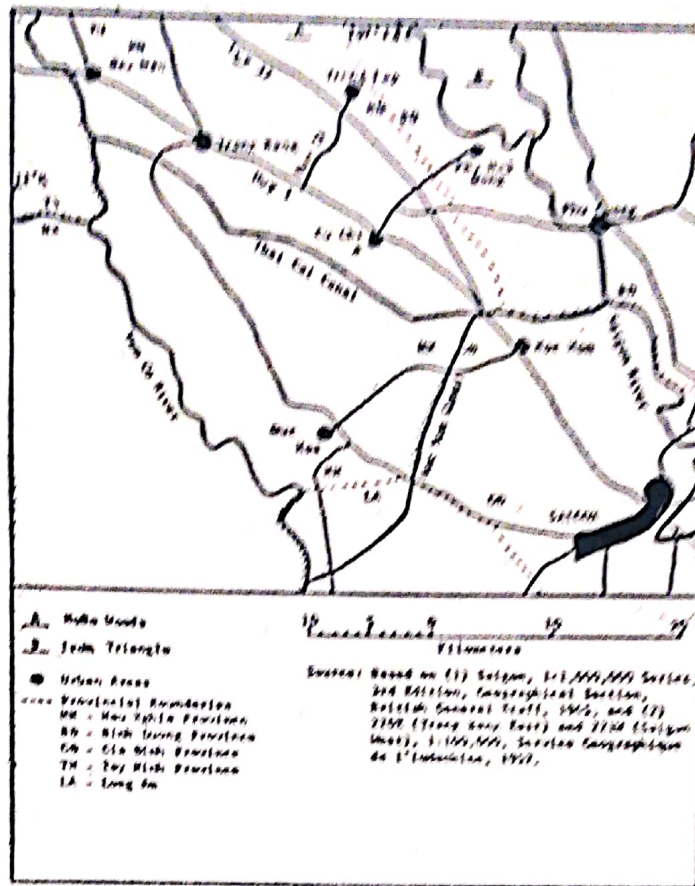
The term resettlement is defined, for the purpose of this paper as a regrouping or a relocation of the population. Regrouping involves the concentration of the people in a particular location by removing them to a nearby site that has better defensive capabilities.

During the Malayan Insurrection the regroupment aspect was called 'close-settlement' in which there was a concentration of rural settlers into existing villages. By this method the settlers ". . . retained the use of their holdings and were not forced to change their place of work" (SANDHU, 1964, pp. 163-164).

Where political or military problems rise in conjunction with regrouping, it is often necessary to relocate the population. This is ". . . the compulsory transfer of rural people. . . from scattered farms to a fortified area laid out and designed by the state" (DOBBY, 1953, p. 4). This implies the abandoning of personal holdings, crops, and houses and may result in traumatic experiences for the individual when he is thrust into a new and unfamiliar environment.

Resettlement can be used successfully providing there is a strong military force available to support it. In Malaya it ". . . made possible the crushing of the Communist rebellion and the defeat of the M.R.L.A. (Malayan Races Liberation Army)" (SANDHU, p. 180). If a strong supporting force is not present the resettlement is doomed to failure. During the mid-1960's a program of relocation of Meo Tribes was instituted in the Central Highlands of South Vietnam. These relocation settlements, called fortified hamlets, failed because they were unable to provide the defensive mechanism necessary to insure the exclusiveness of the territory for the residents — both mentally and physically. The threat was, in this case, from large, well-trained, regular-force Communist units which were able to easily overrun the poorly-trained, irregular government troops in the fortified hamlets.

*Application to South Vietnam.* — A good example of the use of population control as well as the military application of the concept of

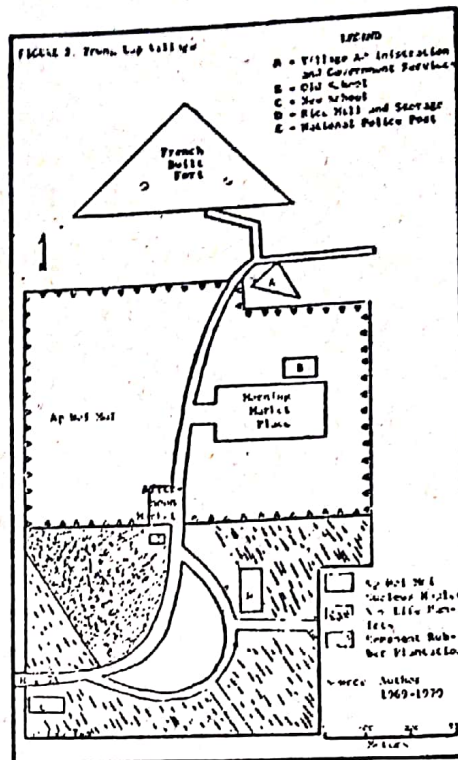


territoriality was the establishment of the central village of Trung Lap, Hau-Nghia Province, Republic of Vietnam, in 1969.

Trung Lap is located northwest of Saigon (see map) and is situated on the Nam-Viet Plain.<sup>2</sup> This is the contact zone between the rain-forest jungle and the natural savanna. The region is, in fact, the transitional zone between the northern Delta (or Trans-Bassac) region of the Mekong River and the Mã Plateau (the southern extremity of the Annamite Mountains). During the Pliocene a string of basaltic volcanoes was situated along the southern edge of the Mã Plateau and extended from Tay Ninh in the west through Thu-Dau-Môt, Bien Hoà, Bà Rịa, to Vung Tau. The weathered basalt is now evident throughout the transitional zone and its color gives its name to the physiographic region: Terres Rouges (DUFFEL, 1957).

The natural vegetation of the transitional zone is savanna as the soil is a poor laterite. In the early 1900's large rubber plantations were established throughout the region, the best known plantation is that owned by the Michelin Tire Company which lies to the north of the Saigon River (adjacent to the bloody Iron Triangle region shown on the map). Almost every single rubber tree south of the Saigon River was destroyed during the war, a remnant plantation is located within the central village of Trung Lap (see Fig. II).

<sup>2</sup> The original Vietnamese spellings have been kept in as many cases as possible. The accented letters should be pronounced as in French. The D with bar is a hard D as in 'day' whereas the D without bar is pronounced as a Z as in 'zoo'.



The major food crop is padi rice which is restricted to low-lying areas because of soil conditions and the lack of plentiful and continuous water supply.

The transitional area is considered poor for rice cultivation. Away from the larger rivers, the farmers rely on rainfall for their paddy cultivation and the rice is inferior. The result is that secondary crops are the most important for cash income. ...in the area of Trung Lap peanuts are the most important cash crop. (HICKEY, 1964, p. 16)

In the northern Delta, farms tend to be larger than in the transitional zone. This is a result of historical population movements. The Delta was settled much later than the transitional zone and by fewer people, primarily due to health conditions — particularly the presence of malaria. The farms of the northern Delta are on the average seven hectares size whereas in the transitional zone they are usually only two hectares in size (HICKEY, p. 15).

The military importance of Trung Lap dates from the end of the Second World War. The French established a training base for their elite Colonial ranger unit at Trung Lap. The base is now simply known as the 'French Fort.' The fort was garrisoned by regular South Vietnamese forces until it was overrun by the North Vietnamese during the Têt Offensive of 1968. Irregular regional forces reoccupied the fort after Têt but the government did not control much else in the vicinity until July 1969.

Prior to the middle of 1969 Trung Lap was composed of many small hamlets or clusters of houses. Trung Lap existed in name only as a governmental village-structure, as, in fact, there was no physical site that was called by that name.<sup>3</sup> The central hamlet (nucleus) was called

<sup>3</sup> For an excellent discussion of this type of village see HICKEY (1964).

Ap-Doi Moi which is a relatively common name for a Vietnamese hamlet (there are over 15 in the Province of Hau Nghia alone). The civilian population, though removed from areas adjacent to the Saigon River, was still scattered throughout the region and was not under government control.

