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The
PHILIPPINE GEOGRAPHICAL JOURNAL

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UNIVERSITY OF LIFE
(Pamantasan Ng Bagong Lipunan)
Correspondence School
Continuing Education Program

by

PEDRO N. LAUDENCIA[1]

INTRODUCTORY CATALOGUE

I. INTRODUCTION

A. The Need

The most important asset of a nation is its human resources. Productive people constitute a progressive nation. In order to be productive people must possess technical skills and proficiency. Technological and scientific development, however, has grown at such a rapid pace amidst a geometrically expanding population that keeps hungering for education. This creates a dire need for technology delivery that must be fast setting but within the means of a developing country like the Philippines.

In its effort to build up economic stability, the government embarked in programs and projects geared towards the dissemination of technologies needed to augment livelihood opportunities. The Ministry of Human Settlements, for one, has developed a housing cum livelihood program in support of the government's present thrust in extending basic community services to the greater population towards self-sufficiency and economic growth.

The generation of livelihood opportunities should be pursued corollary to the development of human skills. Technical proficiency and skills training are important components of such a thrust.

[1] Director, Correspondence School, Continuing Education Program, University of Life. Formerly Professor, Central Luzon State University and Gregorio Araneta University Foundation; Consultant of Asian Development Bank, G.A. Machineries, Inc. and Bueno Industrial and Development Corporation; and Chief, Planning Service of NSDB; Supervising Scientist and NSDB; and Asst. Administrator for Research of Philippine Coconut Authority.

B. The Constraints

The present conventional educational system based on a formal teaching-learning process with daily student-teacher interaction in classrooms demands vast resources for:

1. Remuneration of teachers;
2. Construction and maintenance of classrooms;
3. Provision of instructional materials;
4. Equipment for shops and laboratories, etc.

The prohibitive cost of constructing new school buildings, the galloping increase of population, the meager national resources with many priorities competing for a share, etc., help spawn a worsening crisis in education.

C. The Alternative: The Correspondence School

Pursuant to its humanist ideology to help in the training of technically proficient, socially committed, and productive members of Filipino communities, the University of Life (Pamantasan ng Bagong Lipunan, has established a Correspondence School as one of the projects under its Continuing Education Program. The school is designed to develop a cost-saving, fast accelerating instructional delivery system through packaged self-learning courses with emphasis on technology and skill development. Taking advantage of the "diploma consciousness" of the Filipinos the Correspondence School shall grant certificates to its graduates in the short courses. These may be accredited in the school system in coordination with the Ministry of Education and Culture.

The Correspondence School system is cost-saving because it does not require impressive school buildings nor an expensive campus to maintain for its operation. It is fast accelerating because once the coursewares are prepared and printed a nationwide field delivery system takes over the dissemination process through a network of institutional linkages.

D. Objectives and Goals

The general objectives of the Correspondence School of the University of Life are two-fold:

1. To help develop the nation's human resources through a cost-saving, non-formal educational program emphasizing technical proficiency and skill development as a means of earning a living and/or increasing ones productivity to augment his existing livelihood source;

2. To open new educational opportunities for those who cannot enrol in existing conventional instructional systems due to difficulties in availing of such school services.

The Correspondence School Program is need-oriented. It is not intended to displace or compete with the existing formal educational system but merely to augment it. It is envisaged to widen the educational opportunities for a greater number of people. For example, one who is currently employed as a mere laborer in a commercial piggery may take the correspondence course on Swine Raising so that he could advance into a supervisory position or at least be more proficient in performing his duties to merit a better pay. Employees of government as well as private firms who are planning to go into broiler production after retirement will have the opportunity to take up the course on Broiler Production (Broiler Poultry Raising) while they are still employed. Business firms who are planning to use computers in their operations may convince their present employees who may be displaced by the new system to enrol in the correspondence course on Computer Technology.

The goal is to promote the improvement of livelihood conditions by way of increased productivity or improvement of individual's technical skills. In the rural areas an increase in productivity can be brought about through the utilization of existing resources in the form of household-level activities. For example, during times when farm hands are idle, e.g., after harvest time, the housewife can avail of the course on "Food Processing: Fruits and Vegetables" to enable her to process or preserve surplus fruits and vegetables from the farm for future use or for sale in the open market. Improvement of technical skills will also be brought about through the development of farm management conceptions, including practical tools for their implementation.

In the urban areas, concentration will be made on the improvement of technical skills e.g., development of technicians towards career advancement as well as development of industrial productivity consciousness.

II. THE CORRESPONDENCE SCHOOL CURRICULUM

The Correspondence School of the University of Life is initially introducing two programs or curricula to serve the more urgent need of the masses in increasing productivity and acquiring technical skills and proficiency. These are:

1. The Apprenticeship Curriculum
2. The Proficiency Curriculum

Courses under these curricula are short-term aimed at development of technical proficiency and skills to enable the student to earn a living or improve his present employment status. In general, the goal is to promote the improvement of livelihood conditions by way of increased productivity and acquisition of new skills. These are intended, however, for two groups of clientele.

The Apprenticeship Curriculum subscribes to the definition from the Labor Code of the Philippines (Article 58) which states that "apprenticeship means practical training on the job supplemented by related theoretical instruction." Hence, the emphasis is skill training in actual work situation. Since the training will generally be administered through a selected firm, institution or enterprise, the trainee will be tutored by those on the job and therefore need not be able to read and write. Literates, however, may be allowed to take any course under this curriculum. The tutor is to use the C.S. coursewares to assist him in implementing the learning-by-doing activities for the learner. The coursewares are essentially the same as the coursewares for the Proficiency Curriculum but normally translated in the dialect of the learners. Completion of the training entitles the trainee to a U.L. Certificate of Apprenticeship to be issued by the Correspondence School with the head of the cooperating agency as co-signer.

The Proficiency Curriculum courses are for those who have reading and writing skills sufficient for them to be able to use the C.S. coursewares. Normally, these are at least elementary school graduates. Non-elementary graduates who decide to take the course may still be admitted if they pass a qualifying examination which tests their ability to read, write and comprehend printed materials. They are to study the instructional materials, perform the activities and undergo the evaluation required in the different learning modules. Practicum may be done in their places of work and the output of such will be evaluated as indicated in the modules, either on a self-evaluation scheme or on a supervisory evaluation scheme. A U.L. designated Instructional Manager (IM) shall supervise the program in his assigned area. The completion of the requirements in a set of modules entitles the trainee to a U.L. Certificate of Proficiency after a final evaluation by the Correspondence School. This may also be accredited in the formal school system on an equivalency scheme prescribed by the Ministry of Education. This program may be availed of by different trainees, such as:

1. High School drop-outs in the work force who wish to complete their vocational high school education;

2. Project managers and entrepreneurs who are high school graduates and wish to pursue a post-secondary vocational course;

3. Degree holders who wish to gain added knowledge and acquire a Certificate of Proficiency in new skills.

PATTERNS IN HUMAN GEOGRAPHY[1]

by

RAMON L. SAMANIEGO[2]

Human beings arrange their lives in geographical space. They exist and perform their activities at specific locations, and they move or distribute things in certain directions. They thus give character to places or areas, differentiating and connecting them with respect to the various aspects of the human condition. The geographical expression of man's existence can be thought of very simply as a geometry of points, lines and areas. Production locations, places of residence, settlements and so on form patterns of points or nodes around which life is organized. Lines of communication and transportation form networks of movements and interaction. Human differentiation of geographical space form system of regions or areas distinguished by some particular characteristics bestowing homogenity or functional cohesion. The man-made landscape is a college of these nodes, networks and regions.

The analysis of this geometry of space form is the basic task of human geography. But before the existing situation can be explained, or improved upon, it has to be accurately described. This implies a careful process of observation in which the results can preferably be expressed in numerical form, for the precise description of human geographical patterns is basic to their eventual understanding.

OBSERVING HUMAN ACTIVITY

Knowledge begins with observations; we perceive the world around us with our eyes and other senses, and we arrange these observations in a certain relationship to each other so that they make sense. Repeated observation of the same object or event brings familiarity, repeated observations of a particular association of objects or events create an expectation. Knowledge imposes order or predictability on the world, reducing uncertainty and helping to make the unexpected consistent with

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[1] Prepared for the Orientation Seminar for Technical Services, Ministry of Human Settlements on 9 November 1978 at the Ateneo de Manila University, Makati, Metro Manila.

[2] Professor, UP at Los Baños, Laguna and Vice-Chairman, Philippine Association for the Advancement of Science.

experience if not always entirely unexpected. It gives us a feeling of security knowing roughly where we ourselves stand in the complex reality of life. It also gives us a capacity to control our individual circumstances to make life better.

How do we go about making observations of the world around us? If we want to build up precise and systematic information rather than simply random impressions, some methods of observations will be preferable to others. The cardinal rule in scientific inquiry is that observations should be taken in a way which would lead others to obtain the same results. This is often quite easy to accomplish, such properties as weight and height of a person can be accurately found by independent observers because there are appropriate measuring instruments available and agreed scales of measurements. But in observing many other properties of human beings — how they behave, feel or think — the process is much more difficult.

Something of the range of methods of observations and measurements in human geography can be explained by a simple illustration. Suppose that someone visited 5 cities at known locations and wished to find out about 4 things, whether they have a university, whether they are "attractive," what political attitudes are held, and how much industry there is. The first question is answered in advance by a directory of universities in the library. The attractiveness of each city is established relative to the others by visual observation and subjective judgement. Political attitudes may be answered by asking each of a sample of 50 people to give the national government a score anywhere on a scale of 1 to 10 where 1 means "strongly dislike" and 10 means "strongly like" and then totalling the results. The amount of industry is found by determining how many people are employed in factories. Finally, the geographical position of each city is established by a grid reference on a map.

Human geography has generally relied on 2 main methods of compiling primary data; visual information and asking questions of people. The questions may be verbal or written questionnaires, designed to elicit certain responses from the individual being surveyed or observed. Much information derived from questionnaires is based on a sample or subset of the population. If a sample is used, the numerical information that results is only an estimate of the true value. A properly conducted sample survey is very likely to give results close to those which would have been derived from questioning the entire population. The design of questionnaires is a matter of great importance.

The development of "remote sensing" of human activity by the use of air photography, space satellites, etc. represent an important recent innovation in the geographer's instrumentation. However, the nature of man is such that we can never expect to measure accurately things like his happiness, self-esteem, attitudes — and perhaps we will never wish to.

DESCRIPTION VIA MAPS AND MATRICES

The orderly arrangement and display of a set of observations can be thought of as a description of a segment of reality. Man first joint together his observations of the world as verbal descriptions. This reached a high form of art in early 20th century human geography. Traditionally geographers have relied on the map as a means of description, with the points, lines and areas defining human activities readily depicted on a piece of paper. But with the growing interest in quantitative methods in the past two decades, greater emphasis is now being placed on numerical description, and the map is being replaced by the matrix as the human geographer's basic information system.

