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FOR EL SALVADOR

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INTRODUCTION

Community Systems Foundation accepted a U.S.A.I.D., Office of Nutrition, contract to prepare a nutrition assessment for El Salvador. This technical assessment of El Salvador's nutrition problems is to augment the Health Sector Assessment and Agriculture Assessment currently underway, and to serve as a basis for proposed nutritional projects sponsored by A.I.D. and other international agencies. The result of this project is the following Nutrition Assessment which reports the data collected, analysis of the data for diagnosing malnourishment, and recommendations for future activities and programs to reduce malnourishment in El Salvador.

No attempt was made to undertake a comprehensive evaluation of proposed or ongoing programs in nutrition. However, the 1978 food donation proposal of CRS - Caritas was taken as an example in order to demonstrate the type of procedure or methodology which could be applied to the evaluation of other programs. This example analysis is described briefly in Appendix B.

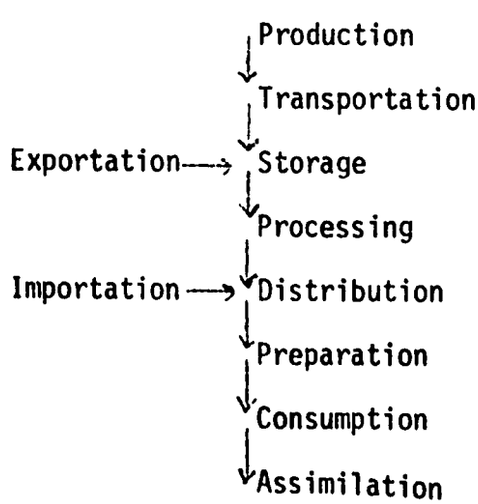
The data which have been compiled for this assessment have been taken, principally, from existing sources. No new data were generated, and no attempt was made to rework the raw data into a different form. As a result, the information available for this assessment was fragmented and incomplete, and thus, made the assessment task that much more difficult.

For example, one problem was how to aggregate the data to facilitate a comparative analysis (more on comparisons later) between and among regions. The various groups, agencies, and ministries which report data either may not use the same regional classification for aggregating the data in their various reports (INCAP data, for example, is available for regions primarily defined by agricultural activity, while much of the data reported by the ministries is available by department, or by regions containing several departments), or the classification that is used may not be appropriate for the particular problem (as in the case where some data are only broken down into four regions, but within each region there exists a wide

variety of agricultural and socio-economic circumstances).

Nevertheless, we believe the available information is sufficient to perform a preliminary diagnosis and identify procedures for a continuing nutrition assessment activity. When a country is just beginning to develop an interest in nutrition planning, it is to be expected that the available data will be sparce and difficult to interpret. This does not mean that planning must wait for a massive data collection effort. The information will never be complete enough, nor accurate enough, for "perfect" decision-making. Moreover, the critical nature of the problem will not permit program delays for an exhaustive attempt to gather and analyze "all" the data.

Given these constraints, common to all planning and decision-making, Community Systems Foundation has developed a theory -- the Nutrient Flow Theory -- to guide, in a scientific manner, the assessment of nutritional status and the formulation of strategies to reduce malnutrition (see Appendix C for a description of the Nutrient Flow Theory). In the field, this theory acts as a point of reference, a conceptual model which describes the qualitative relationships among a set of factors thought to effect the prevalence of malnutrition in a community. Thus, with this Nutrient Flow Model, it has been possible for us to compile and analyze data -- however sparce and fragmented -- in order to identify those areas where nutritional deficits exist or where additional information is required. In simplified schematic form, the model appears as -- and in fact, prescribes, the sequential investigation of -- the "flow" of nutrients, from Production through Assimilation in the body:



Since the causal relationships of malnutrition have been studied for many years and in many different countries, it should be expected that the theory is fairly well developed and in a practical form. This is only partially true, for the causal relationships are only understood qualitatively. For example, it is generally accepted that an environmental sanitation project in a community will reduce infectious disease and hence reduce malnourishment.

There are some drawbacks to only having a qualitative theory. Invariably a nutrition planner finds that he has a long list of potential programs which will reduce malnourishment, but the resources to implement only a few of them. Which ones should he choose?

In this situation, a quantitative theory would help the planner to select those programs which yield the greatest reduction in malnourishment for specific local or regional conditions. A quantitative theory would state that in a specific community, a water supply project which provided pressurized, potable water to each family's patio (given specified levels of nutrient gap and morbidity) would reduce gastrointestinal infection by half and as such, would reduce malnourishment by one third.

Quantitative theories of nutrition are still fairly crude when applied in the field. Again, however, this does not mean that action must stop while the causal relationships are developed and refined.

On the contrary, nutrition planning must be approached, pragmatically, as a learning process: projects should be selected and designed based on the existing information as it applies to - and is defined by - the conceptual model, or theory. Each project is, in effect, a test of a hypothesis about the theory; as new information is gathered during the course of the project, it can be utilized to improve the theory and, at the same time, can be evaluated based on the theory's predictions for project efficacy.

It is with the above process in mind that the Nutrition Assessment for El Salvador has been undertaken. This work is seen as one step in what hopefully will become a continuing process of developing, testing, and

refining nutrition improvement programs.

In general, our analysis of the available information, as applied to the sequential investigation process, confirms the presence in El Salvador of:

1. both acute and chronic malnourishment;
2. a deficit of nutrients, particularly calories; and,
3. high morbidity and mortality rate which leads to an increase in real requirements.

Our conceptual model of malnutrition in El Salvador still lacks consistent, comprehensive data; nevertheless, the process of identifying viable programs has begun. Based upon our diagnostic experience with the Nutrient Flow Theory in other communities, we have recommended for El Salvador a number of steps that can be implemented to further define the problem and identify projects with the potential to reduce malnutrition.

The El Salvador Nutrition Assessment has been divided into three major sections, with Appendices:

The Data

Analysis

Recommendations

Appendices

A. Figures (1-38)

B. Example Program Evaluation: CRS-Caritas

C. The Nutrient Flow Theory

DATA

Some of the problems encountered in collecting and interpreting the data have already been mentioned in the Introduction. This section describes the data which was collected along with constraints or problems in interpreting specific pieces of information. An attempt has been made to organize and present the data in a form which is useful for developing and testing theories concerning El Salvador's nutrition problem. Hence it is no coincidence that the format of this section bears a close resemblance to the Nutrient Flow Model. This facilitates the country-wide analysis which attempts to identify which components or factors are most important.

The problems of selecting the appropriate region for a comparative analysis (which regions should receive emphasis for certain components) was discussed in the Introduction. The functional classification used by INCAP is probably most useful in terms of developing and testing theories. However, at the time of this assessment only limited preliminary results were available from the Functional Classification Study. In order to take advantage of all information available from different sources, the data have been aggregated (or disaggregated) to the departmental level wherever possible. As a result, regionalization by department has been the basis of the comparative analysis.

I. NUTRITIONAL STATUS

Nutritional status is the final output in the Nutrient Flow Model. A measurement of nutritional status indicates the degree to which problems exist in the nutrient flow system. A high rate of malnourishment indicates the existence of an acute problem (or problems) in the system which must be identified or resolved. The principle indicators of nutritional status are anthropometric comparisons in preschool children.

Anthropometric data for 7000 children from 6 to 59 months of age (1.03% of the children in this age group) were obtained from two sources. The majority of these data were collected by INCAP from May to August, 1976,

as part of the Functional Classification Study. A subset of these measurements was taken by the Center for Disease Control-Central America Research Station (CDC-CARS) in January and February, 1976, in the Department of La Paz. These data were regionalized according to a functional classification of agricultural areas (Figure 1 and attachment) Infants less than 6 months of age were not included in this survey because of potential parental objections to obtaining their measurements, and because it was felt that this group would not demonstrate a high prevalence of malnutrition due to the high incidence of breastfeeding. The data for those children included in the INCAP intensive agricultural regions were derived solely from the CDC-CARS study of La Paz and were assumed to reflect the nutritional status of children living in intensive agricultural regions throughout the country. These data are shown in Figure 2.

Weight for height is commonly used as an indicator for acute malnutrition. Additional data obtained by CDC-CARS during visits to a Ministry of Health Clinic has shown that this parameter varies with the season. In December and March, when food and work are abundant, the percentage of patients diagnosed as acutely malnourished is low, whereas malnutrition rates are considerably higher in June when food and work are scarce. The same study indicated that less seasonal variation occurred in rates of malnutrition measured by height for age or weight for age (Figure 3). Therefore, the data shown in Figure 2 for the prevalence of acute malnutrition in intensive regions cannot be reliably compared with similar data from other regions since they were collected during different seasons. That is, measurements collected in June and July will probably indicate higher rates of acute malnutrition than those collected in January or February, since the annual or seasonal prevalence may vary considerably.

Despite these qualifications, the data in Figure 2 indicates that acute malnutrition (weight for height less than 80%) occurs with the highest frequency in marginal agricultural areas. Height for age is commonly used as an indicator for chronic malnutrition, and, as monitored above,

shows less seasonal variation. The highest prevalence of chronic malnutrition is found in coffee regions, followed by central and northern marginal areas.

Since the government of El Salvador is administratively organized by department, or by regions including several departments, the data in Figure 2 were disaggregated to provide malnourishment rates by department. This was done by multiplying the percentage of the population of each department assigned to each functional classification (Figure 1) by the proportion of malnourished children found in that functional classification. These data are shown in Figure 4. As expected, departments with predominantly marginal agricultural regions (Chalatenango, Cabanas) have the highest rates of acute malnutrition. However, the ecological associations of malnutrition shown in the INCAP study are often less apparent at the departmental level since departments often incorporate several functional classifications (for example Sonsonate, La Libertad, Usultan).

Figure 5 presents a third classification of malnourished children by geographic area in the Department of La Paz. These measurements were obtained in the CDC-CARS study in early 1976. The mountainous area corresponds to coffee areas, and the coastal area to intensive agriculture as designated in the INCAP functional classification. The hilly area, however, cannot be easily classified since it parallels a major highway and approximately 30% of the people work in small shops or restaurants. In this study, the prevalence of acute malnutrition was higher in coastal areas, and the prevalence of chronic malnutrition was greater in mountainous areas. Seasonal differences may account for the low prevalence rates observed in this study when compared to the INCAP data for coffee regions.

II. HEALTH STATUS

The health sector primarily covers that portion of the Nutrient Flow

Model which determines the efficiency with which the nutrients are utilized within the body after the food in ingested. Studies, as well as general experience, have shown that in countries similar to El Salvador the health problem that has by far the greatest effect on nutritional status is that of gastrointestinal disease (infection). Generally, the single most useful indicator of gastrointestinal problems is diarrhea. While diarrhea is difficult to define and, as a result, difficult to measure consistently, nevertheless it is a much more practical indicator than laboratory methods which attempt to identify specific pathogens. This assessment then, primarily considers diarrhea-related morbidity and mortality plus environmental factors which effect diarrhea incidence. It is expected that the Health Sector Assessment will achieve much more comprehensive analysis of El Salvador's health problems.