Military operations in the area which lies to the north and north-west of Cu Chi (the district headquarters), during 1969, were conducted by the 25th and 5th Divisions (Army of the Republic of Vietnam — ARVN), the 1st and 25th Divisions (U.S.), and the 3rd Brigade, 82nd Airborne Division (U.S.).<sup>4</sup>

Outside of a few of the larger urban areas the control of the population by the government was nominal, even during the day. A combined operation by the National Police, and a battalion each from the 1st Division and the 82nd Airborne Division in September, 1969, in the village of Phu Hoà Dong (Binh Duong Province), was able to flush out numerous communist cadre (infrastructure personnel) despite government claims that the village was a secure area.

To alleviate this type of situation the 25th Division (ARVN) established a resettlement policy in its area of operation. One battalion of the 49th Regiment was sent to Trung Lap and established its base of operations at the old French Fort in July of 1969. Trung Lap commenced consolidation into a central village during the late summer. Final elimination of the organized communist cadre in the village did not occur until March 4, 1970.<sup>5</sup>

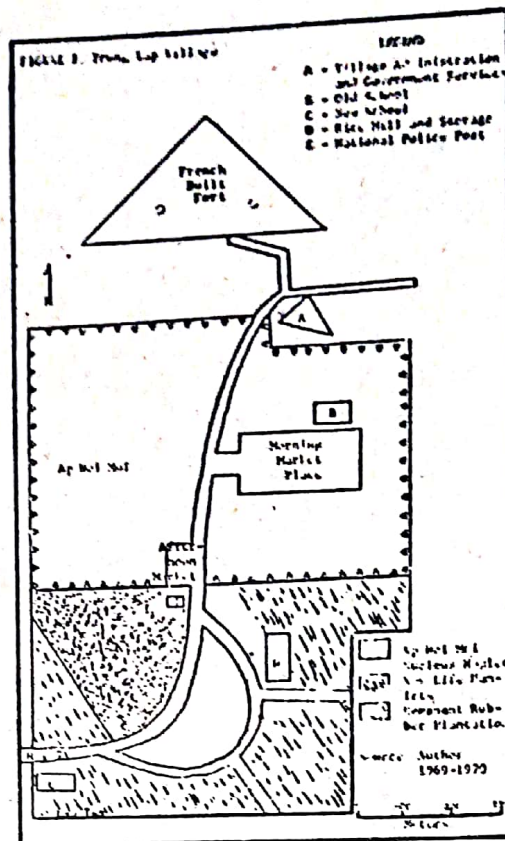
*Establishment of the Distinct Territory.* — To establish a distinct territory, all persons in the small hamlets and clusters of houses were moved (either voluntarily or forcefully) into the central village of Trung Lap. The hamlet of Ap Doi Moi became the nucleus of the central village, the influx from outside hamlets formed 'new life hamlets' as appendages to Ap Doi Moi (Fig. II). The new houses were built with material provided by the ARVN and U.S. 25th Divisions. Materials were also transported in from the old homesites as these were demolished by the Army. Trung Lap was established and survived as a formal territory because it satisfied the three conditions which are essential ingredients in human group territoriality as it operates across various geographical and societal scales. Trung Lap became a government-controlled core area in the region.

Trung Lap provides a sense of spatial identity for its inhabitants. The people living there were not relocated from areas in widely dispersed sections of Hau Nghia, Binh Duong, or other provinces. They were essentially members of the hamlets which had constituted the former loose village structure of hamlets in Trung Lap. The people identified themselves with Trung Lap and were identified by others as being from Trung Lap. They still farm the same plots and paddies that were theirs prior to resettlement. Trung Lap was their home prior to resettlement, it is still their home.

A further identification factor is religion. Almost every small area of Indochina differs from another by some aspect of religion. This

<sup>4</sup>In which the author served as a platoon leader and executive officer, May-November, 1969.

<sup>5</sup>From author's experience as U.S. Advisor to 1st Battalion, 49th Regiment, 25th Division (ARVN) in Trung Lap, December 1969-April 1970.



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Outside of a few of the larger urban areas the control of the population by the government was nominal, even during the day. A combined operation by the National Police, and a battalion each from the 1st Division and the 82nd Airborne Division in September, 1969, in the village of Phu Hoà Dong (Binh Duong Province), was able to flush out numerous communist cadre (infrastructure personnel) despite government claims that the village was a secure area.

To alleviate this type of situation the 25th Division (ARVN) established a resettlement policy in its area of operation. One battalion of the 49th Regiment was sent to Trung Lap and established its base of operations at the old French Fort in July of 1969. Trung Lap commenced consolidation into a central village during the late summer. Final elimination of the organized communist cadre in the village did not occur until March 4, 1970.<sup>5</sup>

*Establishment of the Distinct Territory.* — To establish a distinct territory, all persons in the small hamlets and clusters of houses were moved (either voluntarily or forcefully) into the central village of Trung Lap. The hamlet of Ap Doi Moi became the nucleus of the central village, the influx from outside hamlets formed 'new life hamlets' as appendages to Ap Doi Moi (Fig. II). The new houses were built with material provided by the ARVN and U.S. 25th Divisions. Materials were also transported in from the old homesites as these were demolished by the Army. Trung Lap was established and survived as a formal territory because it satisfied the three conditions which are essential ingredients in human group territoriality as it operates across various geographical and societal scales. Trung Lap became a government-controlled core area in the region.

Trung Lap provides a sense of spatial identity for its inhabitants. The people living there were not relocated from areas in widely dispersed sections of Hau Nghia, Binh Duong, or other provinces. They were essentially members of the hamlets which had constituted the former loose village structure of hamlets in Trung Lap. The people identified themselves with Trung Lap and were identified by others as being from Trung Lap. They still farm the same plots and paddies that were theirs prior to resettlement. Trung Lap was their home prior to resettlement, it is still their home.

A further identification factor is religion. Almost every small area of Indochina differs from another by some aspect of religion. This

<sup>4</sup> In which the author served as a platoon leader and executive officer, May-November, 1969.

<sup>5</sup> From author's experience as U.S. Advisor to 1st Battalion, 49th Regiment, 25th Division (ARVN) in Trung Lap, December 1969-April 1970.

is particularly true of the area to the west and southwest of Saigon as this region was settled by Vietnamese only within the last 150 years and contains many different racial and linguistic groups. Cao Daiism is widespread in the transitional zone and is dominant in Trung Lap itself. The headquarters of the Cao Dai religion is located in the nearby city of Tay Ninh.

It would have been unfortunate if outsiders were resettled in Trung Lap — both the ideals of identification and exclusiveness would have been destroyed. The people of the northern delta are primarily Mahayana Buddhists whereas the Vietnamese of the Mâ Plateau adhere to Theravada Buddhism (HICKEY, p. 14). Throughout the region there are small scatterings of Catholics. These tend to be Tonkinese (northern Vietnamese) who either were brought to the area during the early part of this century to work on the rubber plantations or were refugees from Hanoi after the French Indo-China War in 1954.

The sense of exclusiveness is activated by the perceived invasion of unacceptable persons into the village. There is, in fact, an actual threat of insurgent attack. Exclusiveness is fostered by two government institutions: the Army and the National Police. The military, through active combat and night ambush operations, provides protection for the village from organized attack and infiltration by small Viet Cong units. While through a screening procedure the National Police are able to prevent insurgents from settling in the village. One of the strategies used by the National Police is to utilize an officer who grew up in an area in that same region as he will be familiar with most of the people of the district and, hence, more easily recognize an outsider. Therefore, it can be seen that exclusiveness in Trung Lap relates back to identity. The people in the village are native to the immediate vicinity, no present villagers were relocated from outside the area formerly served or administered by Trung Lap. This exclusiveness permits the government control over one important aspect of behavior, the exclusive development of the political structure.