A matrix is simply a table in which numerical information is inserted. Any set of data can be put in a matrix — could be anything from number of pigs kept to quality of life.

THE GEOGRAPHICAL UNITS OF OBSERVATION

All geographical information on human existence is built up from individual observations — the household census return, a response to an attitudinal survey, a consignment of freight, a crime recorded. Usually the occurrences are aggregated for particular geographic units and these totals or some appropriate ratios then become the data with which the geographer works. Very often, there is no choice but to use given aggregate a real data because records of individual observations are not available.

A major shortcoming of administrative areas as units of observation is that they vary considerably in size and shape. Measures of a real distribution are sensitive to size of the units of observation.

The only really satisfactory solution to this problem is for official data to be compiled so as to give research workers much more freedom to organize information according to their own choice of real units. The ideal arrangement would be for all demographics, social and economic data to be recorded and stored by individual observations each with a grid reference to identify location. Computers could very quickly aggregate such figures for any specific areas.

The description of space patterns of human existence by converting observations into numerical data belong to the contemporary quantitative approach to geography.

Another aspect of contemporary geography closely related to quantitative analysis is the use of statistics. Statistics has a variety of meanings, one of which is its colloquial usage to refer to any numerical information. The term is used more strictly to the science of drawing sound conclusions from limited observations. There are 2 branches: descriptive statistics which is concerned with summarizing a set of numerical observations according to some rule, and inferential statistics which has to do with infering relationships between sets of observations. Statistical methods are very important in the manipulation and analysis of numerical data in human geography.

MAPPING NUMERICAL INFORMATION

The most obvious way of describing a geographical pattern is to map it. A map is a simple model of geographic reality, scaled down in size and with various properties represented symbolically. Once a matrix of numerical information has been compiled it can be displayed cartographically to provide a visual impression of the patterns which the data portray. Maps can also display the results of calculations performed on an initial set of information. Mapping numerical data can add information by showing the location of the incidents which the number represents. A map can represent space forms — the geometry of a transportation network, the regularity of a point pattern or the concentration of large observations in a particular area.

Numerical information can be depicted on maps by various kinds of symbols, lines, patches of shading or color. These correspond with the system of points networks, and differentiated areas which are the physical expressions of man's space existence.

The simplest kind of symbol is a dot. Dot maps can be used to portray data measured on a nominal scale: a place has either or not a particular attribute. The same information can be depicted by any other kind of symbol — squares, triangles, or even simple artistic representation of real objects like an airplane to show the location of an airport. Dot maps can also be used for ratio data, each dot representing a given number of occurrences.

If data are available on ratio scale, symbols of different sizes can be used. The proportional symbols — squares, circles, bars, lines are drawn proportional in size to the magnitude of the occurrence.

Subdivisions of geographical space such as economic regions or political units can be shown by patches of contrasting shading or color.

MAPPING MULTIPLE AND CONTINUOUS VARIABLES

To map a matrix of data with more than 2 variables — bar graphs and divided circles (pie diagrams) in which sizes of segments represent magnitude of different conditions — are used.

MAPPING BY COMPUTER

Recent advances in computer technology have led to the development of "automated cartography." When programmed in a certain way and fed geographical information, computers can draw maps. The advantage of computer maps over conventional handdrawn maps, is their accuracy and speed of production; their main disadvantage is that computers are not very good artists, though their skills are improving.

The best known and most frequently used method of computer mapping is the SYMAP system developed at Harvard University.

SUMMARIZING SETS OF OBSERVATIONS

The map like the matrix involves same simplification of reality. Both arrange geographical facts in a way which facilitate description and analysis, but both are summaries in the sense that some information is inevitably dispensed with in the course of observation, measurement and display. But tabulation and mapping is only a first step, for once the numbers have been compiled or the maps drawn, various calculations can be performed to provide much more concise description of areal variation.

Characteristics of sets of numerical observations can be summarized in various ways. The parameters of populations can be measured directly or they may be estimated from statistics derived from samples. Inferences from samples are merely statements of probability the accuracy of which is dependent on how the samples are taken and on the element of chance. The discipline of statistics coupled with the language of mathematics, thus enables us to analyze data and establish geographical facts.

COMPARING SETS OF OBSERVATIONS

The purpose of summarizing a set of observations is generally to facilitate comparison with another set or with some norm. Compared with one another any set of observations can be pronounced similar or dissimilar, but how great a difference is significant. A significant difference is one which can not be accounted for by chance at a given level of probability.

TRANSFORMING AND COMBINING DATA

We generate numbers which can stand as a summary description and which can also be used for comparison with the incidence of other conditions. But many aspects of life can not be sensibly represented by observation on a single attribute or variable and it may be necessary to combine information on a number of different conditions but conditions measured in different units or on different scales raise problems. How, for example, might we add people in poverty, infant mortality, and crime rates to produce some general social indicator.

The problem can be approached by scale transformation which facilitate the combinations and comparison of data on various variables measured in different ways. A scale transformation comprises any rule which enable one set of observations to be converted into another set which is more useful than the original in a particular context.

MEASURES OF GEOGRAPHICAL PATTERNS

Geographical patterns consider the space relationships of observations to each other. These patterns can be described numerically. The simplest pattern is one of a set of points. They can be arranged in an infinite number of ways. Three basic patterns can be recognized: regular, in which the interval between points are similar; clustered, where they appear in batches separated by gaps; random, one in which the spacing could have been determined by chance.

As measures of distribution patterns, nearest neighbor analysis, centrographic techniques and concentration coefficients can provide very useful summaries. But they reveal little about the detailed form of a particular pattern.

PATTERNS PROCESSES AND PROBLEMS

What are the broad implications of the quantitative approach to human geography?

Great emphasis has been placed on the measurement of location patterns or areal distribution as a focal point of contemporary human geography. These patterns can be summarized in various ways, compared with one another, and ultimately used in the traditional process of regional synthesis. But what is actually achieved by more accurate description of the manner in which man arranges life on the surface of the earth? We may have been able to satisfy curiosity by reducing complex patterns to the simpler form of an equation, index, or distribution map and thus imposing intellectual order on the chaos of the world as we observe it. But where does this lead us? We may have a clearer impression of the way things are, but do we necessarily understand better why they are that way? And do we have any new visions as to how they ought to be? These are essentially philosophical issues.

In human geography the emphasis has been on the location of economic activity and on urban geography. Basic social problems have generally attracted little interest. It sometimes appear that certain aspects of human geography have become popular fields of research more by virtue of convenient numerical data allied to particular techniques or an efficient computer program, than because they are fundamental to man's existence.

Human geography has for a long time its applied aspects — research connected with regional development problems, urban planning, etc. — as well as a deep concern with man's use or abuse of his natural resources. And the current public interest in environmental problems such as air and water pollution has provided special scope in recent years for practical research in the interface between human and physical geography. But there are many contemporary social issues with strong geographical components that have been neglected until very recently; obvious examples — poverty, crime, other aspects of social deviance, physical and mental health.

To quantify quality seems an appropriate challenge to place before the geographer with skills in numerical methods. It is a necessary preliminary to improving the quality of life and to reducing the space inequalities which are increasingly matters of social concern.

REFERENCE: Smith, **Patterns in Human Geography,** Penguin Books 1975.

THE DELIMITATION OF AREAS FOR RURAL DEVELOPMENT: THOUGHTS TOWARDS A TYPOLOGY[1]

by

R. D. HILL[2]

The task of developing a typology of rural areas is basic to the work of the Commission on Rural Development for two reasons. First, there has been no attempt by geographers (or other scholars for that matter) to put together in a systematic way that has universal applicability the many different indicators of levels of development. The task is therefore of intrinsic interest. Second is the desirability of devising methods of identifying areas for development other than by what might be called inspired **ad hoc** methods or by the machinations of the political process. There are, it is true, problems in attempting to devise methods of making such identifications, notably that there is a danger in spending so much time and effort on making surveys that decision-making is unnecessarily delayed. In regions of rapid rural population growth and deteriorating agriculture it is undesirable to wait until all is known that could be known.

In presenting this paper I shall deal first with the question of 'level of development' since the answers to it bear upon the sorts of measures that might be used in a typology. Then I examine the desirable qualities of a typology, here drawing in part upon experience in devising and using the typology of the I.G.U. Commission on Agricultural Typology developed by Kostrowicki and his co-workers. Finally, I look critically at some of the more important indicators.

'LEVEL OF DEVELOPMENT'

The 'level of Development' is and probably never can be precisely defined but clearly the 'level' however defined, must be in relation to something. The basic question is thus whether, for each country or internationally, relative or absolute measures are used. One of the

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[1] Paper presented at a meeting of the International Geographical Union Commission on Rural Development, Nagano, Japan, August 1980.

[2] Department of Geography and Geology, University of Hong Kong.

more important attempts to use relative measures is that of Norton Ginsberg in his **Atlas of Economic Development.** In most of his 48 basic maps he takes a world measure, the mean, and develops a classification with respect to that mean. He has three equally-sized groups above the mean and three below it. In effect, countries are ranked relative to each other and the mean. Instructive though this is, the variation in group intervals from map to map and the use of the mean instead of a simple linear scale for determining classes makes this approach less immediately comprehensible than it might otherwise be.

The alternative is to use arbitrary scales with equal or logarithmic size classes applied to absolute measures. These include such common indicators as Gross Domestic Product, household possessions, newspaper readership, clinics, dietary levels, use of energy and so on. These have the advantage of being well-known and for many, data are already collected at national and regional levels. There is a good case for not using measures which involve monetary values, at least in any international comparison. An alternative approach is to measure the labour input required to earn enough to buy basic foodstuffs and consumer goods, though perhaps this is somewhat 'value-loaded'. Other appropriate units of measurement include 'grain equivalents' and energy units such as kilo-joules. These aggregative units, while necessarily involving some degree of arbitrariness, in consolidating rubber or milk to grain equivalents or fertilizers to kilo-joules for instance, nevertheless allow comparisons to be made on a standardized basis. If this approach is used, there is an obvious need for internationally agreed conversion tables. This approach may be inadequate for social parameters, however.

DESIRABLE QUALITIES OF A TYPOLOGY

Here the most obvious quality is that the typology should be comprehensible and not just to academics. If the typology is to aid in the identification of areas and sectors of rural space for planning purposes, for investment (or disinvestment) for identifying and ameliorating ecological danger zones, then it must also be comprehensive. The balance between a desirable number of characteristics and the need for simplicity is not an easy one to achieve. The I.G.U. typology, for example, has 27 characteristics in four groups.

A third desirable end is that the characteristics have equal 'determining power'. Weighting, is possible of course, but in practice leads to a great deal of complexity (as well as argument as to what the proper weighting might be).