Morbidity and Mortality

Figure 6 contains data from 1973 for total mortality and percentage mortality in children less than one year old, children 1-4 years old, and the percentage mortality caused by diarrhea and dysentery. In addition, this table shows the frequency with which diarrhea was diagnosed during visits to heal children from the same age groups in clinics staffed by the Ministry of Health.

Analysis of these data indicates that departments with large urban centers (Santa Ana, Sonsonate, La Libertad) generally report higher death rates than rural areas. While this may be an accurate reflection of higher urban death rates, under-reporting in rural areas may make rural rates spuriously low. The high death rates in urban children may reflect a similar bias. Although total mortality attributable to diarrhea and dysentery shows a similar trend, there is a generally higher mortality from these diseases in rural areas. These latter data must be interpreted with caution since it is estimated that as many as 70% of the deaths in El Salvador occur in the absence of medical attention (Ministry of Health, 1976). (It has been estimated that the rate of utilization of rural health facilities is 0.2 visits per person per year.)

The annual frequency with which diarrhea was diagnosed at clinic visits was derived from Ministry of Health data for 1975. The relationship of these rates to total mortality, or to mortality from diarrhea or dysentery, must also be interpreted cautiously for the following reasons:

1. Diarrhea rates from 1975 may have no relationship to mortality rates from 1973.
2. The effect of seasonal or regional epidemics of diarrhea or dysentery on mortality rates may be masked by a consideration of annual diarrhea or mortality.
3. The clinical diagnosis of diarrhea may have no relationship to actual incidence, since rates based on diagnosis may reflect perceptions of illness, differences in diagnostic criteria, or accessibility and use of health centers. Diarrhea and dysentery were the single most important cause of death in children less than four years of age, accounting for 24% of deaths in children less than one year of age and 29% of deaths in children from one to four years of age.

Despite these qualifications, attack rates for diarrhea appear to be significantly greater for children in both age groups in rural areas (Morazan, La Union, Cuzcatlan) than in departments with large urban centers.

In order to demonstrate the seasonal variation of the problem, graphs (Figures 7 and 8) were compiled from 1975 data for the clinical diagnosis of diarrhea and malnutrition in health clinics throughout the country for children from 1-4 years of age. The criteria used for the diagnosis of malnutrition were undefined, and the correlation of the clinical diagnosis of malnutrition with anthropometric criteria has been tested and found lacking by CDC-CARS. A comparison of these graphs shows a low incidence of diarrhea during the months of the rainy season in June. The graph for malnutrition demonstrates a small peak in June, with the major peak in October. Although these data were

collected in 1975, comparison of these frequencies with data from the previous two years suggests that such seasonal variation in these diagnoses is common. However, when these data are disaggregated by department, the variations persist for diarrhea, but are not sufficiently uniform for the diagnosis of malnutrition.

Early weaning may affect infant mortality rates in developing countries in several ways: artificial formulas or cow's milk do not contain the factors in breast milk which protect infants against enteric infections, the water used in mixing formulas may be contaminated and may produce high rates of diarrhea, and formulas may be overdiluted, producing malnutrition which may lead to death. Preliminary data for weaning practices were obtained from a retrospective study of 120 mothers of 357 infants representing an urban and rural area of El Salvador. The data shown in Figure 9 indicate that a significantly larger number of rural infants were breast fed for periods greater than 12 months of life. Furthermore, mothers who were illiterate tended to nurse for longer periods of time than those who were not illiterate.

These data do not permit a concrete analysis of the effect of early weaning on infant mortality, since specific death rates from enteric infection or malnutrition in infants fed artificial formulas are not available. They do suggest, however, that an investigation into such a relationship may be useful in planning specific campaigns to prolong breastfeeding.

Environmental Sanitation

The single most important environmental factor affecting diarrhea incidence is the water supply system. The two principle characteristics of a system are the quantity and quality of water which it supplies. Quantity of water depends on the type of delivery system; piped, pressurized water which is available within the house will be utilized to a much greater extent than water which must be manually transported great distances. Water quality depends on the quality of the source and

the degree of protection in transporting to the final point of use; water pumped from a deep well and piped to the home will likely be uncontaminated, whereas water from a surface source which is carried in open containers is likely to be highly contaminated. In addition to the type of physical system which is available, cultural and educational factors can also have a large effect on the quantity and quality of water which is consumed.

Data on water supply was obtained from a survey of households carried out in 1975. Unfortuantely, this data was only reported by regions which combine several departments. The information from this survey is presented in Figure 10 by categories selected to indicate quantity and quality of water provided.

In addition to the water supply system, the type of waste disposal can greatly affect the concentration of contaminant in the environment. This particularly influences contamination by hand-to-mouth and via foods. Data on waste disposal facilities are also available from the household survey and are presented in Figure 11. The general condition of the home can also play an important role although it is a factor which is difficult to define. Figure 12 lists the percent of homes without "hard" floors (tile or brick) and without electric lighting; these can be taken as surrogates of a general household quality indicator but they are also, of course, closely related to income.

What follows is excerpted and translated from a report which briefly describes the Government's activities and plans for the near future:

> Water Supply. The Five Year Plan (1973-1977) for the Health Sector proposes, as a goal, to increment the coverage of water services in the rural area from 23% to 49% by constructing 400 aquaducts. During the first three years of the Plan, the Ministry of Health did not construct the proposed number of aquaducts and FOCCCO (Community Development Office) has constructed or repaired water systems with only low coverage. As a result, the situation

continues without significant change, leaving nearly two million persons in the rural area without service. At the end of 1975, the actual coverage was approximately 27% of the rural population.

Waste Disposal (Latrines). The Health Sector Plan, 1973-1977, proposed, among its objectives, to increase the percent of the population with latrines from 16% to 81% during the five year period by installing 310,000 new latrines. During the first three years 67,512 latrines were built, of which 17,991 were installed; the goal was to construct and install 72,000 latrines. At the end of 1975, the coverage was 20% of the population.

III. NUTRIENT GAP

The concept of nutrient gap is merely a comparison between the requirement for a particular nutrient and the consumption of that nutrient. It can be expressed as a difference between requirements and consumption or as consuming a percent of requirements (i.e. percent adequacy). A nutrient gap can be considered at the individual, family, community, regional or national level as a convenient way to combine requirements and consumption into a single factor.

For this nutrition assessment, nutrient gaps are considered only for protein and calories. These two nutrients are by far the most important and, in addition, they also serve as a probable indicator of the level of consumption of other nutrients.

Requirements

The theoretical requirements for an individual are derived primarily from age and sex, and physiological condition in the case of pregnant or lactating women. The requirements used for this assessment are based

on the "Joint FAO/WHO Ad Hoc Expert Committee Report on Energy and Protein Requirements" of 1973.* These requirements for protein and calories are listed in Figure 13 for the age and sex groupings in the 1971 census.

The requirements for the "average" person will depend on the structure of the population. This is obtained by calculating the percent of the population in each age/sex group. The percentage of the population represented by pregnant or lactating women is estimated by applying certain assumptions to data on the number of live births (Figure 14). When group percentages are multiplied by group requirements, the portion of protein or calories required by each group is obtained. The total protein and calorie requirements for the "average person" are obtained by summing the fraction of requirements attributed to each group.

These calculations were carried out for the 1971 population structure of the entire country and, in each of the departments, for both the urban and rural areas. The results are reported in Figure 15, which indicates that the requirements for the average person do not vary much from one department to the next, nor do they vary significantly between the urban and rural areas. The total protein and calorie requirements for each department (urban and rural) are also presented in Figure 15.

We also calculated El Salvador's total requirements through the year 2000, based on two different population projections. The first projection assumes a constant birth rate of 3.23%, while the second assumes a reduction in the birth rate based on the estimated effect of a population planning program which is underway. The results (Figure 16) demonstrate the benefit of population planning in terms of reduced nutrient requirements.

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*Note: These requirements are based on "safe levels" for individuals. For calories the mean requirement is used, but for proteins a value two standard deviations above the mean is used. As a result, this yields a protein requirement slightly higher than it should be when it is applied to populations such as communities, regions or countries.

Consumption

Food consumption is perhaps the most important factor in the nutrient flow analysis. Based on consumption at the family level, it is possible to determine whether the problem is basically one of nutrient availability (production and marketing), or efficiency in assimilation (health and sanitation).

Unfortunately, food consumption is also one of the most difficult factors to measure with any degree of accuracy. The most common method used is the "24 hour recall." This is subject to a variety of errors, ranging from deliberate bias based on the interviewee's perceptions of the interviewer's expectations, to simply not remembering or being able to quantify what was eaten. Actual weighing of food before it is consumed has the disadvantages of being extremely slow, cumbersome and degrading to the family; it also has the problem that the meal may be specially planned for the event.

As a result of these problems there is very little data available, and that which is available is very difficult to interpret. In the INCAP Functional Classification Study, food consumption data was not gathered. This decision was apparently made because it was felt the information would be unreliable and open to criticism.

The main consumption data that is available is from the INCAP 1965 survey. Because the data is over ten years old and due to the constraints mentioned above, the decision was made not to use this data in a quantitative sense. That is, no conclusions have been drawn from it concerning the level of consumption in El Salvador. However, it was decided that the data might be valuable in a qualitative sense, since it is less likely that problems of accuracy and timeliness would adversely effect the proportion of each food in the diet. Figure 17 gives a rough idea of the percent of protein and calorie requirements which should be

expected from each food based on the 1965 data. This information is used later in considering production gaps by food for each department.

Some recent consumption data does exist for children from one to four years old. The CDC-CARS study in 1976 in the Department of La Paz included a 24 hour recall survey of the preschool children in the sample. In spite of the constraints on consumption measures which were mentioned above, this information has proved useful from the standpoint of developing hypotheses on the level and patterns of consumption in El Salvador. Figure 18 lists the calorie and protein adequacies (consumption as a percent of requirements) by region within the department. Figures 19 and 20 give the contribution of each food group to the calorie and protein consumption by region.

Another potential source of consumption information is the National Survey of Family Budgets (Encuesta Nacional de Presupuestos Familiares). This survey was carried out in 1976 and the data is presently being coded for analysis. The questionnaires are long, complex, and attempt to identify all sources of income and expenditures. Portions of the survey questionnaires were left in the household to be filled out during the week. Due to the length and complexity of the questionnaires it will probably be difficult to interpret the accuracy of the information. Nevertheless, the assessment team has outlined a procedure for organizing the data and analyzing it for consumption patterns. This appears in a separate memo from William Boyle to Dr. Juan Allwood Paredes.

IV. PROCESSING AND PREPARATION

Food processing (outside of the home) and food preparation (within the home) are important in the nutrient flow scheme for two reasons. First, there is the potential for a loss of nutrients as occurs in the polishing of rice; and, second, the processing or preparation can greatly increase the cost of the food which, in turn, reduces the consumption.

The consumption of corn in tortillas represents an example of the importance and inter-relatedness of processing and preparation of food. Corn provides almost half of the proteins and over half of the calories in the Salvadoreno diet, yet it requires considerable effort to transform it from the grain to the tortilla form. Three major steps are involved: cooking the grain, grinding the cooked grain into a dough, and forming and toasting the tortilla.