The government has channeled all its activities, services, and communication facilities into the central village of Trung Lap. This produces a region where human interaction, a necessity for control of the population, must occur. The elementary schools are located in the village (one in Ap Doi Moi at the north end of the village and the other at the extreme southern end in the 'new life hamlet' of Lao Tao, those students who do go beyond elementary school must travel to the district headquarters at Cu Chi). Also located within the central village are the rice mill and store house, the morning and afternoon market places, the National Police Post, and the village administration (Fig. II).

If the cognitive process necessary to achieve a successful distinct territory occurs, as shown in Figure I, a 'concept of nation' is produced. DOW (1966, p. 7) found that it came about "...when a significant majority of the people are aware of their government, prefer it over others, and identify themselves with the state and its policies." If the central village fosters a concept of nation, of a South Vietnamese non-communist nation governed from Saigon, then the central village is a success.

The central village, besides controlling the population, also is an important strategic weapon to be used against the insurgent. It prevents the enemy from procuring rice and manpower. It has been advocated that the best method possible to prevent the population from providing



rice or manpower, either forcefully or voluntarily, to the insurgent is through the rationing of food stuffs from central depots and by forcing the farmers to "...live where they cultivate their land" (THUAN, 1971, p. 92).

By living away from central control the population is directly exposed to the insurgent. The farmer may be forced to sell or give his harvest (before it goes to the central depot) or ration to the insurgent, or he may, if he is sympathetic to their cause, leave rice in caches for the insurgents. Within a central village all excess rice (that is, that rice not needed for immediate consumption) is stored in the village. In the case of Trung Lap the major store house is at the rice mill. If a sympathetic farmer leaves rice cached at his old homesite he is liable to arrest as well as the confiscation of that rice which was cached. In the environs of Trung Lap the harvest is closely scrutinized by both the military and National Police and old homesites are continually checked for caches.

A correlation should be drawn here between the Vietnam War and the Malaya Insurrection which emphasizes the control of food stuffs. In 1948, when open warfare began with Communist guerillas the rural settlers became a problem for the government.

Their settlements on town fringes were Communist hide-outs for intimidating urban workers and extorting supplies to support guerillas. The rural (settlers), spread thinly in pioneer margins, without either security of tenure or protection by police, conveniently supplied food for guerillas. Whether the (settlers) were coerced or not was a secondary point; it was decided to re-locate all people living outside the urban areas by a mass shift of rural people, ...to settlements prescribed on military grounds. (DOBBY, pp. 3-4)

*Terrorism.* — Of greater importance to the government, and more so to the individual, is that the central village controls active or forced collaboration among the local population. The farmer and his family who remain out of central control are active candidates for recruitment and/or terrorism.

Undergrounds seldom rely solely upon the good intentions of recruits. Typically, they avoid leaving anything to chance. Because reasons such as patriotism, social injustice, or personal grievances may or may not be sufficient for attracting or sustaining recruits through the long dangerous struggle of protracted war, coercive measures are often implied, or even applied by the underground. (MOLNAR, p. 111)

The individual's behavior when threatened by death or dismemberment will cause an immediate reaction. The probable course of action is to alleviate the threat present and do that which one is being requested to do. After further reflection, when the pressure of the threat has been removed, the individual may decide that what he has done was wrong. However, because he has performed an illegal act, even though under duress, he will be reluctant to report it to the National Police or other governmental authorities. The insurgent organization also uses this possibility of discovery by the authorities (through the vehicle of an insurgent informer) as an additional threat to new recruits in order to keep them faithful to their cause.

The central village provides the state of exclusiveness. This, by

definition, protects the inhabitants of the 'chosen' territory from outside undesirable influences such as insurgent recruitment and terror. THUAN's arguments for forceful habitation on the individual family plot is a step in the wrong direction. In order to stop a cancerous growth it is necessary to separate the cancer from its source of nourishment. Similarly it is necessary to separate the insurgent from the civilian population. In Malaya, CLUTTERBUCK (1963, p. 64) found the communist insurgents were "...defeated when they have been effectively separated from the people and this is achieved when the government is able to protect the people from guerilla terrorism and reprisals."

The resettlement tactic has been adopted in other counterinsurgent operations. The White Rhodesian government has begun to resettle the native population away from the northern border thereby removing the cover that allowed the guerilla to move undetected across from Zambia. In Mozambique the Portuguese moved people "... out of isolated villages and relocated (them) in protected settlements called aldeamentos, where troops and homeguard units keep Frelimo (Mozambique Liberation Movement) infiltrators at bay" (TIME Magazine, 1973, p. 11).

*Cautionary Note.* — A limitation must be noted when applying the concept of territoriality when devising central villages. It has been assumed throughout this paper that the insurgents are irregular troops, that is, guerillas. The central village is, however, still prone to being attacked and overrun by large regular units.

In April 1972, Trung Lap was overrun by the 101st North Vietnamese Regiment and held for a few hours before reinforcements from Cu Chi were able to force the North Vietnamese to abandon it. The region has been under constant fire by both sides since that time and was still considered as contested territory (excluding the village itself) at the time the Ceasefire Agreement was signed on January 27, 1973.

It should also be emphasized that the concept of territoriality, as a military tactic, is a means to an end, it is a temporary defensive measure that must be used in order to identify and remove the insurgent from society during periods of conflict. It is an accommodation and a solution for the immediate situation but should not be considered as a permanent division of space.

*Conclusion.* — Population control has been utilized for thousands of years as a tactic in counterinsurgent operations. Resettlement has proven to be one of the most successful forms. When the resettlements are established along the guidelines set forth under the concept of territoriality there is an increased chance that the settlement will be a viable village which will control the political, organizational, and economical activities of the civilian population. The central village prevents the insurgent from obtaining ready access to the civilian population on which he depends for material and manpower resupply. Despite the political situation that may have provided the impetus for the insurgency it is doomed to failure if access to the civilian population has been blocked.

#### ACKNOWLEDGMENTS

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## REFERENCES

- BRADSHAW, P.G., "Conflict as a Spatial Process: The Case of Guerrilla Warfare," *Essays in Geography*, No. 11, 1970, pp. 17-21.
- CLUTTERBUCK, R.L., "Malaya, A Case Study," *Military Review*, Vol. 43, No. 9, 1964, pp. 60-67.
- DOBBY, R.H.G., "Recent Settlement Changes in South Malaya," *Jour. of Tropical Geography*, Vol. 1, 1958, pp. 1-8.
- DOW, M.W., *Nation Building in Southeast Asia*, (Praeger Press, Boulder, Colorado, U.S.A.), 1966.
- DUFREIL, M.M., *Manuel de Géographie du Viêt Nam*, Vol. 1, (Kim Loi An-Quan, Saigon, Republic of Vietnam), 1967.
- HICKEY, G.C., *Village in Vietnam*, (Yale University Press), 1964.
- MCCOLL, R.W., "The Insurgent State: Territorial Basis of Revolution," *Annals of the Association of American Geographers*, Vol. 59, No. 4, 1969, pp. 612-631.
- MOLNAR, A.R. (Editor), *Human Factors Considerations of Undergrounds in Insurgencies*, (U.S. Army, Special Operations Research Office, Pamphlet No. 550-14), 1966.
- SALISBURY, H.G., "The State Within a State: Some Comparisons Between the Urban Ghetto and the Insurgent State," *Professional Geographer*, Vol. 23, No. 2, 1971, pp. 105-112.
- SANDHU, K.S., "Emergency Resettlement in Malaya," *Jour. of Tropical Geography*, Vol. 18, 1964, pp. 157-183.
- SOJA, E.W., *The Political Organization of Space*, (Association of American Geographers, Resource Paper No. 8), 1971.
- THUAN, P.G.—Major General, ARVN, "A Vietnam Solution," *Military Review*, Vol. 51, No. 6, 1971, pp. 91-96.
- TIME Magazine, July 30, 1973.