Fourth, is that the various characteristics are discrete, that is, they have a high degree of independence. Where they are not independent (as some of those in the I.G.U. typology are not — quite deliberately), then the degree of dependence must be precisely known. For example, the number of rural clinics and the number of medical personnel are clearly not independent.

Fifth, for mapping purposes in particular, the typology should be hierarchical. That is, it should contain clearly distinguishable levels which can be aggregated or disaggregated according to level of generalization and particular needs.

Sixth, and related to the fifth point is that the typology can be satisfactorily applied at all scales from the purely local level involved in a field investigation, right up to the international level.

Seventh, it is desirable that the measures used should not rely heavily upon estimates or upon arbitrary decisions of the user. In other words the classification of an area must be replicable.

Finally is a question that I am not convinced of, namely the desirability of all measures being quantitative. Certainly, I am persuaded of their utility in so being, but it seems that important social and political characteristics may be omitted simply because it is difficult to measure them quantitatively.

SOME MEASURES OF DEVELOPMENT

These can be grouped into four basic groups, — land, infrastructure (including accessibility), population and, finally, social indicators.

Land. — Some suggested indicators in the 'land' category are contained in the I.G.U. agricultural typology and it is not necessary to elaborate here. Clearly, basic measures of productivity such as production per unit of area, per unit of labour, per unit of energy input are essential, as is an indication of cropping intensity. I have included energy input here since on present trends this is likely to become an important issue. (One should ask the question which is more 'efficient' in the following cases: U.S. rice production of one ton of grain 'costs' 11.2 million KJ, Philippines rice production — using buffaloes — 'costs' half that, while hoe cultivation of one ton of **Sorghum** in the Sudan 'costs' only 858,000 KJ).

The trend of productivity is also important since if it is downwards, a basic policy decision must eventually be made as to whether or not to invest in the hope of reversing the trend or to invest elsewhere to further stimulate production and hence, possibly, to increase regional disparities.

There is a clear need in particular to measure regional productivity so that future infrastructure provision can be properly related to the amount and kind of rural produce to be moved. The consequences of failing to do this are examplified by Thailand which has elaborate airport facilities in some cases for 3-5 aircraft movements weekly and expensive roads (costing US$1 million per kilometre) in regions with very small surpluses above subsistence resulting in substantial numbers of villages having no roads at all since all the money has gone into 'super-highways'.

Infrastructure. — Here the measures are fairly obvious and fall in two sub-groups, those relating directly to production such as power supply, water supply, including irrigation, actual and potential, and those relating to transportation, marketing the provision of agricultural services, including extension services. Concerning these, the basic point is not so much how many exist but the accessibility of these to farmers. Thus it is a matter of no great difficulty to determine the length of road, track or path per areal unit, but it is a matter of consequence to relate this to trafficability. For example, in northeast Thailand, the quite extensive secondary road network has good (if dusty) trafficability in the dry season when there is little produce to shift, but in the short wet season when there is produce to be moved many roads are partly under water or become quagmires. Perhaps an alternative approach is necessary here, one in which accessibility to infrastructure, including social infrastructure, in terms of time and in terms of cost needs to be determined.

Population. — The location of population, in particular measurement of the degree of spatial aggregation (especially important in infrastructure provision) is so obvious as scarcely to require statement. Agricultural density is useful measure though there are problems with this concept in areas of pastoralism, especially those with low-quality pastures (and low-quality animals). There are also definitional problems in some forms of socialist agriculture in respect of what is the agricultural work-force and indeed, what is rural. Similar problems arise in areas of part-time and recreational farming. Clearly, though, the employment structure of the rural work-force is basic, though again there are definitional problems. One clearly classifies the **arbeiterbauer** of the Federal German Republic as part of the rural labour force, but what of those who live in the rural areas yet commute daily or weekly to town employments? Their income, their presence or absence, may be crucial to the maintenance of some kinds of farming, as may that of more truly migrant labourers, of Indonesia or southern Africa for example.

Social Indicators. — Here the common measures include education and health service provision, and again the emphasis should rightly be not just upon their physical existence but upon their actual use by rural people. Literacy is important in developing countries though there are difficulties of definition and adequacy of data. The same is true of such matters as personal security and crime and in an ideal world the measurement of levels of rural development ought also include the assessment of political risk.

In conclusion I would like to suggest that the question of why delimit areas may be as much political, as scientific. The use of some measures or combinations of measures and not of others may give different suggestions as to which areas ought or ought not receive development assistance. For example, were a typology to be so constructed as successfully to identify areas of 'least cost and greatest development potential', might this not influence decision-makers — perhaps at the cost of ignoring 'high cost, low development potential areas' where development expenditure may be desirable for political and social reasons? How can such political and social reasons be identified and should they not be built into the typology?

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SOIL EROSION AND THE KAINGINERO: THE EVOLUTION OF THE SOCIO-ECONOMIC APPROACH TO SOIL CONSERVATION[1]

by

DR. GEOFFREY A. J. SCOTT[2]

INTRODUCTION

While soil erosion theory is firmly established (Bruce, 1978) and the various facets of the universal soil loss equation generally accepted as valid, it is a fact that efforts to apply this knowledge has had limited success in reducing soil erosion from kaingins (swiddens) in the Philippine uplands (Uichanco, 1971; Del Castillo, 1973; Sims, 1975; Duldulao, 1978). Soil erosion techniques most practical in tropical agriculture are those based on mechanical or vegetative control (Mamisao, 1963). Included in these practices are contour cropping, contour buffers and orchard planting. While in the Philippines these practices have been applied with some success in areas of plantation and lowland permanent agriculture, it is apparent that attempts to control losses from the kaingin have had little success. While this condition is by no means unique to the Philippines or even the ASEAN countries as a group (Tamesis, 1960) it is a problem which must depend for its solution, not on research from elsewhere, but on research and its application performed here in the Philippines.

It is now apparent that upland conservation depends not so much on theories of soil conservation, but on the practice of introducing socio-economic modifications to the kaingin system. Vital is the development of cropping patterns and practices and agro-forestry techniques which will not only be socially acceptable and economically rewarding to the kainginero, but will also stem the loss of valuable topsoil. The Philippine kainginero has his own culture, socio-economic constraints and will power. He is, or strives to be, his own master and barring compulsory resettlement it is he who will eventually decide if erosion is to continue unabated or be subject to control.

[1] Presented at the 4th ASEAN Soil Conference, February 12-14, 1979, Manila, Philippines.

[2] Assistant Professor of Geography, University of Winnipeg, Winnipeg, Manitoba R3B 2E9, Canada.

A BRIEF HISTORY OF THE KAINGIN PROBLEM

The history of induced soil erosion in the Philippines is well documented (Rayos, 1965). Recognized in the early colonial period as a major problem, the Spanish promulgated the Forest Laws of 1856 which provided stiff penalties for their violation. Found inadequate to protect forests, the American administration passed numerous additional laws to channel agricultural development only onto soils deemed suitable for this type of ecosystem modification. Following independence additional laws and penalties were introduced in a failing attempt to dissuade the kainginero. It became clear, however, that the difference between law practice continued to widen and forest destruction and soil erosion continued (Garcia, 1960; Gill, 1960; Gulcur, 1968) due to the simple reality that kaingineros considered family and survival first and had, understandably, less appreciation for the concept of the national welfare (Ganapin, 1978).

Only in the last two decades has it became appreciated that social and economic factors were probably those most important in reducing erosion from uplands, and that efforts directed towards understanding the kainginero and his link with the land were necessary (Tagumpay-Castillo, 1965). In the 1970's it became so apparent that the number of kainginero families and their distaste for punitive measures were increasing that Presidential Decree #705 (Revised Forestry Code of the Philippines) was passed legalizing the practice of kaingin agriculture for those already practicing it. PD #705 essentially recognized the reality that punitive measures were completely inadequate to control kaingin activity, that the rights of the kainginero had to be respected and that instead of forcing the kainginero to cease his activities socio-economic incentives would be more effective in limiting run-off, soil erosion and forest destruction. This recognition essentially parallels that of the ecosystem approach to conservation (Blanche, 1975) in which the inter-relationships between environmental limitations, agricultural practices and cultural preferences are integrated. In 1976 the Bureau of Forest Industry Management was established to administer the new laws.

RECENT EFFORTS TO CONTROL UPLAND SOIL EROSION

Three principal approaches are now practiced in an effort to limit erosion and run-off from kaingins: 1) resettlement, 2) protecting the remaining forest, and 3) agro-forestry and reforestation. Each of these approaches has its merits and limitations. The additional socio-economic approach to kaingin management (or forest occupancy management) is presently being evolved.

Resettlement. — This is perhaps the most expensive way to solve the problem due to the large number of kainginero families involved and the fact that not all kaingins are created by forest dwellers. It has been estimated that in 1978 there were as many as 600,000 kainginero families tending to a minimum kaingin area of some 1,200,000 hectares.[3] As it presently costs the government ₱23,000 to resettle one family (Duldulao, 1978b), clearly the task of large scale resettlement is simply impracticable. Resettlement also has the added difficulty of having to ensure a better life for the kainginero, overcoming his strong ties for the land and finding suitable areas for resettlement. Some success has been experienced such as with the Doña Carmen resettlement project on PICOP concession land in Surigao del Sur, Mindanao (Lorredo, 1974), but projects such as this has not significantly reduced the numbers of kainginero families.

Protecting the remaining forest. — Three important problems are experienced here: 1) kaingining by people who live outside the forested area, 2) preventing an increase in kainginero family numbers, and 3) limiting the cutting of new kaingins. One way to help limit the impact of kaingin agriculture is to restrict this practice to true kaingineros only. The term "speculator kainginero" is applied by Duldulao (1978a) to people from outside the upland area who have no need to practice kaingin agriculture but, with only the profit motive in mind, employ others to do the actual work. Unfortunately no specific laws have yet been developed which could prevent this speculation while at the same time allow traditional kaingining to remain legal. Also of concern are the activities of those lowland farmers forced by circumstance to supplement their income by keeping kaingins in the uplands. Like those born to kainginero families their activities are those of necessity and must be considered separately from the speculators. While PD #705 now forbids non-upland people from becoming kaingineros necessity and an expanding population has resulted in a steady increase in kainginero families. It is considered, however, that present laws and their implementation by the Bureau of Forest Industry Management have reduced the potential rate of increase. As stressed by Salita (1978), of additional benefit would be more effective means of reducing or halting the growth of the Philippine population.

A number of other approaches have also been taken to help protect those forest areas that remain. One approach has been to encourage those kaingineros who frequently shift their sites some considerable distance to practice some form of territorial rotation so that they return to use secondary growth (parang) in some form of cyclical way. Probably more effective is encouraging the kainginero not to shift but to introduce conservation practices and establish some form of permanent

[3] From the keynote address by Filiberto Pollisco, Director, FORI, at the 4th Annual FORI Conference, December 20, 1978, College of Forestry, University of the Philippines at Los Baños, Laguna.

agro-forestry. This latter method has been received with some success, particularly where the kainginero is assured of continuity or permanency of occupation through government granted leases or other official assurances. Sensibly, the government has stopped short of granting full title to such land and has thereby prevented speculation.