The average family consumes daily about two and a half kilos of corn in grain form. In order to bring this quantity of corn to a boil and cook it until soft requires several hours worth of fuel. Approximately 70% of this cooking is done with wood. Wood is said to cost about 50 colons (20 dollars) per ton but it is difficult to establish the true value based on the opportunity cost for a campesino who gathers his own wood. It is also difficult to evaluate the social cost of depleted forest resources and increased soil erosion brought about by massive wood gathering. Nevertheless, it is clear that cooking such large quantities of corn over an open fire greatly increases its cost whether in colons, time, or depleted resources.

The 2.5 kilos of dry corn becomes 5 kilos of wet corn after cooking. It takes approximately 4 hours to grind this amount of wet corn using a hand mill (disc grinder). The alternative to hand milling is to take the cooked corn to large motor driven disc mills. The price for grinding corn in these mills can run as high as two colons per arroba (25 pounds) which represents a 32% increase in the cost of the corn.

The preparation of corn for consumption as tortillas greatly increases the "cost" of the Salvadoreno diet. Any change in the method of preparation which increases its efficiency would likely have a positive impact on the nutritional status of the population. One such step would be the industrialization of the pre-cooking and milling processes. The production of Nixtamal (a fortified corn flour for tortillas) is

being considered and evaluated by the Ministry of Planning.

While this proposed intervention may on the whole yield a positive benefit for El Salvador, it may also have a zero or even negative effect on that part of the population with the greatest need. Lack of dependence upon the marketing system may be the single most important factor which permits a large group on the fringe of society to continue to survive. In any case, it is clear that alternative improvements in the processing and preparation of corn should be considered and evaluated. These might include simple, inexpensive kerosene stoves and improved, manually operated disc mills.

V. INTRAFAMILY DISTRIBUTION

Very little emphasis is given here to the problem of intrafamily distribution or misallocation of food within the family. One reason for this is that data for individual consumption are practically nonexistent. Furthermore, the techniques for measuring individual consumption are cumbersome and subject to a high level of error. As a result, use of this information is probably not justifiable unless it is clear that it plays a critical role in the nutrition problem.

A second consideration is that intrafamily distribution is perhaps an area in which it is not ethical for nutrition planners to intervene. If a family is consuming eighty percent of its requirements, the assumption is often made that each member of the family should also consume eighty percent of his requirements. Such an assumption, based on some concept of justice, may run contrary to a delicately balanced survival strategy which is necessary for the overall well-being of the family.

In general, it is probably better to concentrate on other factors unless it is demonstrated that the consumption gap is small at the family level. If this is the case, and high rates of malnutrition still exist, intrafamily distribution should be investigated further.

VI. INTERFAMILY DISTRIBUTION

An understanding of the allocation of food among the various families in a population may indicate a type of food loss. Such a loss may imply interventions to reduce the loss or to increase food supplies to overcome the loss. In other words, food which is consumed by persons or families in excess of their requirements is food which is not available for meeting the requirements of the general population.

Just as consumption data at the family level is scarce and unreliable, the data on allocation of food among groups of families is also difficult to obtain. A study carried out by GAFICA SIECA/GRAFICA (FAO)* contains some consumption data by income groups (Figures 21 and 22). This data was generated based on food availability and certain demand functions for the different food groups.

In order to interpolate this data over a continuous spectrum of incomes, it was first plotted in bar graph form (see line A-A in Figures 23 and 24). Next, a continuous function (line B-B) was interpreted such that the average consumption would remain the same for each income group. Line C-C represents the per capita requirements (2356 calories and 49.27 grams protein). The area below line A-A or B-B represents the consumption of the total population. The area below line B-B but above line C-C represents consumption in excess of requirements. The latter area divided by the former yields the percent of consumption which is "lost" through over-consumption. The loss in calories is approximately 6.3% and the loss in proteins is approximately 14.3%. Based on this analysis, approximately 22% of the population is overconsuming calories and approximately 33% is overconsuming proteins.

The information contained in Figures 21 and 22 (to the extent that they

*"Perspectivas para el Desarrollo y la Integracion de la Agricultura en Centroamerica," Guatemala, 1974.

are accurate) can also be useful in designing interventions aimed at changing patterns of interfamily distribution. For example, the lowest economic class derives 74.3% of its protein from cereals and legumes while the highest economic class only derives 46.1% of its protein from cereal and legumes. This indicates that a policy of subsidizing the price of corn and beans would result in the lower class increasing their consumption of these two items much more than would the upper class.

The above analysis is, of course, only as valid as the data on which it is based. Nevertheless, it demonstrates the magnitude of the effect that income has on consumption, and it demonstrates the utility of generating reliable data concerning the allocation of food among families in a population.

VII. LOSSES

Food losses which occur between production and distribution can have a tremendous effect on the amount of nutrients available for consumption at the family level. For Latin America in general, losses have been estimated at 40 percent.* These losses depend on efficiency in harvesting, type and distance of transport, and type and time of storage.

No data was obtained on efficiency of harvesting in El Salvador. However, in areas of extreme poverty, harvest losses are probably low due to careful manual collection. Even when the initial harvest is mechanical there is often a second harvest by "scavengers". Transportation losses were also not available; however, type of transportation by region and by farm size is known. (For example, see Table 25 of the Agriculture Sector Assessment working draft of February 11, 1977.) A simple study could be carried out which would establish a loss factor for each type of transport. From this, total transportation losses could be estimated.

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*Alan Berg, The Nutrition Factor, The Brookings Institute, Washington, D.C., 1973.

It is clear that storage plays an important role in potential nutrient losses for El Salvador. A large portion of the nutrients consumed are in the form of basic grains and legumes. These are harvested in September and December and must be stored for consumption throughout the year. As with harvesting and transportation, no quantitative data were available on storage losses, although a qualitative understanding of the importance of home storage was obtained during a field visit through the subsistance farm areas of Santa Ana and northern La Libertad.

After several hours driving through particularly desolate farm land, Ramiro (an assessment team member) struck up a conservation with an elderly peasant in the plaza at San Pablo de Tacachio.

Ramiro: "Sir, could you respond to an uncertainty? We have observed that everything is dry and that nothing grows during this time of the year. Furthermore, I understand that the dry season lasts for six months. How are the peasants able to support their families under such harsh conditions?"

Peasant: "Of course. The situation here is a little different. Here the peasant has'su vida propia' (his own life)."

Ramiro: "Vida propia? How is that?"

Peasant: "Yes, he has his own life. He doesn't depend on anyone. He has his own food. At harvest he knows how much food his family will need to sustain themselves during this difficult period. Year after year it is the same - he stores the food in his house which he will need during the dry months. As such he doesn't depend on anyone."

Later, talking to a small store owner in the same area, this information was confirmed.

Ramiro: "Tell me, sir. Who are the people who live in this region? What do they work in?"

Owner: "As you can see, everyone here works the soil. They sow their seeds and then they sell the harvest. From this they obtain their income."

Ramiro: "And you sir - what do you sell most of in your store?"

Owner: "Well, I sell everything: canned goods, soda and beer, candles, baby formula, some rice..."

Ramiro: "Do you sell much corn or beans?"

Owner: "No. The only corn and beans I have is what I need to feed my family. The people here don't buy these items because they produce their own and save what they need during the dry season like now."

These two short dialogues provide vivid evidence of the peasants' belief in the importance of storing grain until the next harvest.

During the field visit a variety of home storage methods were observed. The most common method for storing corn was simply to pile it (on the cob) in a small grass hut behind the house. Some families, however, own large galvanized tanks where the grain is stored with a chemical to reduce loss from weevils.

According to the INCAP Functional Classification System, 45% of the population live in areas characterized as "marginal agriculture." This indicates that a large portion of the corn and beans which are available for consumption are subject to large losses (e.g. spoilage, weevils and rodents) inherent in crude methods of home storage. Clearly, a program that reduces losses in home storage has considerable potential for increasing the food available to the whole country. A first step in reducing these losses is to obtain a quantitative understanding of their magnitude.

VIII. PRODUCTION, IMPORTATION AND EXPORTATION

That food which is produced domestically plus that which is imported, and minus that which is exported, represents the amount of food available to the country before losses are subtracted from production. By considering these three items as nutrients it is possible to estimate whether a country has sufficient food to adequately feed its population or not. These data also indicate how well the country is doing in terms of international exchange of nutrients; it is helpful to know if the nutrient gap is larger or smaller after importation is added

and exportation is subtracted from what is originally available after production.

It was not possible to obtain complete production data from one source nor for one year. The annual production of basic grains (rice, corn and beans) and cane (converted to sugar) was obtained from the Third Agricultural Census of 1971. From the same source, daily production of milk, eggs and honey was obtained and multiplied by 365 to obtain annual figures. For the calculations of milk and honey, one liter was assumed equivalent to one kilogram. Annual production of meat and fish was obtained from the fourth quarter Bulletin of Statistics of 1973. The production of bananas (including plantains) and tubers (yucca and potatoes) was obtained from the SEICA/GAFICA study for the year 1969. This annual production data is presented in Figure 25.

Annual figures for the importation and exportation were obtained from Volume I of the Statistic Annual for 1973. These data were aggregated into basic groups (e.g. "bread" includes bread, biscuits, crackers and bread mixes) and are presented in Figures 26 and 27.

From the above discussion it is clear that the available data on national production, importation and exportation can only lead to conclusions of a very general nature. First, it is difficult to combine and compare the different figures because they represent different years. In general, production is considered to increase by about 3.6% per year. This is, at best, a rough approximation to converting, for example, corn production in 1971 to production in 1973. Also, because the data comes from several sources it is difficult to determine whether the assumptions used in each source are mutually consistant.

IX. REGIONAL PRODUCTION

Data which break production down by region (Departments) are helpful since they contribute to the comparative analysis. By comparing

production data from one region to tnat of another region it becomes possible to identify potential nutrient flows within the country. Furthermore, since much of the basic foods (particularly corn) are grown at the "family farm" level, regional production can serve as an indicator of areas of high food availability.

In Figures 28 through 34, production is listed by department for each of the basic foods. This data was obtained from the Third Agricultural Census of 1971. These figures were then converted to protein and calorie production using standard nutrient content tables.

The protein and calorie production for each food by department was then divided by the protein and calorie requirements for that department. This yields the percent of each department's nutrient requirements which it is producing for a particular food. By comparing this figure with the percent of requirements to be expected from each food (based on a reference diet, Figure 17), it is possible to estimate if a department produces a surplus or a deficit of a particular food. For example, Figure 28 indicates that Ahuachapan produces 61% of its calorie requirements in corn, whereas Figure 17 indicates that in the Salvadorena diet 52% of the calories come from corn. Thus it can be concluded that Ahuachapan probably produces more corn than it needs.