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# SINGLE-CELL PROTEIN: IS IT THE FOOD OF THE FUTURE?

by

TEODULO M. TOPACIO<sup>1</sup>

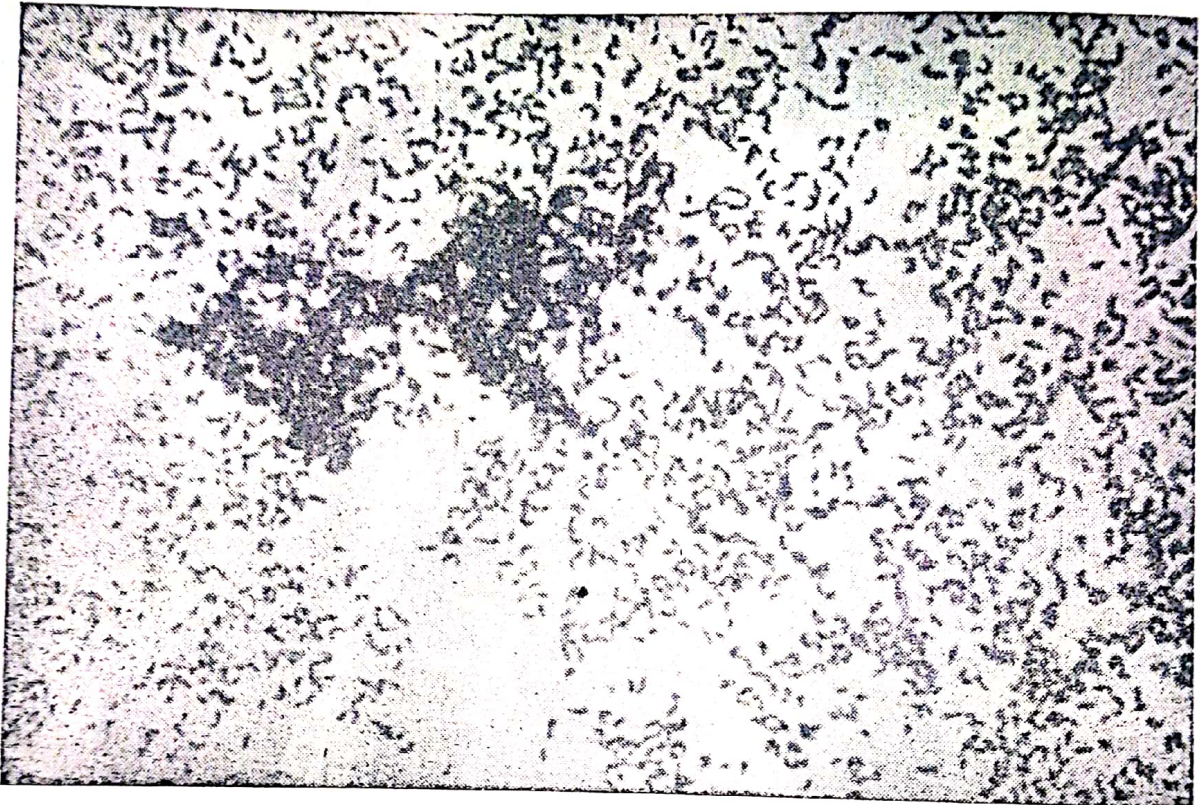


FIGURE I. — SINGLE-CELL PROTEIN (SCP), MAGNIFIED 3000X.

Man from the very start of his existence on this planet has always been faced with the problem of food. He must have food in order to live, to grow, to be able to work, and lastly to propagate himself. Without food he will surely die. Primitive man was an omnivorous feeder. He ate both meat and plants. But he was more of a carnivore and preferred meat to plants. Hence, to get food, he hunted, and led a nomadic existence, moving from place to place where the hunting was good. Later he learned to domesticate the animals he hunted and also to cultivate the plants he ate. Thus, he became a settler and a farmer. He was able to subsist on tracts of land that he cultivated and on which he raised his domesticated animals. It was because of this knowledge and ability coupled with his intelligence that set man apart from the other living creatures on this planet. As a result, civilization grew,

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cities and nations were born. Because of sufficient food supply coming from productive farming, man multiplied and dominated the world.

Today, several countries particularly those highly industrialized ones are self-sufficient in food. In fact many of them have surpluses that they export to other countries which are not as efficient in food production. But it can be predicated that these less fortunate countries will also attempt to achieve self-sufficiency in food in the near future. This is a very timely objective and no doubt efforts are being exerted towards its achievement, since the strength of a nation depend largely on a healthy and well-fed populace.

It would seem that after achieving industrial development and self-sufficiency in food, a nation would practically have no more problems. Ironically in having reached a high level of industrialization new problems would surely arise. Population increase and pollution are good examples. In the beginning, a big population was considered beneficial for a country. It was believed that a nation's strength is in some ways measured by the size of its population, take Red China as an example with a population of almost 800 million. If all these people were properly harnessed, there is no doubt that Red China would be the most powerful nation on earth. But this is not the case because accompanying population increase is the increased in the demand for food. In fact, the population growth is far outstripping the increase in food production in many countries of the world. There is no country today that is not spared of the problem of high birth rate. The rate may vary from country to country, but the overall trend is intensifying. It has been predicted that by the year 2000, the population of the world will be around 8 billion! Just imagine the quantity of food needed to feed this number of people. It is also to be expected that by this time there will be a great shortage of food. Compounding the problem of food production will be the fact that as the people multiply, land will have to be utilized for dwellings and other uses that will be given priority over farming.

According to the computer studies conducted by scientists at the Massachusetts Institute of Technology, the future of this planet is quite gloomy.

The question was asked: What would happen in the future when the present rate of population growth is accompanied by industrialization? The dreaded answer was that this planet will slowly wither and die. All possible solutions were fed to the computer but the answer was always the same — slow death for earth due to over population and lack of food coupled with pollution brought about by industrialization. The fute for mankind based on these studies is indeed dismal!

To supply the necessary amount of food for the ever increasing world population, intensive crop and livestock production of plants and animals is urgently demanded. But as mentioned previously, land to be allocated for farming will eventually be used by man for more pressing needs like building houses. Man will thus have to turn to the sea for food. But can the sea amply supply the needs of the growing world population? Eventually, this source may also be depleted. Hence other sources of food that would supplement man's dietary needs and perhaps even become his main source of food shall be explored.

One source that may yet save mankind from slow starvation are the microorganisms — those tiny living creatures too small to be seen by the naked eye except with the aid of a microscope. They are unicellular organisms also known as single-cell organisms. Most people label them as "germs". The first man to make an accurate description of these creatures was Anthony Van Leewenhoeck, the Dutch Scientist who devised the first microscope. He aptly called these microorganisms — "animalcules" or tiny animals with one big difference; mainly the size. It is precisely because of this characteristic that the single-cell organisms are the logical choice as the food for the future. Furthermore, their chemical components are the same food nutrients that man assimilate from plants and animals, namely: protein, carbohydrates, fats, minerals, and vitamins. Being so easily handled and cultured, there is no reason why single-cell organisms cannot be utilized for food production.

The use of microorganisms as food for both animals and man is not a new idea. Man consumes microorganisms when he eats bread or food products enriched with distillers yeast. The beer and wine he drinks are all processed by microorganisms. Animals too are fed with fodder yeast derived from molasses.

A greater portion of microorganisms is composed of protein. Scientists advocating their use as food have called them single cell protein (SCP). Single cell protein is a totally new kind of food. It is a tasteless, odorless mass that can be treated and dried. To make it more palatable, artificial flavors like pork, beef or chicken can be added. At the moment there are several countries that have gone into pilot production of SCP. However, the finished product is still being used as feeds for livestock. The use of SCP as food by man is not too far off in the future. The world's production of conventional sources of protein has not kept up with the increasing population. It has been predicted that by the year 2000 the shortage of world protein will be around 40 million tons! This demand cannot be fully met by plant and animal protein. It is obvious that a new supply must be found and single cell protein offers the solution.