Reforestation and agro-forestry. — Replanting cut-over forest is clearly an obvious and practical method of reducing soil erosion (Laudencia, 1972) particularly as the true forest cover of the Philippines is less than 30%.[4] In this regard, the Ministry of Natural Resources reported that 1978 was the first year ever when the area reforested exceeded that deforested.[5] Even if this estimate only considers legal logging and the replanting of logged areas and **cogonales,** and not the disputed forest cutting figures attributible to kaingineros, this is indeed an indication of concern and progress, particularly if the replanted seedlings have a high success rate.[6]

Some success has been achieved in getting kaingineros to accept certain agro-forestry techniques, and the role of forestry extension in encouraging the use of fast growing tree species is increasing in importance (Olivar, 1974). The planting of giant ipil-ipil **(Leucaena leucocephala)** as secondary growth or to be coppiced for firewood is becoming widely accepted (Reyes, 1975) and Lorredo (1974) reports that resettled kaingineros in Surigao del Sur now keep two hectares in crop and plant eight with fast growing pulpwood species such as bagras **(Eucalyptus deglupta)** and Moluccan sau **(Albizzia falcata)** which can be harvested in (as little as) six to eight years.

THE INTEGRATED SOCIO-ECONOMIC APPROACH TO KAINGIN OR FOREST OCCUPANCY MANAGEMENT

It is now clear that for any conservation program concerning kaingin erosion to be a success it must be socially acceptable to the kainginero and of economic benefit to him. One of the principal reasons so little success has been achieved in the past is due to our lack of understanding of how to encourage the kainginero to practice conservation for himself. Duldulao (1975) has documented the understanding held by Mount Makiling kaingineros in relationship to their environment, their agriculture and the degree to which they might accept or reject government help, and his data makes clear that in most cases the kainginero is well

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[4] Nablo (1968) suggests a forest cover of 43.8% for the late sixties, while present official figures give 42%. Bruce (1977) gives a figure of 30% while Eckholm (1976) suggests less than 20%. Personal examination of 1976-1977 LANDSAT imagery together with ground verification in Luzon, Samar, Leyte and Mindanao, and aerial observations of Bohol, Cebu and Negros suggest a figure somewhere between those of Bruce and Eckholm.

[5] From the editorial "Indications of Culture" pp. 6. *Bulletin Today,* Manila. January 12, 1979.

[6] Ganapin (1978) reports very different figures stating that ..." we are cutting our forests at the rate of 203,905 hectares annually and are only reforesting at an annual rate of 9,398 hectares." (p. 7).

aware of the effect he is having on forest cover and forest soils. He is also considerably receptive to innovations related to soil conservation provided they bring him benefits. Duldulao's study, however, underlines the problems which might be faced in any attempt at resettlement as 30% of the kaingineros interviewed said they would not accept any alternative to shifting cultivation, and only 4% would agree to forced relocation.

To be a success in reducing soil erosion the integrated socio-economic approach must attempt to prevent any increase in kaingin area, increase kainginero income, educate him as to the importance of the forest, protect the soil cover of his kaingin and restore a vegetation cover of trees to scrub or cogonales previously in kaingin. To adequately attempt this requires detailed research into conditions of soil erosion and run-off under different types of crop and cropping patterns, under different species of plantation tree, and the integration of new crops, multiple cropping and stratified cropping techniques which will be both acceptable to the particular kainginero and suitable for his environment. Such research must be moulded around the needs of the kainginero and not the abstract theory of soil conservation.

One program which is currently attempting to achieve this specific end is the interdisciplinary Upland Hydro-Ecology Program based at the College of Forestry at Los Baños and presently in their third year of experimentation in the Puting Lupa watershed on the slopes of Mount Makiling. This watershed consists of secondary forest, plantation, cogonales and kaingins of different ages (UHRP, 1978). Some 200 erosion plots are constantly monitored for run-off and topsoil losses, and five flumes gauge sediment and discharge at different points along the stream draining the watershed. Constant monitoring of kainginero activities, planting, cropping and crop selection habits is also maintained in order to gauge the relationships between erosion and set kainginero customs. New cropping sequences are also being introduced to gauge not only their degree of control on soil erosion but their general acceptability to the kainginero. Experiments with fodder cover crops are also being conducted in the hope of increasing kainginero incomes through rearing penned cattle and goats. Integrating these sociologic, economic and hydro-ecologic studies is already giving valuable insights on how each cover type, cropping sequence and crop type relates to soil erosion, run-off, biological productivity and kainginero income. Of equal value are the insights this integration is giving to the acceptance by kangineros of innovation. The ultimate goal of this research is to promote sustained yield agro-forestry where plantation and cropping is so practiced that run-off and topsoil losses are minimal, economic returns to the kainginero are maximized and there is some degree of balance between family food production and cash cropping.[7]

CONCLUSION

It is recognized that the socio-economic approach to kaingin management in the Philippines is still in its infancy. However, the very fact that it is being attempted at all shows the deep concern by these researchers for the environment and the kainginero. As the sum effect of all previous approaches to reducing kaingin soil erosion has been minimal, it is sincerely hoped that government officials and researchers alike will respond to this challenging integrated socio-economic approach. As forest destruction continues to be one of the major problems in the Philippines due to non-sustained yield forestry practices and the cutting of kaingins, it is vital that this approach be taken soon, and seriously. This type of holistic approach, however, is both costly and time consuming, and out of necessity must be repeated with different cultural groups and under different types of environmental conditions. Every effort must be made to understand the problem from the kaingineros' point of view for as it is he who is responsible for the problem so it is he who must ultimately administer the control.

ACKNOWLEDGMENTS

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[7] I am greatly indebted to Dr. Percy Sajise, Director of the Upland Hydro-Ecology Program for information concerning their interdisciplinary approach to kaingin management. I am also indebted to Dr. Romeo Raros who devoted so much time to instructing me on the workings of their experiments and guiding me through their experimental sites at Puting Lupa, Calamba, Laguna.

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THE WATER HYACINTH

by

B. C. WOLVERTON

This remarkable plant can purify water and provide a renewable source of energy, feed, food and fertilizer.

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The water hyacinth (Eichhornia crassipes) is the fastest growing plant known to man. Although once known only in South America, in Venezuela in particular, it has now been spread to approximately 50 countries around the globe. Its dispersion during the past century is due to an alluring structure consisting of a floating rosette of green leaves adorned by delicate white or lavender flowers. Sought for its beauty, the hyacinth was first introduced into the USA by the Japanese at the 1884, Cotton States Exposition in New Orleans, Louisiana, as souvenirs of that event. Beauty was soon overridden by problems, as hyacinths made their way into drainage canals, swamps, streams and bayous, hampering many waterways of the south-eastern USA. In its natural South American environment, insects and viruses help to regulate its explosive growth rate and thus minimize any adverse effects to the environment. In other parts of the world where man has introduced this plant, explosive growth rates have occurred in the absence of natural control vectors. Efforts to eradicate or, at least, to restrain its growth have been underway for some 80 years now, and thus far have been virtually unsuccessful. The water hyacinth persists with vigour in every region it has ever invaded.

I intend to show in this article the benefits that can be reaped from the highly prolific water hyacinth if put to work under controlled conditions. In essence, the water hyacinth has taken on a whole new image as a result of studies at the National Aeronautics and Space Administration's National Space Technology Laboratories (NSTL) in Mississippi, USA. It has been transformed from prolific pest to potential provider.