ANALYSIS

The reason for performing analyses is to provide a rational basis for decision-making; the nutrition planner needs to know the extent of the problem and the components which contribute to the problem. In addition, he needs to know the specific needs of certain areas as they may differ from the overall needs of the whole country. The more quantitative the knowledge -- the more rational the decision process. What follows here is divided into two sections. The first quantifies-- to the extent possible -- the various components in the Nutrient Flow Theory at the national level, while the second attempts to quantify differences from region to region.

I. NATIONAL LEVEL NUTRIENT FLOW ANALYSIS

The first step in the analysis is to apply the available data to the Nutrient Flow Theory in order to identify those areas which are most responsible for the high rates of malnourishment in El Salvador. In Figures 35 and 36, the calorie and protein gaps (percent adequacy) are recorded for each step in the nutrient flow from production through interfamily distribution. The production, importation, and exportation were calculated from Figures 25, 26, and 27. Since data on storage and transportation losses are not available for El Salvador, two different estimates were used. The 40% estimate represents a high loss and the 10% estimate represents what might be achieved by improving on the situation. Nutrients consumed by persons in excess of their requirements were subtracted, yielding the average percent adequacy which is available at the family level for the population in general.

El Salvador's production of calories and protein is close to being sufficient to meet its requirements (90% and 95% respectively). However, when losses are included the situation changes considerably. If 40% losses are assumed (assumption 1), then availability drops to 54% for calories and 57% for protein. Even if losses can be reduced to 10%

(assumption 2), the nutrient availability drops to 81% for calories and 86% for proteins.

It is interesting to note that the net effect of importation-less-exportation is an increase in nutrient availability. The increase in calories is small (about three percentage points) but the increase in proteins is considerable (about 22 percentage points); the difference occurs primarily because there is very little export of proteins.

When interfamily distribution is included in the flow analysis it further increases the nutrient gap. When nutrients that are consumed by persons in excess of their requirements are subtracted as unavailable for fulfilling needs, then what is left represents the average nutrient availability at the family level. Under assumption 1 there are, on the average, 53% of the requirements available for calories and 68% for protein. Under assumption 2, the average percent adequacy is 78% for calories and 93% of protein.

In the absence of actual consumption data the nutrient availability derived above must serve as an indirect indicator of consumption. From this it is clear that underconsumption is an important factor. (The magnitude of importance depends upon the actual level of losses.) It is also apparent that the planner's problem is one of increasing quantity in the diet rather than quality, since the deficit of calories is considerably greater than that of protein. Hence a program which concentrates on "fortification" without increasing the quantity will not be dealing with the problem.

The gaps or deficits which were calculated in Figures 35 and 36 are based on the requirements of healthy persons (i.e., those who do not suffer further losses in the assimilation of nutrients nor require more nutrients to combat infection). However, a review of the information in Figure 6 indicates that morbidity and mortality rates are quite high

particularly for children and for gastrointestinal infections. This means that the actual gap between consumption and "real" requirements is much greater than is indicated in the nutrient flow diagrams (Figures 35 and 36).

El Salvador has one of the highest rates of malnourishment in Latin America (73% by the traditional "Gomez" weight for age classification). A "Nutrient Flow" analysis of the available data has demonstrated that El Salvador's nutrition problem differs only in degree from the dilemma facing many of the Latin American countries: increased consumption requirements caused by infection and poor sanitation, are compounded by a deficit in the availability of nutrients.

As was stated in the introduction, the emphasis of this assessment is not on individual conclusions but, rather, the process employed in arriving at the conclusions. If the process is continued, the conclusions can be refined to the point where they become much more useful for policy definition.

II. REGIONAL ANALYSIS

Once a planner has identified the principle components of a nutrition strategy for the country as a whole, he must then decide how the various activities or services should be distributed throughout the country. However, a single program designed to apply equally to regions, departments or localities may, by its very nature and broad scope, be less effective than programs carefully designed to meet the unique needs and circumstances of each area. This assumes - not unrealistically - that the problem of malnutrition may differ in severity and in its origins of cause from one segment of the population to another and from one area to another.

An important step then, in a nutrition assessment as well as a continuous nutrition planning diagnosis, is to undertake a comparative analysis.

We have attempted such an analysis for this assessment but have had little success. This lack of success in the assessment stage indicates a particular need for longer term planning to try to improve our understanding of possible differences in the nutrition problem among the various areas.

The first attempt at a regional analysis concentrated solely on the Department of La Paz. There were two reasons for this. First, the Department of La Paz has a range of agricultural activities which, to some extent, is representative of the whole country. Second, the CDC-CARS study of 1976 provides limited data for three different regions: coast, hills, and mountains. This data source is particularly useful since it represents the same point in time and was collected using the same field staff and methodology.

Figure 37 combines data on the three principle malnourishment classifications, diarrhea prevalence for infants and preschoolers, and protein and calorie consumption (as a percent of requirements) for preschool children. It quickly becomes apparent that the coast region rate of malnourishment by all three classifications is higher than either the mountain or hill region. The acute (weight for height) measurement is almost twice as high as either of the other two regions. Hence, the comparative analysis shows that the magnitude of the malnourishment problem is much greater in the coastal area. The explanation for this situation is apparent in the remaining data of Figure 37, which indicates that it is a problem of a high prevalence of diarrhea and a low calorie consumption. The situation in the coast region appears to be significantly worse with respect to both of these factors. It is difficult to explain the difference in diarrhea prevalence without more detailed information on the differences in environmental factors among the three regions. The lower energy consumption (as well as the lower protein consumption) can, perhaps, be explained by the fact that, in general, there is much less small scale production of basic food items in the coastal area.

This means that the market, or commercialization of foods, plays a much more important role in the nutrient flow process. That is, in the coastal area the effect of being poor has a greater impact on nutritional status since most or all food must be purchased. This would indicate a need for a program in food supplementation or price support, or possibly a program which makes it possible for the poor to produce their own food.

The next step in the regional analysis is to try to apply the conclusions from the Department of La Paz to the country as a whole. An attempt has been made to do a comparative analysis of the departments based on anticipated differences among the three basic regions as defined in the INCAP functional classification. The coast region of La Paz corresponds to the intensive region in the INCAP classification; the mountain region is similar to INCAP's coffee classification and, to a lesser degree, the hill region is similar to the marginal agricultural region. The output of the La Paz analysis can be thought of as hypotheses to be tested against data from other departments.

Figure 38 was constructed to gain an overall view of the fourteen departments and the various factors related to malnutrition. Each department was ranked according to its relative situation for each of the following factors: percapita production of both calories and protein; the three anthropometric classifications of malnutrition, prevalence of diarrhea for infants and preschool children; and two indicators of environmental sanitation. There are, of course, problems with ordering the data in this fashion, but one would expect to be able to identify certain patterns nevertheless.

In fact, careful analysis of Figure 38 failed to reveal any significant patterns or consistant relationships. This probably means that the data just is not sufficient or sensitive enough. As an example, when one tries to determine which region is better off nutritionally and which one is worse off, the results are just the opposite from what was found

in the La Paz analysis. That is, in the La Paz study the coast region has the highest rates of malnourishment when compared to the other two regions, whereas the INCAP data indicates that the intensive region (equivalent to the coast region) has the lowest rates. As was noted earlier, this is undoubtedly due to the fact that the data for the intensive region were gathered during a different time of the year. Although it is possible to explain this inconsistency, this problem renders the malnourishment data practically useless in terms of any kind of quantitative comaprisons among regions.

Similarly, it was necessary to use only production data as a surrogate for the lack of consumption data. Clearly there exists considerable importation/exportation of food among departments and there is likely to be little, if any, relation between production and consumption at the department level.

The outcome of this analysis is that more and better data is needed in order to identify differences in the nutrition problem which might exist among regions. Perhaps when the INCAP Functional Classification Study is complete a better understanding of the problem will be possible.

CONCLUSIONS AND RECOMMENDATIONS

The recommendations which have evolved from this nutrition assessment activity emphasize two principle needs. First, El Salvador needs to develop an interest and a capability in the nutrition planning process. Second, new data must be generated which better defines the nutrition problem, its location and its causes. These two needs are closely related and, in fact can best be met by being combined.

We strongly suggest that the planned nutrition loan be postponed until 1979, and primary emphasis be placed on the grant for the next two years. The grant activities should concentrate on training and supporting a technical level planning staff which would, in time, produce a detailed plan for a nutrition loan. The plan would include projected reductions in malnourishment with a reasonable level of confidence - something which is not possible at the present time.

The only current nutrition planning staff is in the person of Dr. Allwood Paredes. His office (the Nutrition Office in the Ministry of Planning) is the obvious institution for developing an effective nutrition planning capability, but it will need to increase its professional staff to four or five persons. Ideally, this would include two specific staff persons, one on loan from the Ministry of Health and the other from the Ministry of Agriculture.

The primary emphasis for the first year should be on training the new staff in the scientific approach to nutrition planning. The scientific method relies heavily on the development and testing of hypotheses in analysing the causes of malnourishment. This approach is much more efficient and reliable since it zeros in on the answer much faster than the random collection of data in the hope of stumbling on something significant.

The ideal way to learn this method is by practicing it in the field on the same types of problems that are the target of the planning activity. It

is recommended that training be supported primarily in the field with technical assistance, logistics, and materials and supplies. The learning exercise could consist both of collecting needed data and designing experimental pilot projects.

The following is a list of activities that would fulfull the dual purpose of providing excellent learning situations and at the same time, filling in some of the information gaps which are inhibiting a more precise diagnosis of El Salvador's nutrition problem:

1. Develop and implement a methodology for measuring losses during home storage of basic grains. This could also be extended to a technique for estimating family consumption of basic grains by measuring the change in stock from one month to the next.

2. Design and carryout a study which measures the seasonal variation of basic food prices, food consumption, infectious disease prevalence, and malnourishment rates. This should be done in a marginal subsistance area as well as in an intensive agriculture area.

3. Design and implement a training program for the rural health promoters which increases their impact in the area of nutrition. Such a training program would concentrate on simple diagnostic procedures aimed at increasing community awareness of the factors which effect nutritional status. Diagnosis by community members can be a powerful tool when it is necessary to change attitudes and customs.

4. A few "complete" diagnoses should be carried out in separate and "different" communities. Such projects would measure all of the factors in the Nutrient Flow Theory for a given community.

5. Based on the above diagnoses, pilot projects would be designed and implemented. This process would include predicting the results of the projects and then evaluating the actual results and comparing them to the predictions.

The above is, of course, only a partial list of the types of activities which might be carried out as part of the field training of the nutrition planning staff. In fact, the selection of the appropriate activities is itself an important exercise.

It may appear that a lot of data collection is being recommended when, in

fact, this is not the case. All of the measurement activities suggested above would require a relatively small sample size (say, perhaps, 20-50 families). This is the strength of the scientific method which requires relatively few observations before reevaluating the hypothesis.

In addition to the basic training activities in the field, other types of training will also be needed. There will likely be cases where a short course is called for to develop specific skills. Working visits to other nutrition planning groups in Latin America can also be very helpful.