The advantages of SCP as food over the conventional sources of farm-produce food (plants and animals) are the following:

1. SCP production does not need large tracts of land which conventional plant and animal farming requires. SCP can be produced indoors throughout the year in buildings requiring small land areas.
2. There is a variety of sources. Several types of microorganisms such as bacteria, yeast, algae, and fungi are most commonly used.
3. Production does not depend on climatic or other natural conditions. Plants and animals in order to survive depend on proper climate, sunshine, rainfall, etc. Production of single cell protein can be entirely controlled by man.
4. Rate of growth due to high protein is fast. Cattles can double their size in approximately 1-2 months; pigs in about 4-6 weeks; chickens in 2-4 weeks, and grass and some plants in 1-2 weeks. (SCP can double their size in approximately 20-200 minutes!)

5. Another advantage is that plants and animals take longer periods to propagate themselves whereas single cell organisms multiply geometrically so that starting with one organism a population of billions can be attained in a matter of hours! It has been calculated that a 500 kg. cattle can produce only a few grams of protein in one day; in contrast, 500 kg. of yeast can produce approximately 2000 kg. of protein in the same period of time!
6. Protein content of the single cell can be improved. This can be done by manipulating the nutrients fed to the microorganisms which will produce the best quality protein.

Both plant and animal protein are composed of some 20 amino acids which too are needed by the body of man. When ingested, these proteins are broken down into amino acids and absorbed by the body. These amino acids are then used by the body build up its own specific protein. The finished protein in turn is used for repair and growth of the different body tissues. The amino acids function just like the hollow blocks used in building a house. Hence protein is an indispensable food nutrient of man and animals. What happens when protein is withheld or there is a lack of it in the body? A person suffering from protein insufficiency is emaciated, and gaunt with bloated belly and bulging, blank staring eyes. Physical stunting, mental retardation, and low resistance to diseases are also other accompanying characteristics of protein deprivation. This condition known as "kwashiorkor" was prevalent during the civil war between Biafra and Nigeria when millions of Biafran children suffered starvation. Children in many parts of the world are afflicted with mild extreme protein deprivation which illustrates the increasing and aggravating problem of world-wide food shortage.

If up to now there are still to be found people suffering from protein deficiency in spite of intensified and highly developed farming, then one can imagine the staggering amount of protein requirement of the population a hundred years from now! Many countries in Europe (United Kingdom, France, Germany, etc.) and in Asia (Japan and Taiwan) are ahead in undertaking intensive research on the production of single cell protein. In fact in several of these countries, pilot plants to produce SCP have been set-up. This means that the basic knowledge on SCP production are already available. Experiments on feeding SCP to animals have been done and the results are really encouraging. In addition, limited trials are now being carried out in man.

For the space traveller, SCP has been selected as the food of the future. How and why this choice arrived at? It is a well known fact that to reach distant planets will take months or even years. Even if food is supplied in the concentrated form, a several months supply surely will be bulky and heavy. In space travel, space and weight are vital factors. Furthermore the supply of oxygen and the equipment needed to remove the waste materials excreted by the passengers will likewise be bulky and heavy. This is where SCP becomes indispensable. With simple and light equipment, the microorganisms can be grown and processed in the space ship and served as food for the travelers. Waste materials of the space travelers are not wasted, in fact they can be used as the medium for culturing the microorganisms. If there are SCP species that can break down organic wastes to carbon dioxide ( $\text{CO}_2$ ) and water, then there are also those species that can consume  $\text{CO}_2$  and

liberate oxygen. As a result waste materials in the space ship will not accumulate. Everything is consumed and the life processes can go on almost indefinitely. This is a remarkable example of what is known as a "bioregenerative system". Intensive research efforts using this system are being conducted at the U.S. National Aeronautical Space Agency (NASA).

Can SCP be produced in the Philippines? Definitely the technology can be adapted locally, however, the efforts of food researchers in our country are still geared toward the conventional means. This is a logical approach since we still have tracts of land for agricultural purposes. But at the rate, our population is exploding — 3.1 per cent annually, one of the highest in the world — it won't be long before these land will be taken over by the people. In fact no less than the Secretary of Agriculture, Arturo Tanco, made the observation that "One of the grimmest manifestation of the population problem in the Philippines is the growing pressure on the land. In the Philippines of 1972, the old myth of vast untapped land resources is exactly that — a myth". Therefore, the land problem due to a fast-growing population is now with us and a new source of food that can be produced making use of only a small tract of land must be sought. Hence, research efforts concerning SCP should be started now.

One advantage of SCP is that no country has an exclusive right to the use of these unicellular organisms since they are found all over the world. Each country therefore can undertake its own research using strains of SCP peculiar to their region. The National Research Council of the Philippines (NRCP) has just approved a research proposal by the author on the isolation production and the use of SCP as animal feeds. Hopefully the results of this study may pave the way for future investigations on the use of SCP as food for man.

The benefits that SCP offer are very promising. It can help minimize the problems of over population and pollution brought about by industrialization. As life in this planet goes on, man will still be making remarkable progress in technology. But accompanying this progress will be two of man's vital problems: Inadequacy of food supply and environmental pollution. SCP production, it would seem, is the only means that can minimize or even overcome these two problems. Truly, SCP is the food of the future.

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### THE FIRST AMERICAN GEOGRAPHY

In colonial days geography was spoken of as "a diversion for a winter's evening," and acquaintance with it was considered an accomplishment rather than a necessity. Some rudimentary instruction in the science was occasionally given at more advanced schools, but the topic was not taken up in the elementary schools until after the Revolution. A knowledge of it was first made a condition for entering Harvard in 1815, and a dozen years more elapsed before Massachusetts named it among the required studies in the public schools. To begin with, it was not introduced as a separate study, but the books were used as readers. The same was true of the early school histories. However, geography presently won a place of its own and kept it in spite of the protests that the scholars' attention was thereby being taken away from "cyphering." — Clifton Johnson, "The First American Geography," *Journal of Geography*, III, 7 (September 1904), 311.



# WIND AND SOLAR ENERGY AS POTENTIAL SOURCES OF ELECTRIC POWER

by

M. I. FELIZARDO<sup>1</sup>

In recent months many countries of the world have begun again to intensify research in the utilization of wind energy and solar energy for the production of electricity on a commercial scale.

*A historical perspective.* — Eight years ago, the writer was told by a Filipino who had travelled in Soviet Russia that he actually saw and was also informed of the many gigantic windmills that were supplying electric power to existing electric transmission systems in the hills close to the Ural Mountains. Some months later an Austrian friend sent the writer some translations of newspaper clippings describing those large wind-power generators but gave very meager technological details.

A year or so later, the writer met two Russian technologists who were attending a World Power Conference here in Manila, and the writer asked them if Russia was indeed constructing large wind-power generators. At first they said "No"; but when I told them that I knew they had many in the foothills of the Ural Mountains, they reluctantly said: "Yes, we have many there, but we discontinued their construction after we found huge quantities of petroleum in the Ural Mountains so that our reserves are now more than five times those of the United States!"

The writer also came across a clipping from a German publication which reported that a German technologist had designed a 15,000 KW wind-power generator. In another instance, an American friend informed the writer that a U.S. Government Scientist has also designed a 7500 KW unit. This was after a 1250 KW unit, which had been constructed and operated for two years in the state of Vermont, was destroyed by a sudden gust of wind which blew its blades away, and was thus abandoned.

Later, the writer came across a publication from the United Nations describing a 1000 KW electric power generator unit deriving its energy entirely from the sun. The unit also produced 10 metric tons of ice per day as a by-product. The author of that publication was the Director of the Russian Solar Energy Laboratory located somewhere in Southern Russia where the latitude is 45° North — the nearest to the equator within Russian territory.

What power such a big solar-power generator could produce in the Philippines — at latitudes around 14°-16° North — could perhaps be computed by Filipino scientists, in terms of its potential capacity in electric power and also in tons of ice per pay.

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<sup>1</sup> Editor's Note: The author is Vice-Chairman, National Research Council of the Philippines.

Perhaps the 10 tons of ice the Russian 1000-kilowatt unit was only a "by-product" of doubtful economic value for that country. But for the Philippines, which is in a tropical region, those 10 tons of ice daily are really "companion products" of economic importance.