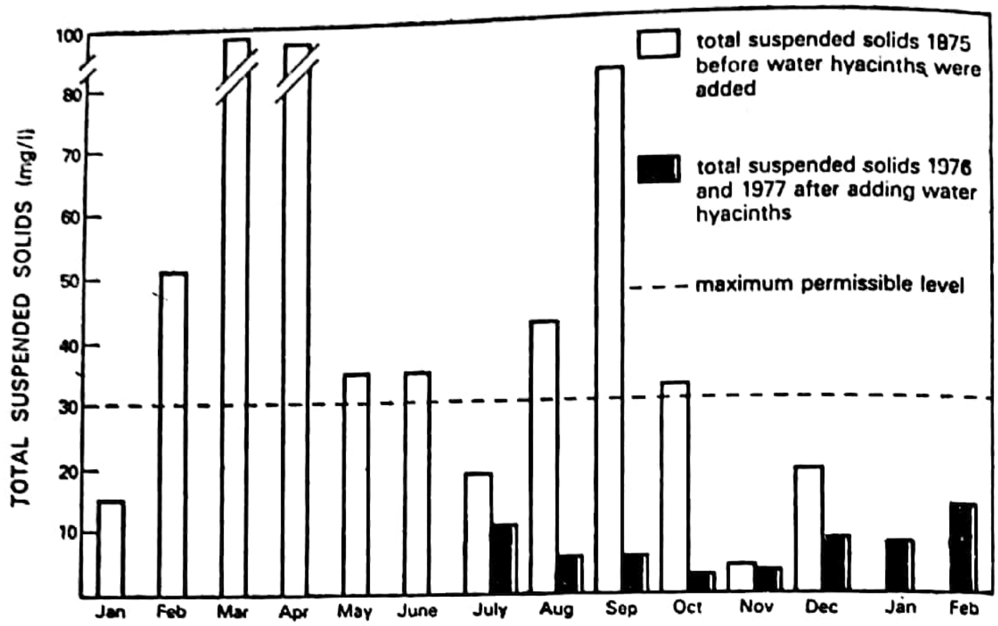
500 TONNES PER HECTARE

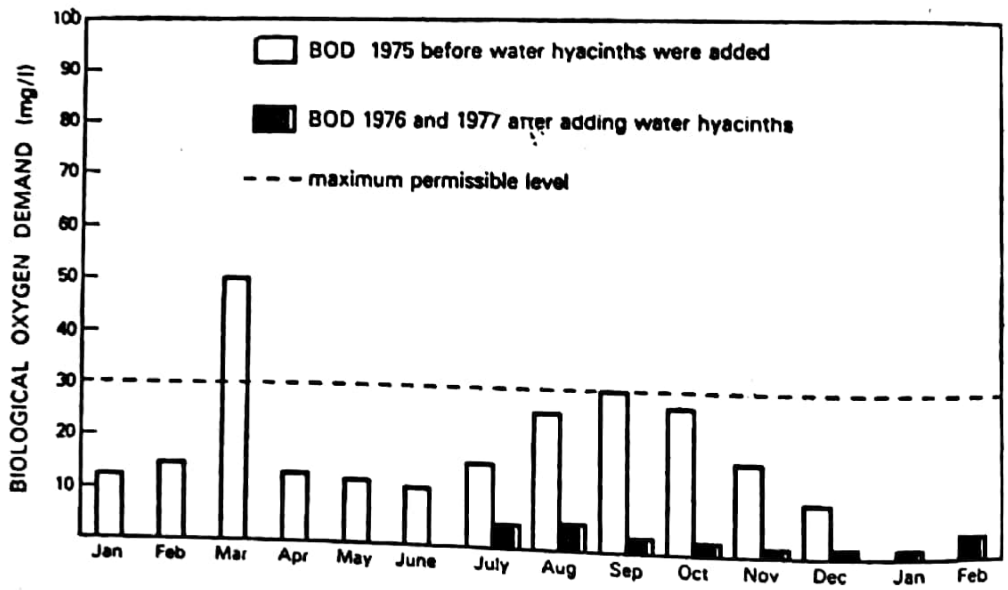
The water hyacinth has pronounced, spongy, swollen petioles, or leaf-stalks, that allow it to float. In lone plants the base of each petiole is inflated with air sacs, forming a float with an internal structure similar to that of the foamed plastic material used to make buoyant beach toys. The rosette of petioles creates a circle of floats that prevents the plant from capsizing. When the plants are crowded together, however, the petioles are less swollen, and grow tall and slender. In this way one hectare can be packed with 360 to 480 tonnes of water hyacinths. The white or lavender flowers, borne on a spike, rise from the center of the plant. If the flowers are not pollinated by insects after being open for 48 hours, self-pollination takes place. For the next three weeks the tiny black seeds mature, and the flower spike bends downwards. The seeds are the only part of the water hyacinth with a specific gravity greater than one. They sink to the bottom mud where they can remain viable for years. These seeds can germinate only when an exact process of drying and rewetting has taken place. Therefore, the seeds are only a back-up reproductive system. The water hyacinth reproduces mainly in a vegetative, non-sexual manner by means of slender horizontal runners, called stolons, that are sent across the surface of the water. As the stolon grows, new plants form at the tips and, in a matter of days, a parent is surrounded by offspring. Optimum water temperature for water hyacinth growth is 26-30°C. Under favourable conditions it can double its number every ten days. Frost may kill the plant's outer leaves, but unless the waterway freezes or stays near freezing for long periods, the vertical stem, or rhizome, remains viable and responds to returning warmth with new roots, leaves and stolons.

The water hyacinth can tolerate salt water for only very brief periods. Plants can tolerate 1.0 part per thousand (ppt) salinity for indefinite periods of time; whereas 2.2 ppt salinity is usually lethal after 30-day exposure periods.

A WATER PURIFIER

Terrestrial plants get their nutrients from minerals dissolved in the moisture of soil. The water hyacinth's roots hang into the water, allowing maximum and continuous contact with the water from which it extracts all of its nutritional requirements. The principal plant macronutrients are nitrogen, phosphorous and potassium, which are also the major elements of fertilizers. When these substances enter waterways as agricultural run-off, sewage or industrial effluent, they are considered pollutants and beyond recovery. The water hyacinth absorbs large quantities of these elements along with numerous other chemicals, and utilizes them in the metabolic process of producing new plant material or concentrates them in root and plant tissue. When the water hyacinth is systematically harvested so that successive crops continuously remove nutrients from the water, the plant becomes a natural pollution control agent. Studies undertaken thus far have proven it of a great value in purifying domestic and certain industrial waste waters. An example


total suspended solids 1975 before water hyacinths were added
total suspended solids 1976 and 1977 after adding water hyacinths
maximum permissible level
TOTAL SUSPENDED SOLIDS (mg/l)
100
80
70
60
50
40
30
20
10
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
Jan
Feb


BOD 1975 before water hyacinths were added
BOD 1976 and 1977 after adding water hyacinths
maximum permissible level
BIOLOGICAL OXYGEN DEMAND (mg/l)
100
90
80
70
60
50
40
30
20
10
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
Jan
Feb

of the water hyacinth's ability to reduce the biochemical oxygen demand (BOD) and total suspended solids (TSS) of domestic waste water is shown above.

NASA has also been using duckweeds in conjunction with water hyacinths to treat all domestic waters at NSTL. Duckweeds (family Lemnaecae) are the simplest and smallest of the flowering plants, ranging in length from 1.5 cm to 0.1 mm. These small, free floating, aquatic plants of the genera Spirodela, Lemna and Wolffia are normally found co-existing with water hyacinths. They can survive in low light intensities of 50 footcandles or less. When the frost kills the exposed vegetation of the water hyacinth, the cold tolerant species of duckweeds flourish and function as an effective waste water treatment plant. The frost-free season brings about the return of the more aggressive water hyacinth, suppressing the duckweed, causing it to take on a less active role in the waste water treatment.

The results of various waste water treatment systems investigated at NSTL which proved highly effective and efficient are now being put to use in parts of the USA by numerous cities and communities for waste water treatment. NASA has assisted with the design and/or operation of water hyacinth waste water treatment systems ranging from single dwellings to the cities of Coral Springs, Disney World, San Diego, and Rio Hondo, Texas. These systems are now either in operation, under construction, or planned.

The hyacinth's nuisance characteristics are being further abated as scientific investigations unveil its potential as a producer of such desirable products as high quality vegetable protein, vitamins, minerals, energy (in the form of biogas), fertilizer and chemicals. Along these lines, NASA is conducting research into the possible utilization of water hyacinths and other plants for life support functions in remote space stations. The use of water hyacinths and/or other higher plants for recycling human waste and producing oxygen, food and pure water in a completely closed system in space stations is a biological and engineering challenge that will require many years to perfect, but the technology evolving from this project is having a major beneficial impact on immediate earthly problems.

FOOD, FEED AND FERTILIZER

During the period May to October 1977, growth rate studies conducted at NSTL utilizing water hyacinths grown in lagoons receiving raw sewage showed an average of 46 per cent weight increase per week. The growing season in south Mississippi also includes April for the Gulf Coast Region. Data was extrapolated for April. Over this seven month span, 3080 wet tonnes or 154 dry tonnes (based on an approximate solids content of 5 per cent of wet weight) per hectare were produced. Duck-

Table 1. Protein From Water Hyacinths and Duckweeds (essential amino acids, g/100g crude protein)

Crude* Protein	Iso-leucine	Leucine	Lysine	Meth-ionine	Pheny-lalanine	Thre-onine	Trypto-phane	Tyro-sine	Valine
Fao ref.									
pattern	4.2	4.8	4.2	2.2	2.8	2.8	1.4	2.8	4.2
57.8[1]	4.92	9.20	6.60	2.06	6.10	4.99	1.50	4.67	5.84
31.3[2]	4.09	8.68	5.96	1.47	5.70	4.56	1.04	3.55	5.03
39.5[3]	4.64	8.89	6.44	2.16	5.69	4.61	2.10	3.53	5.83

[1] Protein Extracted From Green Water Hyacinth Leaves
[2] Protein From Dried Water Hyacinth Leaves
[3] Protein From Dried Duckweeds (*Spirodela* and *Lemna* sp.)
* Per cent of Dry Weight

weeds can be expected to produce 30 per cent or more of this volume of biomass when grown under similar conditions. It is possible to maintain such a high growth rate because of high nutrient levels, warm temperatures (26-30°C), and increased carbon dioxide concentrations as a result of the anaerobic digestion taking place in the bottom portion of the lagoons.

The volume of plant biomass capable of being produced as a by-product of domestic waste water treatment using water hyacinths and/or duckweeds has potential value as a renewable energy source, fertilizer, vegetable protein, vitamins, minerals, chemicals, etc. The potential food and feed value of this plant material is shown in Table 1. From 0.07-0.11 m^3 of methane has been produced per 0.45 kg of dried water hyacinths and/or duckweeds. Such food plants as corn, sorghum, peas, cucumbers, squash and tomatoes have been grown in abundance at NSTL using decomposing water hyacinths as the sole nutrient source. Some of the minerals found in water hyacinths and duckweeds grown in domestic sewage are shown in Table 2.

Table 2. Composition (Dry Weight) of Whole Plants From Domestic Sewage Lagoon

Plants	Crude Protein %	Fat %	Calcium %	Po-tassium %	Sulfur %	Kjeldahl Nitrogen %	Phos-phorus %
Duckweeds	39.5	3.4	1.00	2.00	0.80	6.32	0.85
Water Hyacinths	23.4	2.20	1.50	4.00	0.40	3.74	0.85

The hardiness and high productivity of the water hyacinth can be put to use in a controlled, fresh water environment to remove pollutants and nutrients from domestic waste waters and return these minerals to the earth in a safe, stabilized form. In the process of absorbing nutrients and minerals from domestic sewage, the water hyacinth produces large quantities of plant biomass which can be useful for food, fertilizer and energy.

THE PROMISE OF AQUACULTURE

At present, water hyacinth systems are limited to fresh water environments in warm climates. However the use of cold-tolerant duckweeds as winter supplement shows promise for extending this waste water treatment method further north. Covered systems would still be required in extreme northern zones.

The use of vascular aquatic plants is a simple, economical method for waste water treatment. It can be applied in the design of small single home systems as well as used to design more complex systems treating tens of millions of litres of sewage a day. Aquaculture for waste water treatment is one of the most promising concepts to emerge recently for waste water treatment because it is simple and cost effective and converts undesirable pollutants into products such as energy, food, and fertilizer.

WEATHER FORECAST VERIFICATION ON BOARD R/V RESEARCHER AND R/V ALBACORA, 1979

by

E. AMORES-VERGARA,* C.P. ARAFILES[1] AND M.D. BERSAMIN*

INTRODUCTION

To weather forecasters, verification is the entire process of establishing the "truth, accuracy, or reality" of the actual weather. This could take in the form of comparing the predicted weather with the actual weather, then utilizing some quantitative measures to interpret the results. In the discussion which follows, the performance of the forecast in terms of selected variables are compared with the actual observations. It should be assumed that no subjective element of judgment was employed in this comparison.

Why the need for a forecast verification?

The long-standing problem of how to improve the reliability of the forecast has been nagging weathermen for many years now. With the advent of forecast verification, the prospect is bright that somehow the problem will eventually be overcomed. Thus, the need for a forecast verification is already long overdue.

Whether in open oceans, in ports or on lands, forecast verification could offer more realistic and positive basis for forecast assessment. The verification scheme on board the R/V Researcher and the R/V Albacora gives some experiences and accounts of the fallacies and the "false intuitions" on why "things" seem reasonable at first, and what went wrong in the end.

In general, forecast verification is important for its scientific, economic and administrative usefulness. The mere existence of a checking scheme, no matter how imperfect, would keep the forecasters on their toes in maintaining the accuracy of the forecast.

METHODOLOGY

The study was a joint project of the Bureau of Fisheries and Aquatic Resources (BFAR) and the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). Particular interest was focussed on the weather conditions in the open oceans and on the state of the sea on board two research vessels whose code names are

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* Weather Specialists, PAGASA
[1] Director, National Institute of Atmospheric, Geophysical and Astronomical Sciences (NIAGS), PAGASA.