APPENDICES

A. Figures (1-38)

B. Example Program Evaluation:
   CRS-Caritas

C. The Nutrient Flow Theory

Figure 1

PERCENT OF POPULATION IN EACH FUNCTIONAL CLASSIFICATION

BY DEPARTMENT

DEPARTMENT	POPULATION	URBAN	MARGINAL	COFFEE	INTENSIVE
Ahuachapan	211730	9.7	60.5	29.8	0.0
Santa Ana	516502	28.7	40.9	30.3	0.0
Sonsonate	281863	26.6	29.9	30.1	13.3
Chalatenango	204982	0.0	100	0.0	0.0
La Liberatad	338764	22.2	38.7	22.0	17.1
San Salvador	870117	70.6	21.0	5.5	2.9
Cuzcatlan	279450	13.6	83.7	0.0	2.7
La Paz	215898	9.2	34.9	4.7	51.2
Cabanas	155634	0.0	100	0.0	0.0
San Vicente	182206	12.0	81.8	2.9	3.3
Usulatan	349228	9.6	17.4	22.3	50.7
San Miguel	380439	22.5	35.9	7.3	34.3
Morazan	185158	0.0	87.0	0.0	13.0
La Union	262343	8.1	91.9	0.0	0.0
Total		27.3	45	12.6	15.0

Source: Calculated from INCAP Functional Classification by Department

(See following page - Criteria for Functional Classification of Agricultural Areas)

CRITERIA FOR FUNCTIONAL CLASSIFICATION OF AGRICULTURAL AREAS

Urban region:	27.3% of the total population. Includes any canton or center with 10,000 persons or more reported in the 1976 malaria population census.
Coffee region:	12.6% of the total population. Includes municipios where at least 1/3 of total land was used for coffee or where 2/3 of the land was used and the percentage of land for coffee exceeded the percentage used for other cash crops.
Intensive region:	15% of the total population. Includes municipios where at least 1/3 of the total land was used for other cash crops (cane, cotton, etc.) or where more than 2/3 of the total land was used and the percentage of land utilized for other cash crops exceeds the percentage used for coffee.
Marginal region:	45.0% of the total population. Included municipios where less than 2/3 of the land was used for agriculture except those cases where 1/3 or more of the land was utilized for either coffee or other cash crops.

Figure 2

NUTRITIONAL STATUS - EL SALVADOR

INCAP Functional Classification Region	Percent of Standard Weight for Height			
	>100%	90-100%	80-90%	<80%
Northern Marginal	28.7	45.8	22.9	2.6
Central Marginal	34.6	44.3	18.8	2.3
Urban Slums	37.0	46.3	15.3	1.3
Coffee	41.9	43.2	12.8	2.1
Intensive	51.0	36.8	11.0	1.1

INCAP Functional Classification Region	Percent of Standard Height for Age			
	>95%	90-95%	85-90%	<85%
Northern Marginal	23.5	36.8	28.8	10.8
Central Marginal	16.9	36.8	30.8	15.4
Urban Slums	29.7	37.0	23.9	9.5
Coffee	16.5	31.6	31.8	20.0
Intensive	26.0	40.4	23.6	9.9

INCAP Functional Classification Region	Percent of Standard Weight for Age			
	>90%	75-90%	60-75%	<60%
Northern Marginal	23.5	53.8	21.0	1.7
Central Marginal	24.2	50.8	22.5	2.4
Urban Slums	33.6	51.1	14.0	1.3
Coffee	23.1	54.3	20.4	2.2
Intensive	37.1	48.8	12.5	1.5

Source: Preliminary results from INCAP Functional Classification Survey, 1976

Figure 3

PERCENT DISTRIBUTION OF MALNOURISHED CHILDREN IN THE DEPARTMENT OF LA PAZ BY ANTHROPOMETRIC CLASSIFICATION BY SURVEY MONTH

	June 1975	Sept. 1975	Dec. 1975	Mar. 1976	June 1976
Weight/Height 90%	21.2	15.4	14.0	12.7	15.4
Weight/Age 75%	19.0	18.6	15.7	18.5	17.3
Height/Age 85%	9.8	13.2	11.0	13.8	11.2

Source: Taken from preliminary results of CDC-CARS survey of approximately 350 children per month

Figure 4

NUTRITIONAL STATUS: PERCENT BY DEPARTMENT

	Percent of Standard Weight for Age				Percent of Standard Weight for Height		Percent of Standard Height for Age			
Department	>90	90-75	75-60	<60	>90	<90	>95	90-95	85-90	<85
Ahuachapan	25.2	52.7	20.3	1.98	79.5	20.3	18.1	35.2	30.4	16.1
Santa Ana	28.1	52.6	17.5	1.75	82.9	16.9	23.2	34.7	27.8	14.1
Sonsonate	29.2	52	17	1.7	82.8	17	23.1	35.8	27.4	13.6
Chalatenango	23.6	52.8	21.5	2	76.4	23.5	23.5	36.8	28.8	10.8
La Libertad	27.2	52.2	18.6	1.85	80.9	18.9	20.6	36	28.6	14.5
San Salvador	31.4	51.5	15.6	1.5	82.1	17.7	27	36.6	25.4	11
Cuscatlan	25.3	52.5	20.3	1.9	77.6	22.3	18.9	36.9	29.7	14.5
La Paz	31.1	50.5	16.2	1.67	83.2	16.7	22.6	38.5	26.5	12.3
Cabanas	23.6	52.8	21.5	2	76.4	23.5	23.5	36.8	28.8	10.8
San Vicente	25.6	52.4	20.1	1.87	78	21.8	19	36.8	29.6	14.5
Usulutan	31	51	16.1	1.78	84.3	15.5	22.4	37.4	26.8	13.1
San Miguel	28.9	51.4	17.6	1,86	82.1	17.7	20.5	37.2	28	14
Morazan	25.7	52.2	20.1	1.95	78	21.8	23.8	37.3	28	11
La Union	24.6	52.4	20.8	1.95	76.9	22.9	18.3	36.8	30	14.7
TOTAL	26.4	52	19.3	1.8	83.84	16.1	23.4	36.6	27.45	12.54

Source: Taken from preliminary results of INCAP Functional Classification Study - 1976. These values were calculated taking into account the portion in each classification by Department. Basically, it is a combination of data from Figures 3 and 4 in the previous two tables.

Figure 5

NUTRITIONAL STATUS: PERCENT BY REGION DEPARTMENT OF LA PAZ

Percent of Standard Weight for Height

Region	>100%	90-100%	80-90%	<80%
Mountain	59.1	34.3	5.8	0.8
Hill	53.5	38.7	7.1	0.6
Coast	51.0	36.8	11.0	1.1
Total	54.5	36.6	8.0	0.9

Percent of Standard Height for Age

Region	>95%	90-95%	85-90%	<85%
Mountain	23.5	35.1	38.1	13.4
Hill	28.1	39.0	22.2	10.7
Coast	26.0	40.4	23.6	9.9
Total	25.8	38.2	24.6	11.3

Percent of Standard Weight for Age

Region	>90%	75-90%	60-75%	<60%
Mountain	37.3	48.2	13.4	1.1
Hill	39.7	46.6	12.2	1.4
Coast	37.1	48.8	12.5	1.5
Total	38.1	47.9	12.7	1.4

Source: Preliminary results from CDC-CARS survey, 1976

Figure 6

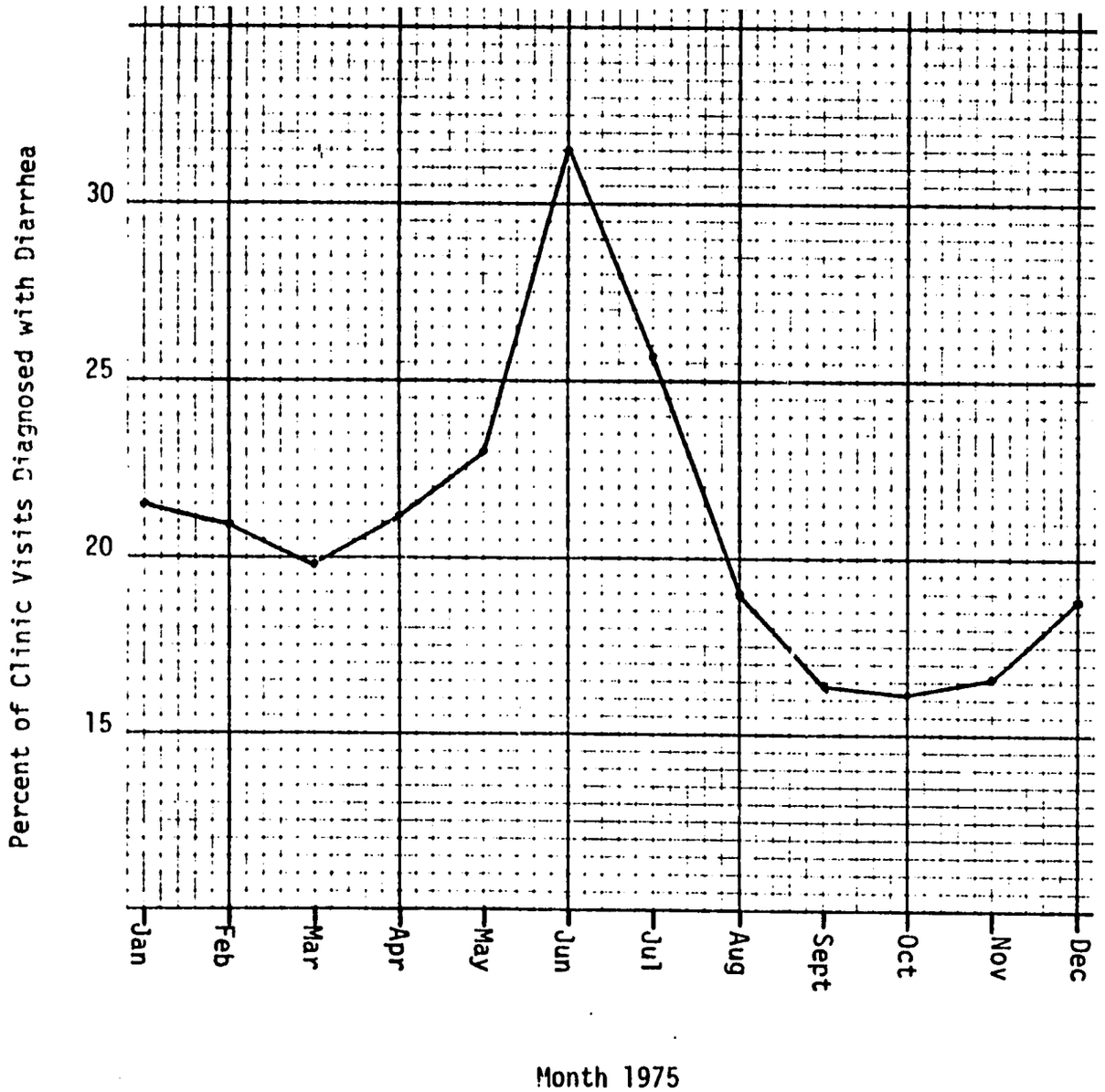
MORTALITY AND MORBIDITY DATA FOR CHILDREN, BY DIARRHEA, BY DEPARTMENT

Department	Total Deaths	Deaths/1000 Inhabitants	% Deaths <1 year	% Deaths 1-4 years	% of deaths from dysentery and enteritis Total Population	% Clinic Visits for Diarrhea <1 year	% Clinic Visits for Diarrhea 1-4 years
Ahuachapan	1836	9.5	26	21	19	31.6	22.2
Santa Ana	4098	10.5	34	15	12	29.7	19.1
Sonsonate	2474	9.9	30	18	14	27.5	22.3
Chalatenango	1353	6.9	22	16	19	30.5	17.2
La Libertad	3317	10.8	34	16	24	36.7	24.7
San Salvador	6479	9.0	33	10	12	30.4	19.8
Cuscatlan	1713	10.4	27	18	17	37.4	22.2
La Paz	1533	7.5	26	16	15	33.0	17.9
Cabanas	611	4.2	15	11	16	32.7	20.9
San Vicente	1192	7.1	21	16	18	31.6	21.3
Usulutan	2346	7.3	29	15	16	34.5	19.9
San Miguel	2694	7.6	29	15	16	34.3	20.0
Morazan	1004	5.6	11	14	13	40.4	26.3
La Union	1216	5.0	19	13	12	40.4	25.2
Total	31865	8.3	29	15	16	32.3	20.7

Source: Mortality data from "Anuario Estadistico" 1973, Vol. II (Demografia-Salud). Morbidity data from Ministry of Health clinic records, compiled by CDC-CARS.