It must be pointed out that the solar and wind energy units mentioned above are not in the category of small windmills for home water pumping nor of solar cookers and water heaters for residential use. A 1000 KW unit is big enough to supply the electric power needed by two large, or three small adjacent towns of the Philippines.

*Utilization of wind and solar energy on public utility scale.* — There is no doubt that even long before the present world crisis in petroleum fuels (which is making even the United States apprehensive, but perhaps not Russia), many countries have been already working towards the utilization of both wind and solar energy for the generation of electricity on public utility scale. In fact, both kinds of electric power generators have been successfully constructed in Russia. It is probable that such generator units might have been constructed in other countries, but the writer unavoidably had to discontinue all studies on these two branches of technology three or four years ago.

A scientist from India discovered that at elevations 100 to 150 meters above ground level, the wind energy is fairly constant and may reach three times that obtainable at 10 meters level. This, if also found to be true in the Philippines, can be of great importance to the development of our wind energy utilization.

A Filipino scientist, who has visited Taiwan, told the writer that the solar energy received in the Philippines might have higher infra-red content than in Japan or Taiwan. If this opinion can be verified, then it is probable that our solar-energy collecting mirrors would be effective even during cloudy days.

*Essential Characteristics of Wind and Solar Energy.* — In wind and solar energy utilization, the source of energy does not have to be transported to the generator plant as petroleum, nuclear fuel, and hydraulic energy have to be brought to the electric power generators. This means that transportation and handling costs are eliminated entirely.

Another obvious characteristic is that the use of both wind and solar energy would not entail payment. Petroleum crudes, coal, alcohol, nuclear fuels, coconut shells, natural gas — all these sources of energy involve considerable "cost of material" for any electric-power generating plant.

The free and unlimited supply of available wind and solar energy would thus reduce installation expenses considerably — as long as the cost for the acquisition of the machinery would remain relatively and reasonably low.

This is in direct contrast with the practice that is followed in all electric-power plants, wherein proper economic balance must be sought among the following factors: (a) the price of fuel, (b) the efficiency of fuel utilization in terms of the amount of fuel to be consumed for every kilowatt hour of electrical energy that is saleable, and (c) the annual interest on the capital investment necessary to set up the power plant, per average annual kilowatt of saleable capacity.

In a solar or wind energy plant, only the last item (c) can be considered, which simplifies the engineering and economic design of the plant to a great degree.

Up to now, the Philippines does not have any natural source of petroleum oil. Despite official assurances that it will be found, no one can exactly predict when it will be. There is a local fuel for motor vehicles that can be made available within one year. It can provide about 20 percent of the quantity of motor gasoline that is currently consumed annually. However, it cannot be used for generating electric power on a public utility scale.

One solution to the petroleum fuel shortage now being felt is for us to acquire the necessary technology on wind and solar energy utilization which has long been known in many countries but which is unfortunately not appreciated locally.

*Short Coming of Solar and Wind Energy.* — The principal shortcoming of solar and wind energy utilization is their intermittent availability. Solar energy becomes available during the night time and is greatly reduced during cloudy and rainy weather. Also, wind energy (this can be felt even at ground level) varies in velocity almost from minute to minute.

Moreover, it must be expected that radiation intensity and wind velocity will vary from locality to locality.

In spite of these inadequacies, the application of proper technology probably has partly solved by those countries that have developed prototypes of wind and solar power generators.

*Interconnection of Solar and Wind Energy Power Plants with Existing Power Plants.* — To minimize the above shortcomings, electrical interconnection of the wind and solar energy generators with existing hydro-electric and petroleum fuel electric plants (which has been done with the wind-energy electric power plants in the foothills near the Ural mountains of Russia) is proposed.

The electrical interconnection between wind and solar energy generators with hydro-electric and petroleum energy power plants eventually may become a reality because:

1. Petroleum can be easily stored in tanks that can hold even as much as one month's supply of fuel, and
2. Hydraulic energy that will last for several months can be stored in water reservoirs with one or more domes.

Although, wind energy cannot be stored even for one minute, solar energy, however, in the forms of solar heat can be stored in steam accumulators but for overnight use only.

Whenever a wind or solar energy power plant must reduce its output due to reduction in wind velocity or to the weakening intensity of solar energy, the interconnected hydro-electric power plant simply increases its rate of water withdrawal from its hydraulic reservoir; or the petroleum energy power plant draws more fuel from its storage tanks, so that the electrical transmission network can continue to deliver the required total output needed by the consumers.

The technology of adjusting electrical outputs from the various electric power plants in the network is well-known and not too complicated.

*New Method of Utilizing Wind and Solar Energy.* — There is now a new method proposed for the utilization of both wind and solar energy, whereby not electricity but liquefied hydrogen at very low temperature is to be produced. In effect, this will make the solar and wind energy plants simply producers of storable and transportable fuel.

A very recent technical article revealed the feasibility of using solar energy to generate hydrogen from water by direct heat at high temperature, and of utilizing wind energy also to generate hydrogen through wind rotors driving direct current generator for water electrolysis. The hydrogen is to be liquefied by a well-known process and stored or transported to the fuel burning power plants. The combustion of hydrogen yields no obnoxious gases that can pollute the air which petroleum fuels always do. In fact, the liquefied hydrogen can even be carried in insulated small containers for motor vehicle use.

Some Filipino scientists should make a techno-economic study of the above-mentioned recommendations to see if it is applicable to Philippine conditions.

*Some concrete suggestions.* — The National Science Development Board (NSDB) has a Philippine Atomic Energy Commission. It might be suggested that the President of the Philippines create a "Philippine Wind and Solar Energy Commission", which will be charged with the primary duty to:

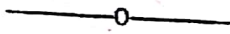
1. Gather basic research data on the characteristics of wind and solar energy adaptable to Philippine conditions as auxiliary or complementary to petroleum and hydraulic energy sources;
2. Study the technology of both wind energy and solar energy utilization for the generation of electric power on public utility scale;
3. Hold competitive examinations for the selection of a group of Filipino scientists and technologists to be sent for immediate, and intensive familiarization abroad on the technology of wind energy and solar energy utilization;
4. Undertake all necessary preparations so that the Commission can recommend the construction of wind and solar energy electric power plants, as soon as practicable, using as many locally-made components as possible;
5. Keep abreast on all foreign and local technological findings on wind and solar energy utilization and work speedily to make them applicable to Philippine conditions.

The National Research Council has created a small group of scientists and technologists who will undertake research work on energy resources not yet well-known in the Philippines. Unfortunately, because these people are only part time workers who do not receive any compensation whatsoever, and because of the lack of publications on the subject, all that the council can offer at this time is a symposium.

The proposal for the immediate creation of a Philippine Wind and Solar Energy Commission therefore, would provide for the thorough and

intensive study of the utilization of these two natural energy sources for the fulfillment of our country's energy needs. If immediately given the necessary budgetary support, the proposed Commission could enlist the cooperation of competent technicians who can assist the Commission in accomplishing its primary duties, with the least possible delay.

*Concluding statement.* — Our nation-wide gasoline station "pila" may soon be followed by brown-outs occurring several times a day all over the country. Time is fast running out. The solution to the present petroleum shortage is difficult to work out. If the Philippines is to survive as a nation, we must hasten the utilization of all sources of energy that we have in our country now, for the three most vital national services, namely: Fuel, transportation, and electricity.



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## PROGENITORS OF SOME PRESENT-DAY BREEDS OF SWINE

by

VALENTE VILLEGAS<sup>1</sup>

Ancestral forebears of modern breeds of swine in Europe, Africa, Asia, Indonesia, Ceylon and Philippines are traceable to various species, namely; *Sus scrofa* Linne, *Sus cristatus* Wagner and *Sus vittatus* H. Boie, 1828. In the Philippines, the progenitors are four wild species namely; *Sus celebensis philippenensis* Nehring, *Sus celebensis mindanensis* Major, *Sus celebensis negrinus* Sanborn, and *Sus barbatus sheoenobarbus* Huet.