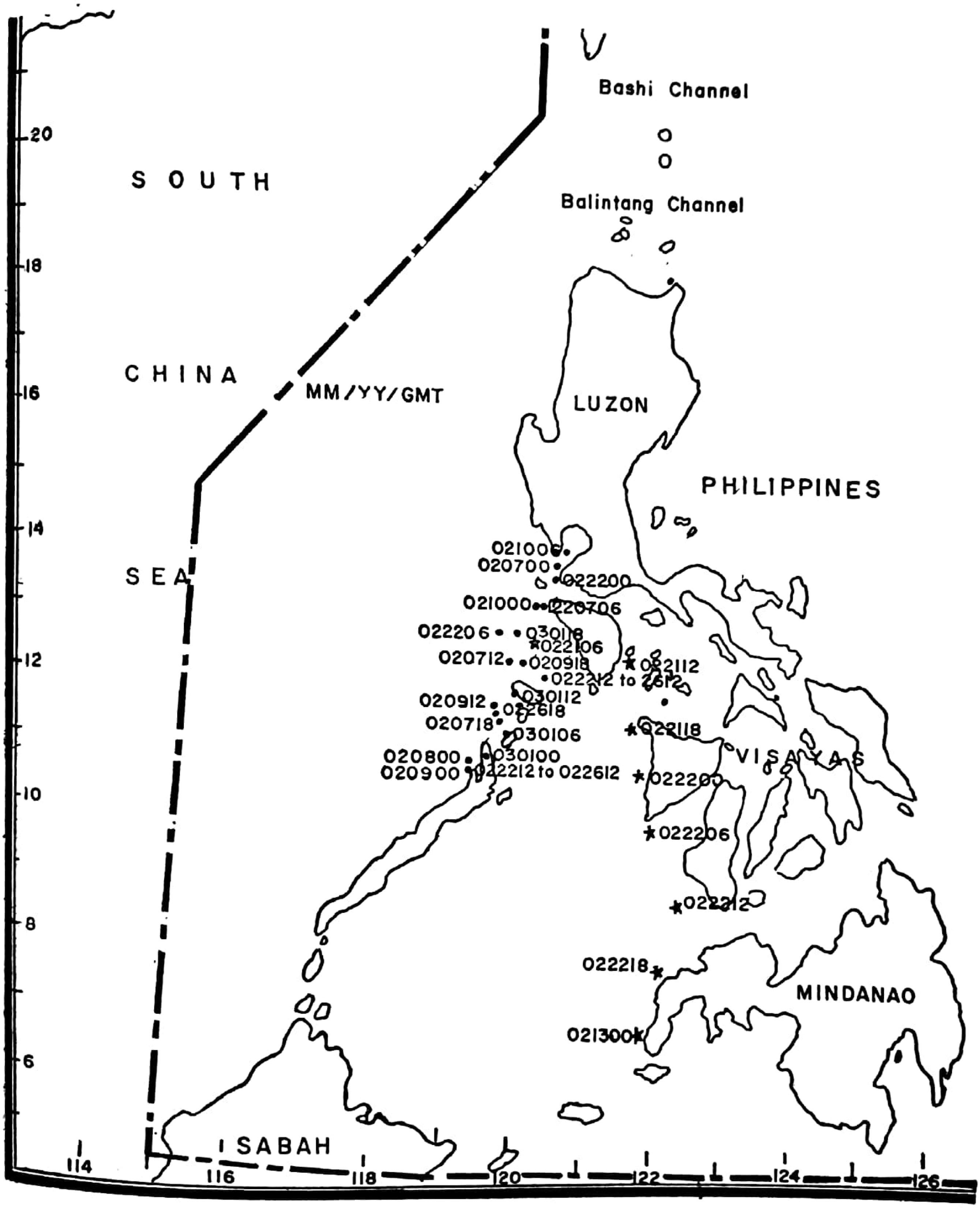

Fig. 1.0. The Tracks of R/V Researcher (●) and R/V Albacora (★), 1979.

R/V Albacora and R/V Researcher. Figure 1.0 shows the tracks of these vessels. All the observing points were confined within the Philippine area of responsibility, circumscribed by a line 5°N 115°E, 15°N 115°E, 21°N 120°E, 25°N 120°E, 25°N 135°E, 5°N 135°E. The range of the observation area was 4.8 to 14.8°N and 119.3° to 121.6°E. The route was primarily selected on the basis of its fishing potential as assessed by BFAR scientists.

The salient features of the approach employed in this study is presented in the flow diagram in Figure 2.0. Top priority in the system was given to the communication facilities, and the communication centers were put up in the BFAR and the PAGASA offices.

The routine activities for the ship's weather-observing program included the basic observing schedule, the filling out of a bank observation log sheet with the required data and the coding and transmission of weather reports to the weather center. Weather messages as much as possible were transmitted according to the format of the International Code for Radio Weather Reports from Ships. All observations taken at sea were recorded on the Weather Bureau Form 3001, Ships Meteorological Observations Log. A number of codes related to the observations were extensively used.

For forecast verification, the analysis included the calculation of the differences in the observed and the forecast parameters. From this analysis, quantitative measures of forecast verification were evolved (Tables 1.0-4.0.A). The ideas from Pierson **et al.** (1955) were applied, although constraints on the number of data and the nature of measurements were taken into consideration.

The computer facilities of the PAGASA were used. These consisted of both the "hardware" and the "softwares" of the IBM 1130.

RESULTS AND DISCUSSION

The Observed and the Forecast Wind Direction (dd) and Speed (ff)

The comparison of the observed and forecast wind speed and direction is presented in Table 1.0. The wind directions are in codes, as shown in Table 2.0, and the wind speeds are in true knots. It should be noted that the wind direction codes could represent nine degrees range. Thus, the actual calculation of accuracy could only be considered as an estimate (Table 3.0).

The estimate of the accuracy per se or the absolute accuracy as defined in Table 3.0 could not be taken as a fair measure of the reliability of the forecast since these variables were attained within certain ranges (Table 2.0). For instance, the observed wind direction could vary within 9 degrees during the process of coding (Table 2.0). However, innovations were introduced by determining the percentage deviation up to certain limits (Table 1.0).

For instance, in order to give a picture of the range of deviation of the observed and the forecast wind direction, the percentage deviation

TABLE 1.0 THE RANGE OF DEVIATIONS OF THE AVERAGE FORECAST AND THE AVERAGE OBSERVED WIND DIRECTION (dd)* AND SPEED (ff).

		Ave. Position		Ave. dd (°)				Ave. ff (knot)			
GMT	DATE	XLAT N	XLON E	OBSD	FCST	|Δ|	|Δ²|	OBSD	FCST	1 1	1 1
0000-1200	02/07/79	13.5	120.2	05	04	01	1	16	20	4	16
1200-0000	02/07/79	11.9	119.6	10	04	06	36	08	12	4	16
0000-1200	02/08/79	11.1	119.3	08	04	04	16	05	12	7	49
0000-1200	02/09/79	11.5	119.5	04	04	00	0	10	6	4	16
1200-0000	02/09/79	12.7	119.9	04	07	03	9	11	10	1	1
0000-1200	02/10/79	13.9	120.5	05	09	04	16	18	10	8	64
0000-1200	02/22/79	13.2	120.2	09	01	08	64	05	10	5	25
1200-0000	02/22/79	12.6	120.4	00	11	11	121	01	10	9	81
0000-1200	02/23/79	12.6	120.4	02	01	01	1	04	10	6	36
1200-0000	02/23/79	12.6	120.4	03	11	08	64	05	10	5	25
0000-1200	02/24/79	12.6	120.4	14	01	13	169	07	16	9	81
1200-0000	02/24/79	12.6	120.4	20	01	19	361	05	10	5	25
0000-1200	02/25/79	12.6	120.4	03	01	02	4	04	10	6	36
1200-0000	02/25/79	12.6	120.4	99	01	00	0	02	12	10	100
0000-1200	02/26/79	12.6	120.4	23	01	22	484	04	10	6	36
1200-0000	02/26/79	11.8	119.3	99	01	00	0	03	10	7	49
0000-1200	02/27/79	11.0	119.3	02	09	07	49	07	10	3	9
1200-0000	02/27/79	11.0	119.3	00	04	04	16	03	12	9	81
0000-1200	02/28/79	11.0	119.3	99	04	00	0	01	10	9	81
1200-0000	02/28/79	11.1	119.3	99	07	00	0	07	12	5	25
0000-1200	03/01/79	11.6	119.7	14	04	10	100	15	12	3	9
1200-0000	03/01/79	12.7	119.9	03	04	01	1	20	16	4	16
1200-0000	03/04/79	5.8	120.7	12	09	03	9	09	16	7	49
1200-0000	03/06/79	5.1	120.3	02	04	02	4	10	12	2	4
0000-1200	03/07/79	5.1	120.3	18	09	09	81	04	10	6	36
1200-0000	03/07/79	5.0	120.3	02	01	01	1	03	10	7	49
0000-1200	03/08/79	5.0	120.3	08	01	07	49	08	10	2	4
1200-0000	03/08/79	5.0	120.4	13	09	04	16	08	10	2	4
0000-1200	03/09/79	5.0	120.4	14	09	05	25	08	10	2	4
1200-0000	03/16/79	4.8	119.9	19	01	18	324	06	10	4	16
0000-1200	03/17/79	4.8	119.9	00	01	01	1	00	10	10	100
0000-1200	03/20/79	6.0	120.9	07	01	06	36	06	8	2	4
1200-0000	03/20/79	6.4	121.6	09	09	00	0	05	12	7	49

$$\% \text{ Zero deviation} = \frac{\Delta_0}{n} \times 100 = 18.2\%$$

$$\% \text{ Deviation up to } 10^\circ = \frac{\Delta_0 + \Delta_{10}}{n} \times 100 = 33.3\%$$

$$\% \text{ Dev. up to } 20^\circ = \frac{\Delta_0 + \Delta_{10} + \Delta_{20}}{n} = 39.4\%$$

$$\% \text{ Dev. up to } 30^\circ = \frac{\Delta_0 + \Delta_{10} + \Delta_{20} + \Delta_{30}}{n} = 45.5\%$$

$$\% \text{ Zero deviation} = \frac{\Delta_0}{n} \times 100 = 0\%$$

$$\% \text{ Dev. up to 5 kt} = \frac{\Delta_0 + \Delta_5}{n} \times 100 = 51.5\%$$

$$\% \text{ Dev. up to 10 kt} = \frac{\Delta_0 + \Delta_5 + \Delta_{10}}{n} \times 100 = 100\%$$

$$\text{RMSE} = \sqrt{\frac{(F_i - O_i)^2}{n}} \text{ ---- } 7.9$$

$$\text{RMSE ------- } = 6.0$$

* in codes

was estimated from zero up to 30° (Table 1.0). For a two-month period, it was noted that 18% of the observed and the forecast data were the same. If the number of the observed and the forecast wind direction with deviation of not more than 10 degrees was estimated, the percentage value increased to 33. The number of cases having percentage deviation of 20 and 30 degrees included 39 and 46 percent, respectively, of the total data. Because of one's varying needs or purpose, the range of deviation would give a better picture of the state of "quality" of the data. Attempts were made to compare the results when the analysis was based on the observations at the real time and the forecast period. The variations in the difference based on these two analyses ranged from 0% to 18.2%, which is still within the acceptable limits of deviations. Hence, it appears that no significant improvement could be introduced in the analysis by using the average observations for the period. Using the observations based on the real time could save computer time and will also result in a cut-down in analysis cost.