Figure 7

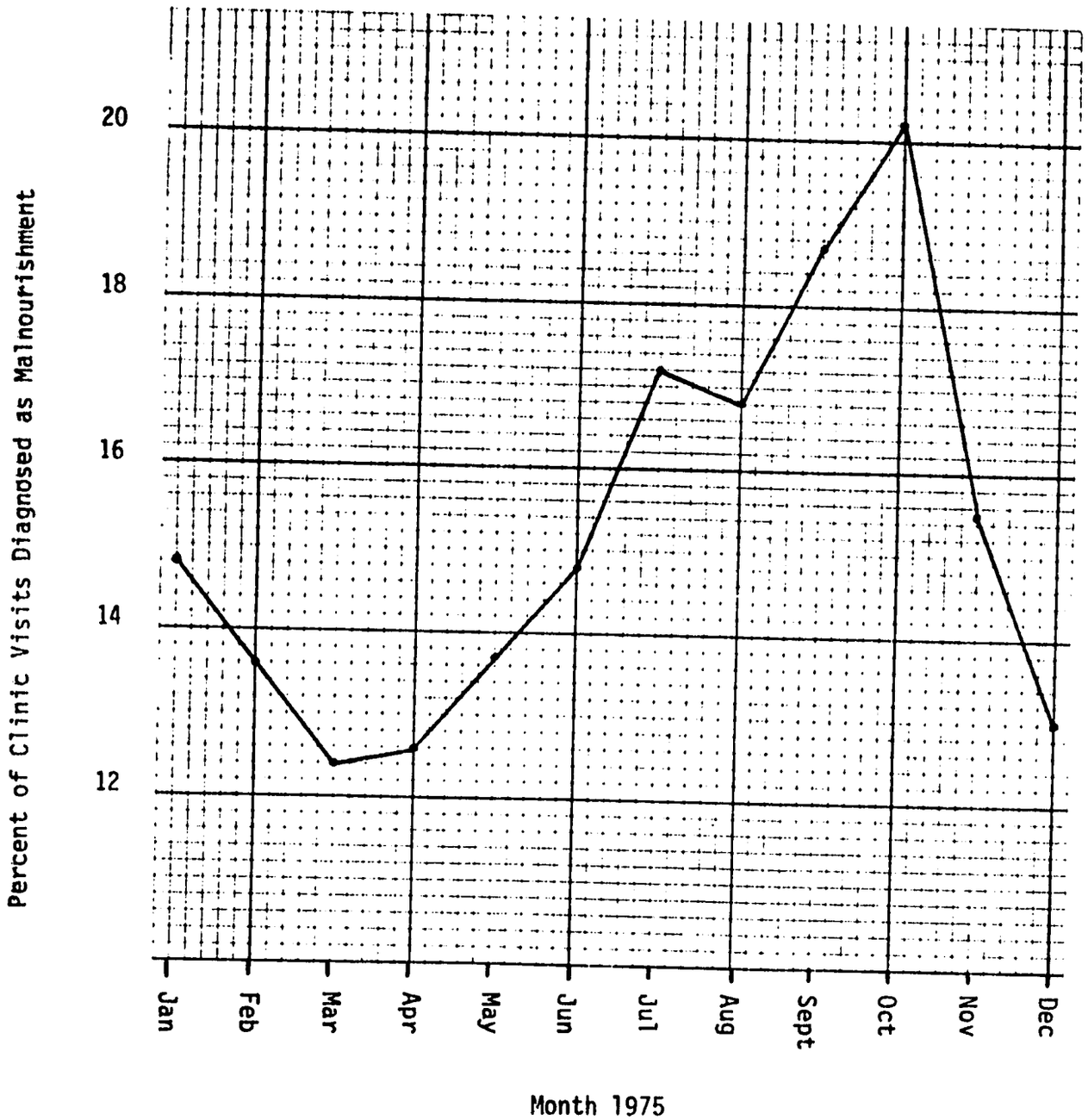
PERCENT OF CHILDREN (1-4 YEARS) WITH DIARRHEA BY MONTH 1975



Source: Plotted from preliminary CDC-CARS data

Figure 8

PERCENT OF CHILDREN (1-4 YEARS) DIAGNOSED MALNOURISHED BY MONTH 1975



Source: Plotted from preliminary CDC-CARS data

Figure 9

LENGTH OF NURSING BY URBAN/RURAL RESIDENCES

AND BY LITERACY OF MOTHER

	<6 months	6-11 months	>12 months
Urban	20	27	89
Rural	27	17	177
Literate	25	23	92
Illiterate	22	21	174

Source: Preliminary results from study conducted in two communities (one urban and one rural) in 1976. Sample consisted of 357 children.

REGIONAL DEFINITIONS*

Western Region:	Includes the Departments of Ahuachapan, Santa Ana, and Sonsonate
Central Region 1:	Includes the Departments of Chalatenango, La Libertad, San Salvador, Cuscatlan, except the Metropolitan Area
Central Region 2:	Includes the Departments of La Paz, Cabanas, and San Vicente
Eastern Region:	Includes the Departments of Usulutan, San Miguel, Morazan, and La Union
Metropolitan Area:	Includes the urban part of the following Municipios: San Salvador, Mejicanos, San Marcos, Ayutuxtepeque, Cuscatancingo, Ciudad Delgado, Ilopango, Soyapano, Antigno Cuseatlan, and Santatecla
Urban Area:	Is understood to be that town or area in the municipio which house the government functions for the municipio
Rural Area:	Includes the rest of the municipio not included in the urban area

*Applies to Figures 10-12, following.

Figure 10

SOURCE OF WATER SUPPLY - PERCENT OF FAMILIES BY REGION

	Piped (private)	Piped (public)	Well (private)	Well (public)	Other Source
Whole Country	32.0	14.4	8.5	14.9	30.2
Urban	66.2	20.2	1.7	2.2	9.6
Rural	5.5	9.9	13.6	24.8	46.2
Western Region	35.2	16.4	6.7	10.4	31.4
Urban	75.5	16.1	0.3	0.1	8.0
Rural	5.3	16.6	11.1	17.4	47.6
Central Region 1	22.4	15.8	9.5	12.0	40.3
Urban	55.2	23.0	1.2	3.8	16.8
Rural	11.5	13.4	12.3	14.7	48.1
Central Region 2	13.3	13.8	9.3	14.4	49.3
Urban	41.1	33.5	2.2	2.0	21.1
Rural	3.0	6.6	11.8	18.9	59.6
Eastern Region	15.9	7.0	14.3	31.1	31.6
Urban	53.5	14.3	7.1	7.7	17.3
Rural	0.6	4.0	17.4	40.7	37.4
Metropolitan Area	74.8	21.5	0.3	0.3	3.0

Source: Results from "Encuesta de Hogares, Abril-Julio 1975," Ministerio di Planificacion y Coordinacion de Desarrollo Economico y Social, Cuadros 49-64.

Figure 11

WASTE DISPOSAL FACILITIES - PERCENT OF FAMILIES BY REGION

	Piped (private)	Piped (public)	Well (private)	Well (public)	Other source
Whole Country	19.4	9.9	14.6	6.0	50.0
Urban	38.5	21.3	17.4	10.3	12.5
Rural	4.8	1.0	12.5	2.7	79.0
Western Region	16.6	13.2	14.8	7.6	47.9
Urban	33.7	30.8	14.7	12.9	8.0
Rural	4.8	1.0	14.8	4.0	75.5
Central Region 1	14.7	4.5	18.3	6.3	56.1
Urban	32.0	13.4	29.2	10.2	15.2
Rural	8.9	1.6	14.7	5.1	69.7
Central Region 2	10.3	2.6	14.6	1.9	70.7
Urban	27.0	6.1	36.0	4.1	26.8
Rural	4.2	1.3	6.8	1.2	86.6
Eastern Region	10.7	2.9	17.0	1.7	67.7
Urban	32.4	9.2	29.3	4.1	24.9
Rural	1.8	0.3	11.9	0.7	85.3
Metropolitan Area	47.1	27.0	7.1	12.8	6.1

Source: Results from "Encuesta de Hogares, Abril-Julio 1975," Ministerio de Planificacion y Coordinacion de Desarrollo Economico y Social, Cuadros 33-84.

Figure 12

OTHER ENVIRONMENTAL CHARACTERISTICS - PERCENT OF FAMILIES BY REGION

	% of houses without brick or tile floors	% of houses without electric lighting
Whole Country	59.8	55.3
Urban	27.0	16.2
Rural	85.1	85.6
Western Region	56.4	53.3
Urban	20.7	14.1
Rural	81.0	80.4
Central Region 1	64.2	62.2
Urban	34.6	23.0
Rural	74.0	75.2
Central Region 2	80.8	75.2
Urban	51.8	28.5
Rural	92.2	91.3
Eastern Region	80.1	76.5
Urban	46.3	33.2
Rural	94.1	94.4
Metropolitan Area	15.4	6.0

Source: Results from "Encuesta de Hogares, Abril-Julio 1975," Ministerio di Planificacion y Coordinacion de Desorrallo Economico y Social, Cuadros 17-32.

Figure 13

NUTRIENT REQUIREMENTS BY AGE AND SEX

	Calories		Protein (gms)	
Age Group	Male	Female	Male	Female
0-1	850	850	23.33	23.33
1-2	1360	1350	27.00	27.00
2-3	1560	1520	27.00	27.00
3-4	1720	1670	34.00	34.00
4-5	1870	1790	34.00	34.00
5-10	2258	2106	41.40	41.00
10-15	2780	2440	57.20	50.40
15+	3000	2200	62.00	48.00
Pregnant		2500		63.00
Lactating		2750		76.00

Source: Combined from FAO/WHO Ad Hoc Expert Committee recommendations, 1973.