Breeds of swine in Thailand and China are assumed to have come from *Sus cristatus* Wagner which comprises three subspecies. The type locality of the species is the Malabar coast. The species are spread to India up to a high altitude in Himalaya, Ceylon, Burma, Thailand, Tenasserim, part of Malaya and adjacent islands.



SUS SCROFA L. (Courtesy, Lauglier D'Europe)

In Indonesia, covering Sumatra, Java and Flores, and in Malaya, is found *Sus vittatus* H. Boie 1828 comprising 13 subspecies. These species are "small, refined and fine-haired". Breeds of swine in Southern Europe, Africa and parts of Asia are believed to have come from *Sus vittatus*, H. Boie, 1828. *Sus vittatus* H. Boie 1828 according to "most authors is a race of *Sus cristatus* Wagner, (the latter a subspecies of *Sus scrofa* (See Ellerman and Morrison-Scott, 1951)".

Philippine Swine in different islands are believed to be descended from their wild forebears, namely: From *Sus celebensis philippenensis* Nehring in Luzon, from *Sus celebensis mindanensis* Major in Mindanao, from *Sus celebensis negrinus* Sanborn in Negros Island and from *Sus barbatus shecenobarbus* Huet in Palawan.

<sup>1</sup> Editor's Note: The Author is Professor Emeritus of Animal Science, University of the Philippines.

*Sus scrofa* Linne, are large, rugged and covered with a dense coat of "gray hairs". It has 10 subspecies.

The type locality is Germany. The species is found in the temperate zone of Europe up to the eastern part of the Baltic Sea. In Asia, the habitat of this species is from the north to Himalaya.

Modern breeds of swine in northern Europe like the Yorkshires and the Tamworth, the Landraces of Denmark, Sweden and Holland originated from *Sus scrofa* Linne., but are the results of inter breeding during the 18th and 19th centuries with imported Chinese breeds. (Juliet Jewell Dr.)

The writer encountered a herd of swine in New Delhi, India, which were grayish in color, short-bodied with long pointed snout and erect ears. These wild pigs may be descendants of *Sus scrofa cristatus*.

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# MAPPING THE FOOTHILLS OF REGIONAL GROWTH

by

C. G. TIPPEN<sup>1</sup>

Regional socio-economic imbalance is a widespread problem in Europe. Britain's Northern Region, suffering from the rundown of traditional industries, is a case in point.

For economic development purposes this region consists of the counties of Cumberland, Durham, the North Riding of Yorkshire, Northumberland and Westmorland. For more than a century its economy was based on coal, steel and shipbuilding making it vulnerable to up and down swings of national and international demand.

*Relative Decline.* — War-time needs during World War II and post war development brought relief but steel usage per unit of national product has fallen as development has progressed.

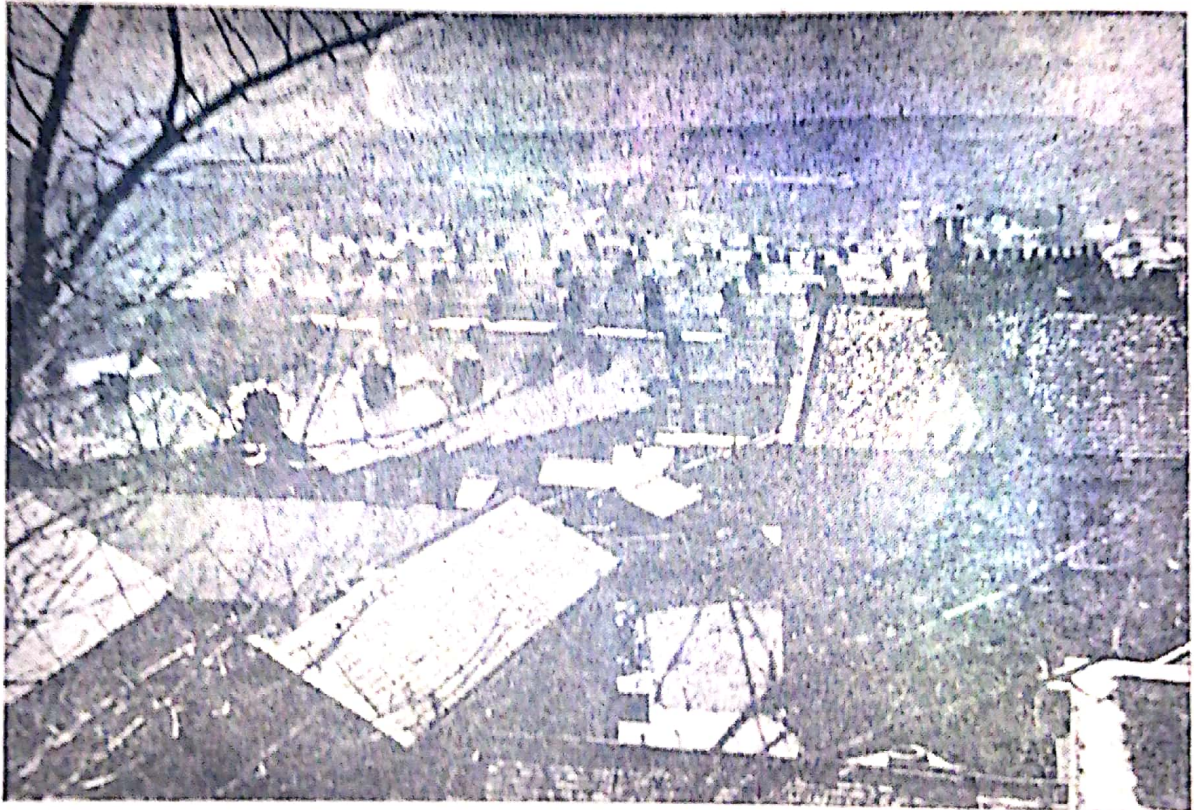


FIGURE I — A VIEW OF THE MINING TOWN OF HOUGHTON-LE-SPRING, COUNTRY DURHAM, NORTHEAST ENGLAND IN THE SIX YEARS FROM 1965 TO 1971 THE NUMBERS EMPLOYED IN THE PITS FELL FROM 119,000 TO 64,000 LARGELY DUE TO EXHAUSTION OF COAL RESERVES IN THE WEST OF THE COUNTRY.

Then some coal mines became exhausted or uneconomic to work leading to closures; and ship-building reacted markedly to the stop-go ef-

<sup>1</sup> Editor's Note: The author is a London journalist.



fects of post-war world-trade and keen competition from modern newly-equipped yards in other countries.

On paper, ways of dealing with such problems may seem simple enough. First, revitalization potential of declining industries can be assessed. (The outcome of modernization may not be increased employment but stable employment for a smaller number). Then there is the possibility of redeploying or re-training surplus labor. Finally there is the ideal of creation of new industries in the area. All these things however are not yet matters of materials and methods, they also involve people.

Realization has presented problems. Certainly the coal, steel, and shipbuilding industries have been improved so that they have become more viable in commercial terms. Retraining of surplus labor however is not so easy where generations of skills have been applied in local idioms of heavy industry — producing some resistance to change.

*Regional Councils.* — Government policy has included the setting up of Regional Economic Planning Councils and Planning Boards; the council's task being to help develop a regional economic policy and to advise central government on the local impact of national policy.

The planning board, consisting of Government officials, co-ordinates departmental regional work and co-operates with the planning council in preparing long-term strategies.

*Worker Distribution.* — When the Northern Regional Council was set up, the total labor force in the area was 1,329,000 with some 34,300 of these unemployed. Distribution of workers in employment in 1965 and 1971 was:

	Coal mining	Iron, steel and metal manufacturers	Ship-building	Chemical and allied industries	Other work
1965	119,000	60,000	44,000	54,000	1,024,000
1971	64,000	48,000	36,000	55,000	1,039,000

The changed distribution is due to reorganization within existing major industries and the introduction of new ones. The total labor force in 1972 was 1,298,000 of which 78,800 were unemployed. Averaged over three-year periods the percentages of unemployed are 1964/66 2.8 percent, 1970/72 5.6 percent.