Assuming that the shipping sector has a range of meteorological "tolerance" comparable with that of the aviation industry, the mean surface wind direction has an acceptable error based on ICAO standards of ± 30 degrees. On the other hand, the mean wind speed up to 25 knots could still be within ICAO standards with a deviation of ± 5 knots. Above 25 knots, the allowable deviation for aviation forecasting is ± 20%.

To date, there is no clear-cut forecast "accuracy" or "reliability" requirements for shipping. Nevertheless, it would not be farfetched to assume that the weather forecast requirements in shipping are just about similar as in aviation, if not only slightly less.

The root-mean-square-error (RMSE) could be used as the yardstick in determining the deviation of the observed and the forecast values. The monitored wind directions showed an estimated RMSE of ± 7.9. This means that the probable deviation of the forecast wind direction is about 7.9 degrees.

The true wind speed in knots was monitored in this study. None of the forecast value was the same as the observed wind speed. Those with 5-knot deviations were 51.5% and all of the forecast winds had deviations not exceeding 10 knots. No forecast with a deviation greater than 15 knots was observed. The wind speed forecast has RMSE of ± 6.0,

TABLE 1.1 COMPARISON OF THE ANALYSES BASED ON (a) THE OBSERVATIONS AT THE REAL TIME AND (b) THE AVERAGE OBSERVATIONS FOR THE PERIOD.

	(a)	(b)	|△ (a)-(b)|
(1) Wind Direction (dd)			
% Zero deviation	15%	18.2	3.2
% Deviation up to 10°	21%	33.3	12.3
% Deviation up to 20°	33%	39.4	6.4
% Deviation up to 30°	48%	45.5	2.5
RMSE — — — — — — — —	12.9	7.9	5.0
(2) Wind Speed (ff)			
% Zero deviation	9.1%	0%	9.1
% Deviation up to 5 knots	51.5%	51.5%	0.0
% Deviation up to 10 knots	96.9%	100%	3.1
RMSE — — — — — — — —	6.6	6	0.6
(3) Present Weather (ww)			
% With deviation<"49"	78.8%	75.8%	3.0
% With deviation>"49"	21.2%	24.2%	3.0
RMSE — — — — — — — —	31.7	36.8	5.1
(4) Wave Height (WHGT)			
% With deviation of "00"	12.1%	6.1%	6.0
% With deviation up to code "01"	24.2%	18.2%	6.0
% With deviation up to code "02"	27.3%	45.5%	18.2
% With deviation up to code "03"	93.9%	100%	6.1
RMSE — — — — — — — —	2.0	2.5	0.5

TABLE 2.0 WMO CODES OF THE TRUE DIRECTION (dd) FROM WHICH THE WIND IS BLOWING.

CODE FIGURES	DEGREES	COMPASS POINTS	CODE FIGURES	DEGREES	COMPASS POINTS
00	calm	calm	20	195-204	SSW
01	5-14		21	205-214	
02	15-24	NNE	22	215-224	SW
03	25-34		23	225-234	
04	35-44	NE	24	235-244	
05	45-54		25	245-254	WSW
06	55-64		26	255-264	
07	65-74	ENE	27	265-274	W
08	75-84		28	275-284	
09	85-94	E	29	285-294	WNW
10	95-104		30	295-304	
11	105-114	ESE	31	305-314	
12	115-124		32	315-324	NW
13	125-134		33	325-334	
14	135-144	SE	34	335-344	NNW
15	145-154		35	345-354	
16	155-164	SSE	36	355-004	N
17	165-174				
18	175-184	S			
19	185-195				

slightly less than the RMSE of the wind direction. This would imply that the forecast wind direction was varying to a slightly greater extent than the wind speed.

The Observed and the Forecast Weather (ww) and Wave Height (WHGT).

Table 4.0 shows the observed and the forecast weather and wave height. Also shown are the RMSE and the varying deviation at certain categories. Generally, the present weather is divided into two: with precipitation and without precipitation, as given in Table 5.0. The present weather codes 00 to 49 represent no precipitation at the ship's observation area while codes 50 to 99 denote precipitation at the time of observation. The detailed description of each weather code is given in WMO code 4677. In Table 4.0, about seven present weather codes were used, 00 for cloud development not observed or not observable;

TABLE 3.0 THE DEFINITION OF TERMS AND THE CORRESPONDING QUANTITATIVE MEASURES.

Terminology	*Definition*	*Quantitative Measures*	*Remarks*
Accuracy (exactness, definiteness)	The degree of agreement between the experimental or forecast value and the actual value.	(a) % accuracy = $\frac{N\Delta_o}{N} \times 100$ $N\Delta_o$ = no. of observations where the forecast and the actual values are the same. N = total observations (b) Mean Deviation = $\frac{\Sigma\lvert F_i - O_i\rvert}{N}$ F = forecast value O = observed value	When two results obtained independently are in close agreement, they are said to have a high degree of precision.
Reliability (dependability, trustworthiness)	The quality or state of being suitable or fit, of proven consistency in producing satisfactory results.	RMSE = $\frac{\sqrt{\Sigma(F_i - O_i)^2}}{N}$ $\Delta\lvert F_i - O_i\rvert$ = R (empirical) $R \leq C$ = within limits R = range of values C = constant	Would give an idea of the degree to w/c numerical data would tend to spread about an average value.

01 for clouds generally dissolving or becoming less developed; 02 for the state of the sky on the whole is unchanged; 03 for clouds generally forming or developing; 08 for a well-developed dust whirl(s) or sand whirl(s) seen at or near the station during the preceding hour or at the time of observation, but no duststorm or sandstorm; 60 for rain, not freezing, intermittent, slight at the time of observation; and 80 for slight rain shower(s).

About 75.8% of the present weather in Table 4.0 had the observed and the forecast data within the "range of reliability". The constant used was 49. This was the value separating precipitation from the absence of the precipitation at the time of the observation (Table 5.0). The calculation offered a rough estimate of the "reliability gaps" of the forecast and the observed present weather parameter. As the duration of the observed and the forecast codes lessens, the "reliability gaps" decrease correspondingly also, hence, the direct relationship.

TABLE 4.0 THE RANGE OF DEVIATIONS OF THE AVERAGE FORECAST AND THE AVERAGE OBSERVED WEATHER (ww)* AND WAVE HEIGHT (WHGT)* AT THE LATITUDE (XLAT) AND THE LONGITUDE (XLON) WITHIN THE PHILIPPINES.

GMT	DATE	XLAT°N	XLON°E	OBSD	FSCT	1 1	1 1	OBSD	FCST	1 1	1 1
PERIOD		Ave. Position		Ave. WW					Ave. WHGT		
0000-1200	02/07/79	13.5	120.2	02	60	58	3364	03	04	01	1
1200-0000	02/07/79	11.9	119.6	02	02	0	0	05	03	02	4
0000-1200	02/08/79	11.1	119.3	02	02	0	0	04	03	01	1
0000-1200	02/09/79	11.5	119.5	02	02	0	0	03	03	0	0
1200-0000	02/09/79	12.7	119.9	02	02	0	0	04	03	01	1
0000-1200	02/10/79	13.9	120.5	02	02	0	0	05	03	02	4
0000-1200	02/22/79	13.2	120.2	02	02	0	0	01	03	02	4
1200-0000	02/22/79	12.6	120.4	02	00	02	4	00	02	02	4
0000-1200	02/23/79	12.6	120.4	02	00	02	4	01	02	01	1
1200-0000	02/23/79	12.6	120.4	02	02	0	0	01	04	03	9
0000-1200	02/24/79	12.6	120.4	02	00	02	4	00	03	03	9
1200-0000	02/24/79	12.6	120.4	02	00	02	4	00	03	03	9
0000-1200	02/25/79	12.6	120.4	02	00	02	4	00	03	03	9
1200-0000	02/25/79	12.6	120.4	02	00	02	4	00	03	03	9
0000-1200	02/26/79	12.6	120.4	02	00	02	4	00	03	03	9
1200-0000	02/26/79	11.8	119.3	02	00	02	4	00	03	03	9
0000-1200	02/27/79	11.0	119.3	02	03	01	1	01	03	02	4
1200-0000	02/27/79	11.0	119.3	02	02	0	0	00	03	03	9
0000-1200	02/28/79	11.0	119.3	02	02	0	0	00	03	02	9
1200-0000	02/28/79	11.1	119.3	01	02	01	1	01	03	02	4
0000-1200	03/01/79	11.6	119.7	02	02	0	0	03	03	0	0
1200-0000	03/01/79	12.7	119.9	02	02	0	0	05	03	02	4
1200-0000	03/04/79	5.8	120.7	15	00	15	225	01	03	02	4
1200-0000	03/06/79	5.1	120.3	05	80	75	5625	01	03	02	4
0000-1200	03/07/79	5.1	120.3	02	80	78	6084	00	03	03	9
1200-0000	03/07/79	5.0	120.3	80	00	80	6400	00	03	03	9
0000-1200	03/08/79	5.0	120.4	03	80	78	6084	00	03	03	9
1200-0000	03/08/79	5.0	120.4	01	80	79	6241	00	03	03	9
0000-1200	03/09/79	5.0	120.4	01	80	79	6241	00	03	03	9
1200-0000	03/16/79	4.8	119.9	13	80	67	4489	00	03	03	9
0000-1200	03/17/79	4.8	119.9	02	03	01	1	00	03	03	9
0000-1200	03/20/79	6.0	120.9	01	02	01	1	00	03	03	9
1200-0000	03/20/79	6.4	121.6	01	02	01	1	00	03	03	9

$$RMSE = \sqrt{\frac{\Sigma(F_i - O_i)^2}{n}} = 36.8 \qquad 2.5$$

% with Deviation<"49" = 75.8
% with Deviation>"49" = 24.2
% with Deviation of "00" 6.1%
% with Deviation up to Code 01 .... 18.2%
% with Deviation up to Code 02 .... 45.5%

* in codes

TABLE 5.0 GENERAL DESCRIPTION AND CODES OF THE PRESENT WEATHER (ww).