Figure 14

NUMBER OF LIVE BIRTHS, PREGNANT WOMEN, AND LACTATING WOMEN BY DEPARTMENT

	No. of Live Births*			No. of Pregnant Women**			No. of Lactating Women***		
Department	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Ahuchapan	1666	6142	9808	1250	4607	4607	833	3071	3904
Santa Ana	5606	9662	15268	4205	7247	11451	2803	4831	7634
Sonsonate	3792	6406	10198	2844	4805	7649	1896	3203	5099
Chalatenango	2015	5485	7500	1511	4114	5625	1008	2743	3750
La Libertad	4946	8161	13107	3710	6121	9830	2473	4081	6554
San Salvador	25147	6070	31217	18860	4557	23413	12574	3035	15609
Cuscatlan	1941	4628	6569	1456	3471	4927	971	2314	3285
La Paz	2688	5609	8297	2016	4207	6223	1344	2805	4149
Cabanas	906	4511	5417	680	3383	4063	453	2256	2709
San Vicente	1732	4681	6413	1299	3511	4810	866	2341	3207
Usulutan	3979	8898	12877	2987	6674	9658	1990	4449	6439
San Miguel	4478	9341	13819	3359	7006	10364	2239	4671	6910
Morazan	1273	5561	6834	955	4171	5126	637	2781	3417
La Union	2266	8042	10308	1700	6032	7731	1133	4021	5154

Sources:

*Anuario Estadistico, 1973, Volumen 11. pp. 14-18

**Calculated as 9/12 of number of live births. No attempt was made to estimate pregnancies resulting in other than live births

***Calculated assuming an average period of lactation of 6 months, i.e. 6/12 of number of live births

Figure 15

DAILY NUTRIENT REQUIREMENTS - EL SALVADOR - BY REGION

REGION	Population		Average Per Capita Requirement		Total Requirements ($x10^6$)	
	Number	(%)	Calories	Protein (gms)	Calories	Protein (gms)
El Salvador (Total)	3549260	100.00	2356	49.27	8362.1	174.87
Urban	1402972	39.53	2383	50.22	3343.3	70.45
Rural	2146288	60.47	2341	48.77	5024.5	104.67
Ahuachapan	179820	5.06	2360	49.31	424.4	8.87
Urban	42814	1.21	2382	49.89	102.0	2.14
Rural	137006	3.86	2353	49.12	322.4	6.73
Santa Ana	332958	9.38	2375	49.72	790.7	16.55
Urban	141642	3.99	2394	50.35	339.0	7.13
Rural	191316	5.39	2359	49.30	451.3	9.43
Sansonate	233604	6.58	2333	48.33	545.0	11.29
Urban	85294	2.40	2387	49.82	203.5	4.24
Rural	148310	4.18	2321	48.04	344.2	7.12
Chalatenango	172075	4.85	2341	48.86	402.8	8.40
Urban	46524	1.31	2367	49.27	110.1	2.29
Rural	125551	3.54	2325	48.44	291.9	6.08
La Libertad	282762	7.97	2357	49.28	666.4	13.93
Urban	96611	2.72	2384	50.15	230.3	4.84
Rural	186151	5.24	2341	48.83	435.8	9.09
San Salvador	731679	20.61	2378	49.90	1739.9	36.51
Urban	560504	15.79	2387	50.22	1337.9	28.15
Rural	171175	4.82	2347	48.84	401.7	8.36
Cuscatlon	152203	4.28	2334	48.63	355.2	7.42
Urban	41283	1.16	2363	49.56	97.5	2.05
Rural	110920	3.12	2324	48.40	257.7	5.37
La Paz	184420	5.20	2341	48.81	431.7	9.00
Urban	53702	1.51	2355	49.38	126.4	2.65
Rural	130718	3.68	2336	48.60	305.3	6.35
Cabanal	129199	3.64	2344	48.55	302.8	6.27
Urban	21432	0.60	2401	50.34	51.4	1.07
Rural	107767	3.04	2333	48.51	251.4	6.22
San Vicente	156224	4.40	2351	48.42	367.3	7.56
Urban	44083	1.24	2378	49.70	104.8	2.19
Rural	112186	3.16	2344	48.74	262.9	5.46
Usulutan	293292	8.26	2347	49.00	688.3	14.37
Urban	81208	2.29	2379	49.93	193.2	4.05
Rural	212084	5.97	2334	48.65	495.0	10.32
San Miguel	523039	9.10	2351	49.11	759.5	15.86
Urban	110795	3.12	2367	49.62	262.2	5.50
Rural	212244	5.98	2343	48.84	497.3	10.36
Morazan	157971	4.45	2340	48.79	369.7	7.71
Urban	29091	0.82	2380	49.77	69.2	1.44
Rural	128880	3.63	2342	48.80	301.8	6.28
La Union	220014	6.20	2347	48.96	516.4	10.77
Urban	48034	1.35	2366	49.53	113.6	2.38
Rural	171980	4.85	2342	48.81	402.8	8.39

Source: Calculations based on age/sex structure from 1971 population census. Requirements based on FAO/WHO recommendation of 1973.

Figure 16

DAILY NUTRIENT REQUIREMENTS FOR EL SALVADOR: PROJECTIONS 1970-2000

	Assumption 1: birth rate remains constant at 3.23%; includes international migration.			Assumption 2: birth rate drops from 3.23% to 2.17%; includes international migration.		
Year	Population	Total Calorie Requirements $x10^6$	Total Protein Requirements $x10^6$	Population	Total Calorie Requirements $x10^6$	Total Protein Requirements $x10^6$
1970	3,582,371	8440	176.5	3,582,371	8440	176.5
1975	4,176,478	9840	205.8	4,142,863	9760	204.1
1980	4,913,604	11576	242.1	4,796,976	11302	236.3
1985	5,842,865	13766	287.9	5,556,415	13081	273.6
1990	7,081,894	16685	348.9	6,484,409	15277	319.5
1995	8,615,503	20298	424.5	7,531,070	17743	371.1
2000	10,519,267	24783	518.3	8,708,169	20516	429.1

Source: Population projections from "La Poblacion de El Salvador por Sexo y Edad en el Periodo 1950-2000" Feb. 1976, pp. 123 & 125.

Figure 17

PROTEIN AND CALORIE CONTRIBUTION BY FOOD IN THE DIET OF EL SALVADOR

Food	% Proteins	% Calories
Milk	9.59	5.95
Eggs	1.73	0.73
Meat	12.07	2.03
Legumes	19.75	9.63
Vegetables	1.41	0.68
Fruits	0.14	0.48
Plantain	0.31	1.02
Tubers	0.31	0.92
Rice	3.21	4.74
Corn	43.6	51.96
Tamal (corn/meat)	0.46	0.63
Bread	4.51	4.26
Other	1.38	1.06
Sugar	-	7.6
Fats	-	6.43
Coffee	1.22	0.77
Other drinks	0.31	1.11

Source: Calculated from consumption data from the rural area (actually heads of municipios). Original data from "Evaluacion Nutricional de la Poblacion de Centro America y Panama - El Salvador" INCAP, 1965.

Figure 18

PERCENT ADEQUACY OF SELECTED NUTRIENTS BY REGIONS

FOR AGES 1-4 COMBINED

Region	No.	Calories	Protein	Retinol
		% Adequacy	% Adequacy	% Adequacy
Mountains	76	62	113	34
Hills	54	65	121	38
Coast	64	54	96	37
All Regions	194	60	110	36

Source: Preliminary Table from CDC-CARS, 1976 La Paz study

Figure 19

PERCENT CONTRIBUTION OF SELECTED FOOD GROUPS TO CALORIE INTAKE BY REGIONS FOR AGES 1-4 COMBINED

Food Groups	Region		
	Mountains	Hills	Coast
Milk products	11	14	13
Eggs	4	3	4
Meat, poultry, fish	3	4	2
Beans	10	11	10
Vegetables	0	0	0
Fruits	1	1	1
Banana, plantain	1	1	0
Cereal products	51	48	48
Sugar	8	10	9
Fats, oil	1	0	1
Miscellaneous	8	6	11

Source: Preliminary Table from CDC-CARS, 1976 La Paz study

Figure 20

PERCENT CONTRIBUTION OF SELECTED FOODS TO PROTEIN INTAKE BY REGIONS FOR AGES 1-4 COMBINED

Food Groups	Region		
	Mountains	Hills	Coast
Milk products	20	25	22
Eggs	8	7	9
Meat, poultry, fish	9	8	7
Beans	18	20	18
Vegetables	0	0	0
Fruits	1	0	0
Banana, plantain	0	0	0
Cereal products	36	33	34
Fats, oil	0	0	0
Miscellaneous	7	6	10

Source: Preliminary Table from CDC-CARS, 1976 La Paz study

Figure 21

DAILY PER CAPITA CALORIE CONSUMPTION BY FOOD TYPE
FOR POPULATION GROUPED BY INCOME

	Level of Income				Total
	Low (50%)	Middle (30%)	High (15%)	Very High (5%)	Population
Cereals	836.5	1292.8	1361.1	1514.3	1086.0
Tubers & Plantain	23.2	33.7	44.4	54.5	31.1
Sugar	229.7	324.1	420.5	512.1	300.8
Legumes	54.7	83.8	113.5	141.8	76.7
Vegetables	9.8	19.4	29.1	38.4	17.0
Fruits	36.4	60.0	93.9	142.0	57.4
Meats	19.0	34.9	65.2	123.7	35.9
Eggs	9.7	20.9	45.9	96.7	22.9
Fish & Seafood	2.6	4.6	8.3	14.4	4.6
Milk & Byproducts	43.1	90.2	195.2	448.8	100.9
Fats & Oils	63.8	118.6	224.9	415.8	122.0
Other Products	16.9	45.0	94.7	192.3	45.7
TOTAL	1345.4	2128.0	2696.7	3694.8	1901.0

Source: "Perspectivas para el Desarrollo y la Integracion de la Agricultura en Centroamerica - Volumen II," SIECA-GAFICA, Guatemala, Mayo de 1974, pp. 91.