It is impossible to say how the unemployment figures would have looked if great efforts had not been made to improve the regional employment situation. Relative to the rising national averages of unemployment slight progress has been made.

*Coal Mining Changes.* — Though subject to changing techniques and fuel demands, coal mining has a continued role in the region's economy. Exhaustion of the pits in the western areas of County Durham is being counterbalanced by the National Coal Board's developments on the east coast line. Here there are prospects of developing rich reserves of coal up to seven to 12 miles out (11.3 km to 19.3 km) under the sea.

World shortage of coking coal has given Durham's mining prospects a fillip. New techniques have improved overall demand but more significantly coal of high coking quality is available in the easterly re-

serves now being exploited. This will be of special benefit to the Teesside steel industry.

*Steel Job Losses.* — In 1972 the British Steel Corporation completed a £100 million modernization program in the region. Now it has a new 10-year strategy involving another £3000 million of which £1000 million will be spent on a major steel complex at Redcar — Europe's biggest.

Though construction will provide some new jobs short-term the resultant closure of out-dated small steel works must involve some more job losses.

*Chemicals Boost.* — Soon after World War I Imperial Chemical Industries set up a major agricultural fertilizer and associated products plant at Billingham on Teesside. While natural expansion of this has been continuous, the feedstock has changed successively from coal, through naphtha to natural gas.

In the 1950's a petro-chemical complex was built at Wilton and also has expanded continuously.

These have been invaluable contributions to the region's economy and today employ a total of 25,000 people.

*Shipbuilding Problems.* — Many European shipbuilding yards are only slightly better equipped or laid out but they suffer less from poor labor relations, job demarcation, and proliferation of trade unions.

The sites in the Northern Region tend to be in congested areas, not suited to flow-line assembly methods. Most are located well away from the steel-works and access difficulties preclude delivery of big plates.

Re-design of lay-out, introduction of sub-assembly sheds, and better steel handling methods have enabled some yards to keep pace. And these have specialized with success in series production of particular classes of vessels.

*Retraining Labor.* — The problem for the 1970's only slowly being resolved is whether Tyneside and Teesside can overcome all the organizational and human problems — the integration of craftsmen in an assembly-line process and the creation of better labor relations.

The shortfall in the Region's job situation can be improved if more labor-intensive service industries can be attracted into the area. A promising sign of this is the setting up of textile plants using man-made fibers. Many of the operatives are ex-miners who have switched from their traditional work quite happily.

An increasing number of teenagers are staying on for further education, so it becomes the more essential to offer a richer variety of employment.

*New Towns.* — Government moves to improve life in the region include the provision of five new towns.

Some of these towns are aimed at coalescing existing and surrounding townships and providing "overspill" homes for Tynesiders and Wear-siders. One town has already provided 2 million square feet (186,000 m<sup>2</sup>) of factory space, and another town 1 million square feet (93,000m<sup>2</sup>).

*Hope of Growth.* — The Northern Economic Planning Council believes that although the region can now point to considerable improvement in many fields, the increased job-loss which will follow the recent

changes in the region's economic outlook means that in the few years immediately ahead the region must run even faster merely to stay where it is. But over the past 20 years new industry has been steadily establishing itself and a new industrial structure is now taking shape which carries in itself the seeds of future growth and prosperity.

This belief that the region is on the threshold of solving what seemed an intractable problem seems to be held also by the Confederation of British Industry (CBI), which says that diversification into tighter engineering, modern factories, and capital equipment are good pointers.

Also given new powers the Northern Region Industrial Development Board has in less than a year already approved projects which will create some 9000 jobs in a wide variety of industries.

Industry alone will not necessarily correct all the imbalance of the region, particularly for the younger and well educated who have tended to migrate and there is local pressure for more office jobs with good career structures.

—o—

## 23RD INTERNATIONAL GEOGRAPHICAL CONGRESS XIVTH GENERAL ASSEMBLY OF IGU USSR — MOSCOW

The 23rd International Geographical Congress, with its symposia and excursions, will be held on July 12-August 13, 1976 in Moscow, USSR. There will be three usual phases in the Congress, namely: (1) Symposia of the IGU Commissions and Working Groups — July 12-26, 1976; (2) General and sectional meetings of the Congress, symposia, and workshops, as well as the sessions of the 14th General Assembly of the IGU — July 27-August 3, 1976; and (3) The post-Congress period (scientific excursions) — August 4-13, 1976.

During the 23rd International Geographical Congress, July 27-August 3, 1976, ten sections will be organized, such as:

1. Geomorphology
2. Climatology, Hydrology, Glaciology
3. Geography of the Ocean
4. Biogeography and Geography of Soils
5. General Physical Geography
6. General Economic Geography
7. Geography of Population
8. Regional Geography
9. Historical Geography
10. Education in Geography, Geographical Literature, and  
Dissemination of Geographical Knowledge

General Symposia designed to catalize interest towards advanced studies in Geography will be held on days free from other technical meetings of the Congress. Attention will be focused on the problems dealing with the scientific-technological revolution in order to highlight potentialities of geography as a means of understanding and managing man's changing environment.

There will also be Congress Exhibits which will be placed in the building of the Moscow State University, where the meetings of the Congress will take place.

For further information, write to:

Dr. Yuri V. Medvedkov, Secretary General  
23rd International Geographical Congress  
Staromenetnyi per. 29  
Moskva 109017, USSR

—o—

## MEASURING TIDES IN THE "SOLID" EARTH

by

ROY HERBERT<sup>1</sup>

"Tides" in the earth's surface caused by the gravitation of the sun and moon, and the "ringing" of the earth after earthquakes, are being studied in England by laser light. At Cambridge University's seismological observatory in Yorkshire, in a disused railway tunnel 1 1/2 miles (2.4 km) long and 500 feet (150m) underground is a laser system, developed by the National Physical Laboratory (NPL), which measures the earth's dimensional changes in thousand-millionths of a meter.

Earth tides occur because of the world's rotation in the gravitational fields of the sun and moon. The moon causes the earth to bulge into an ellipsoid a little like a rugby football, with the longer axis along the line joining the centers of the two planes. So there are two maximum and two minimum tides a day.

But there are many more complicated gravitational influences that cause strain variations. Measurement of these is important in the study of the earth's structure. The "ringing" by earthquakes is a series of small free oscillations which can provide information which may be used in earthquake prediction. The NPL's laser system is expected to produce far better data than has been available.

*Detectable variation.* — A beam of light from a laser shines along a 180-foot (55m) pipe connected by a flexible joint to a reflector fixed to the rock of the tunnel. Strains in the ground cause changes in the length of the light path, as the rock moves. So the reflected light goes out of phase on its return and the difference can be detected. To keep this interference signal at its maximum, the frequency of the laser light is continually and automatically adjusted.

These changes in frequency are compared with the frequency of another laser specially developed by the NPL, which is constant to one part in a hundred thousand million. The frequency differences between the two are therefore a record of the earth strain changes over the length of the tunnel.

The laser and recording system have already been run for 60 days at a stretch with little trouble. Automatic telephone equipment has been installed because even the most enthusiastic scientist wants to avoid living in a tunnel with temperatures of 50 degrees Fahrenheit (10°C) and running water that ensures 100 per cent relative humidity!

<sup>1</sup> LPS Science Correspondent.

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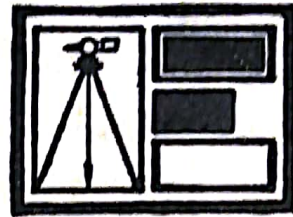
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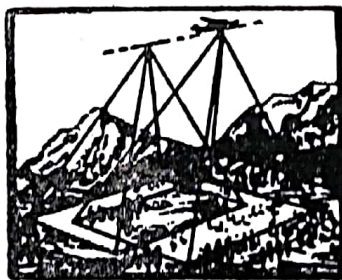
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