Code	Description
00-49	No precipitation at the station at the time of observation.
00-19	No precipitation, fog, ice fog (except for 11 and 12) duststorm, sandstorm, drifting or blowing snow at the station at the time of observation or, except for 09 and 17, during the preceding hour.
20-29	Precipitation, fog, ice fog or thunderstorm at the station during the preceding hour but not at the time of observation.
30-39	Duststorm, sandstorm, drifting or blowing snow.
40-49	Fog or ice fog at the time of observation.
50-99	Precipitation at the station at the time of observation.
50-59	Drizzle
60-69	Rain
70-79	Solid precipitation not in showers
80-99	Showery precipitation or precipitation with current or recent thunderstorm.

TABLE 6.0 CODES TO DESCRIBE THE STATE OF THE SEA.*

Code Figures	*Descriptive Terms*	*Height in meters*
0	Calm (glassy)	0
1	Calm (rippled)	0 - 0.1
2	Smooth (wavelets)	0.1 - 0.5
3	Slight	0.5 - 1.25
4	Moderate	1.25- 2.5
5	Rough	2.5 - 4
6	Very rough	4 - 6
7	High	6 - 9
8	Very high	9 - 14
9	Phenomenal	over- 14

* The exact bounding height is to be assigned for the lower code figure, e.g., a height of 4 meters is coded as 5.

† Refers to well-developed wind waves of the open sea.

The comparison of the observed and the forecast wave height (WHGT) is also shown in Table 4.0. It was noted that 45.5% of the observations have deviations not greater than the state of the Sea Code 02 (Table 6.0), i.e., from 0.1 to 0.5 meters. Furthermore, 18.2% of the data have deviations not greater than Code 01, i.e., from 0 to 0.1 meter. As generally observed during this period, the state of the sea could vary from calm to slight, and hardly could be in a moderate state.

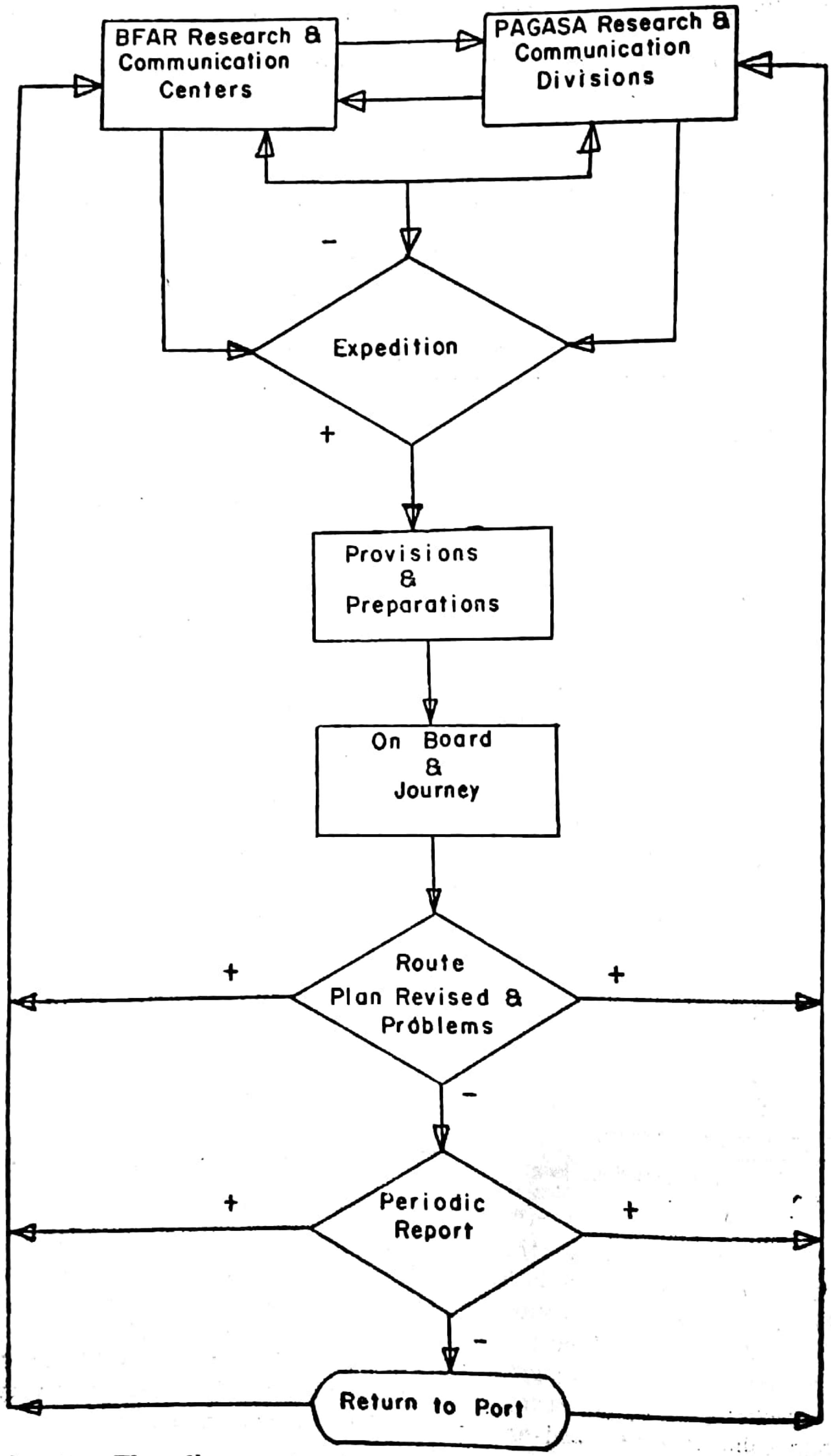

Fig. 2.0. Flow diagram showing salient features of approach employed.

Some Estimates of Wave Statistics

Generally, the application of wave spectra and statistics is confined to the data taken from the wave records. No wave recording instrument was used in this study. Nevertheless, the observed data were still used to determine, even though as rough estimates only, some wave statistics as suggested by Pierson **et al.** (1955), which is also currently employed by the PAGASA as one of its operational forecasting tools.

One such number is designated as "E" with a dimension of feet^2 or meter^2 (Table 7.0). To compute E, the average value of the wave heights was calculated, and this average value was subtracted from each of the original readings. Then each resultant number was squared and an average of the sum of the squares was estimated. The resulting value was multiplied by two and was denoted as E. The E value calculated this way was found to be 17.92 ft.^{2} or 1.66 m^2 (Table 7.0). As defined by Pierson **et al.** (1955), E is equal to twice the variance of a larger number of value, in this case, the wave heights.

Table 7.0 shows the estimated average wave height data based on the computed E-value. The most frequent wave height was 1.82 meters, while the average height was 2.28 meters. The "significant" height was 3.65 meters which represented the average of the heights of one-third of the highest waves. The average of the heights of one-tenth of the highest waves was 4.64 meters.

TABLE 7.0 THE ESTIMATED AVERAGE WAVE HEIGHT DATA BASED ON THE E-VALUE (17.92 ft.^{2} OR 1.66 m^2)*

The Most Frequent Wave Height will be $1.4\sqrt{E}$ — 5.98 ft. or 1.82 m.

Average Height = $1.77\sqrt{E}$ — — — — — — — 7.50 ft. or 2.28 m.

"Significant" Height: Average of the Heights of 1/3 Highest Waves = $2.83\sqrt{E}$ — — — 11.99 ft. or 3.65 m.

Average of the Heights of the 1/10 Highest Waves = $3.6\sqrt{E}$ — — — — 15.25 ft. or 4.64 m.

* After Longuet-Higgins in Pierson, *et al.* (1955).

These "crude" estimates should not be taken per se since the observations could hardly satisfy the requirements of the sampling theory. Nevertheless, these rough estimates of the wave characteristics based on the Pierson-Neumann-James theory could reinforce the idea of what this new tool could offer in the field of wave forecasting.

CONCLUSIONS/RECOMMENDATIONS

Weather forecast verification in the ocean would assume that the proper wave observation techniques have been used, including those of the other parameters. A poor wave observation could lead to the conclusion that the forecast is wrong, and that the verification, not the forecast, is at fault. This study could not assume an exemption to this assumption because of the limited data used in the analysis. However, field observers have reported that each observation was made for at least 15 minutes and in most cases longer. This assessment was made because it is well known that a certain height varies to a wide extent. A series of waves, all of a non-representative height range, could persist for only a fraction of time. Thus, an average height based upon a shorter time would prove to be inadequate. This may not have posed a problem in this study, but then the lack of sufficient data covering a shorter period could not warrant a conclusive finding. Nevertheless, the study has brought into focus the following:

(1) For statistical validity and to provide a higher degree of certainty, continuous data monitoring should be maintained for at least ten years.

(2) Should there be a plan for a follow-up project on these studies, it must enlist the direct involvement of NAGADO, NIAGAS and NWO. The maximum use of PAGASA facilities and equipment and the full application of technical skill and know-how is necessary. At least one oceanographer and one marine engineer who are competent enough should also be included to work in the project so as to ensure a more vigorous pursuit of the objectives.

(3) The shipping and the fishing industries would certainly stand to benefit from these studies, hence the necessity to extend the project calls for a serious consideration by the agencies involved — PAGASA, BFAR and BCGS.

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FEEDBACK ON THE CONCEPT OF PLANT A TREE ON YOUR BIRTHDAY

May 27, 1981

Prof. Dominador Z. Rosell
President
Philippine Geographical Society
P.O. Box 2116, Manila

Dear Prof. Rosell:

I received a copy of the Philippine Geographical Journal, Special Issue 1981 today and would like to thank you for it. I particularly read with avid interest your article on the Impressions on the 150th Anniversary Celebration of the Royal Geographical Society of London.

I shall be happy to adopt your concept of "Plant a Tree on Your Birthday", especially since I'm going to celebrate mine, very soon — come June 19. I know, Sir, you don't forget as I too don't forget your birthday every November 5th. Any tree you can recommend to plant, Sir?

I cannot imagine the Philippine Geographical Society without you. I'm glad to note that you're again its President, and very much alive indeed. May you never stop to share with people who come under your influence the many invaluable knowledge or learning you have so enriched yourself with. I have profited so much as we of your "fledglings" in the 50's as Shirley is in the 80s. Give my regards to her Sir, and to Lyd — the best to you.

Sincerely,

(Sgd.) JOSIE ALCALA
National Irrigation Administration

Republic of the Philippines
Department of Public Works, Transportation and Communications
BUREAU OF POSTS
Manila

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DOMINGO C. SALITA
BSEM, BSCE, LLB, MS, PhD
Professor of Geology and Geography
and former
Dean, College of Arts and Sciences
University of the Philippines

and

DOMINADOR Z. ROSELL
B. Agr. (Soil Technology) BSc.
(Geography), MBA (Management)
Former Professorial Lecturer in
Geography, University of the
Philippines, and
Philippine Women's University

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