Figure 22

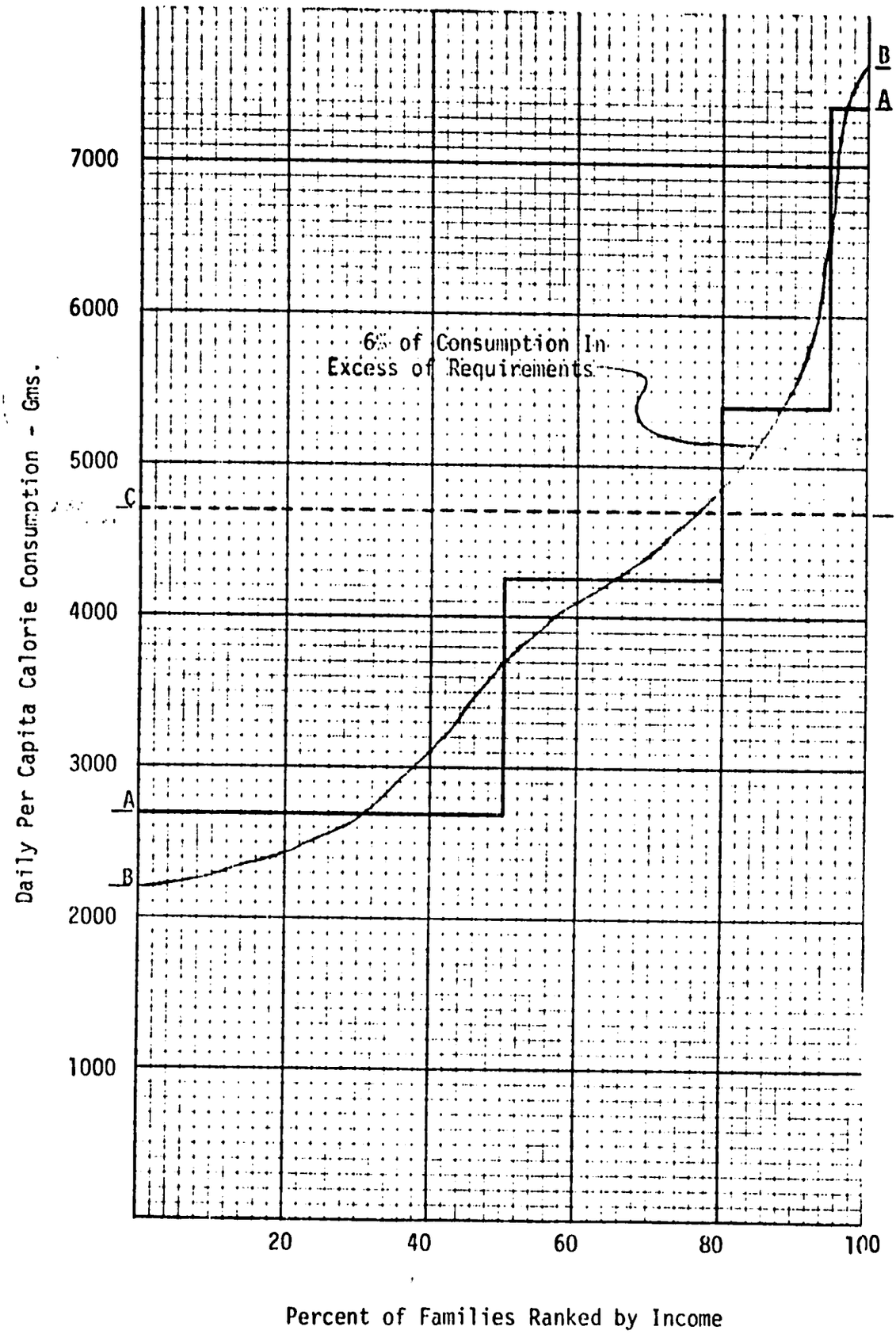
DAILY PER CAPITA PROTEIN CONSUMPTION BY FOOD TYPE
FOR POPULATION GROUPED BY INCOME

	Level of Income				Total Population
	Low (50%)	Middle (30%)	High (15%)	Very High (5%)	
Cereals	18.7	29.0	31.8	37.4	24.5
Tubers & Plantain	0.2	0.4	0.5	0.7	0.3
Sugar	0.1	0.1	0.1	-	0.1
Legumes	3.6	5.6	7.5	9.3	5.1
Vegetables	0.4	0.8	1.2	1.6	0.7
Fruits	0.4	0.7	1.0	1.3	0.6
Meats	2.2	4.4	8.7	17.3	4.6
Eggs	0.7	1.6	3.5	7.4	1.7
Fish & Seafood	0.5	1.0	1.7	3.1	1.0
Milk & Byproducts	2.7	5.1	9.4	20.0	5.3
Fats & Oils	0.1	0.1	0.2	0.3	0.1
Other Products	0.4	1.3	2.2	3.0	1.1
TOTAL	30.0	50.1	67.8	101.4	45.1

Source: "Perspectivas para el Desarrollo y la Integracion de la Agricultura en Centroamerica - Volumen II," SIECA-GAFICA, Guatemala, Mayo de 1974, pp.91.

Figure 23

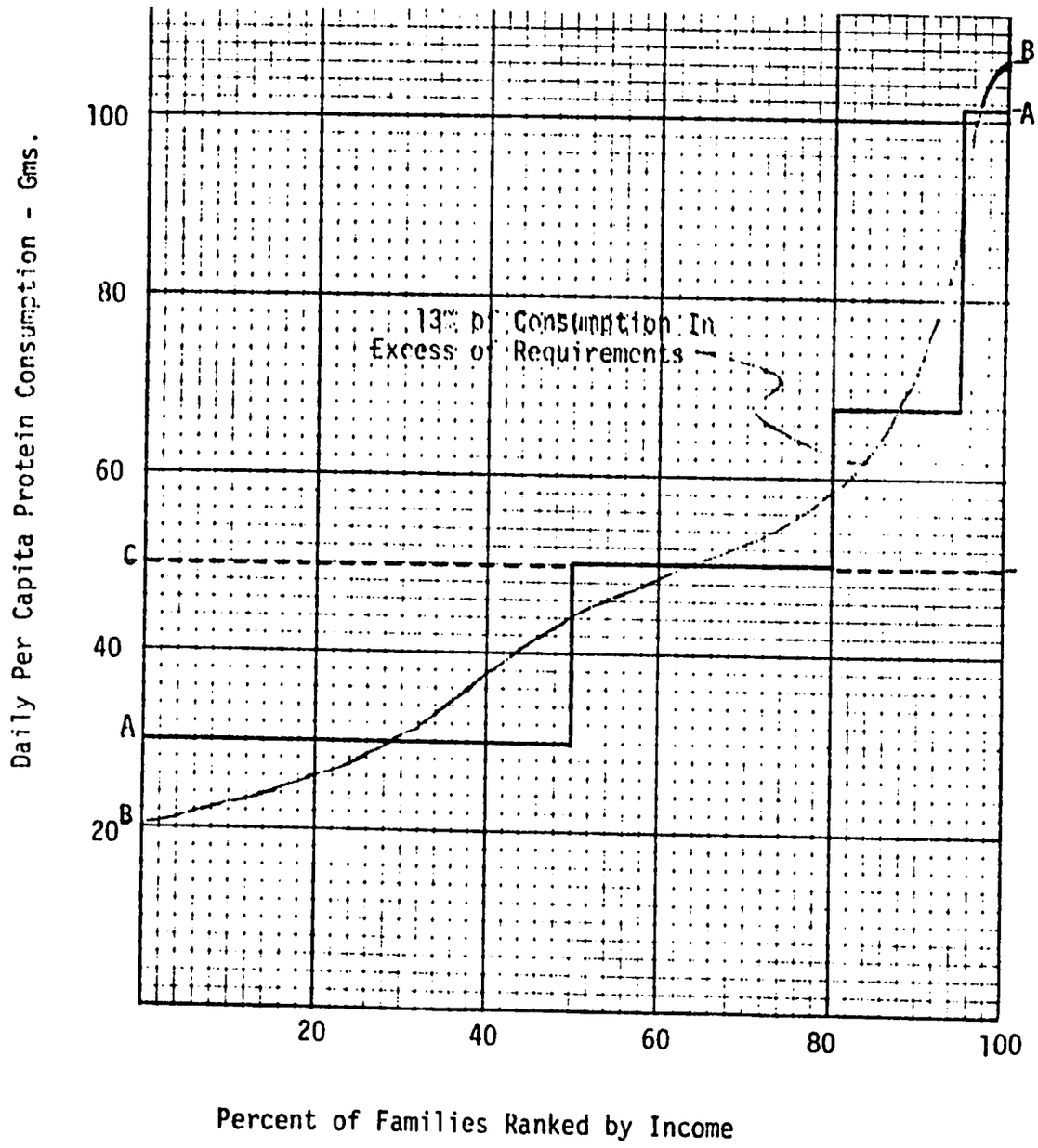
CALORIE CONSUMPTION BY LEVEL OF INCOME



Source: Constructed from data in Figure 21.

Figure 24

PROTEIN CONSUMPTION BY LEVEL OF INCOME



Source: Constructed from data in Figure 22.

Figure 25

NATIONAL PRODUCTION OF PROTEIN AND CALORIES

Product	Production Tons	Protein gms $x10^6$	Calories $x10^6$
Meat*	3621.82	651.92	8185
Milk & by products	300205	9906.77	180123
Eggs	12008	1441	19574
Honey	81723	----	240267
Fish*	5172.55	993	8431
Rice	30478	2377	109448
Corn	421985	36712.6	1413649
Legumes	38650	7884.6	116722
Sugar	143026	----	549219
Tubers	15360	190.0	18054**
Banana & plantain	60600	727.0	78780
		60891.89	2742452**

Source: Data taken from "Tercer Censo Nacional Agropequario-" El Salvador - 1971"

*Data taken from "Boletin Estadistico No. 100," Oct.-Dec. 1973, El Salvador

**Data taken from "Perspectivas para el Desarrollo y la Integracion de la Agricultura en Centroamerica - Volumen II," SIECA-GAFICA, Guatemala, Mayo de 1974

Figure 26

NATIONAL IMPORTATION OF PROTEINS AND CALORIES

Product	Quantity Imported Tons	Protein Imported gms x10^6	Calories Imported x10^6
Cows	502.820	94.027	1166
Pigs	115.007	14.950	310
Chickens	334.269	60.168	802
Meat	719.337	129.480	1582.5
Infant formula	1067.405	106.740	4269.6
Soups	19.189	0.191	8.25
Milk	49.481	1.632	29.6
Cream	129.327	3.103	351
Butter & cheese mix	233.130	23.313	163
Condensed milk	484.796	79.991	1624
Powdered milk	2979.713	774.725	11531
Butter	74.625	0.970	552
Cheese	507.927	126.981	1965
Eggs	139.856	16.782	227.9
Honey	217.581		639.6
Fish	1119.803	215.002	1825.2
Wheat	72198.523	7219.85	288794
Rice	4.771	0.372	17.1
Barley	1.388	0.138	4.3
Corn	62849.037	5467.86	210544.2
Other cereals	67.463	5.869	226.0
Oats	17.339	1.907	60.3
Flour	1637.4170	158.829	2996
Malt	3192.971		
Pasta	207.513	22.203	726
Bread	845.763	76.118	2850
Fruit	37691.96	376.916	39576.5
Nuts & coconut	22.417	0.784	66
Fats & oils	2189.647	13.137	18414
Potatoes	6234.462	118.454	5673.3
Beans	3780.157	771.152	11416
Garbanzo	17.715	3.418	60
Other legumes	19306.814	444.056	6371
Casava	8.884	0.071	12.9
Sugar	3431.600		13177
Processed coffee	22.094	3.314	77.3
Powdered chocolate	99.800	8.283	299.4
		16340.786	628407.95

Source: Data calculated from "Anuario Estadistico - 1973 Vol. I," El Salvador

Figure 27

NATIONAL EXPORTATION OF PROTEINS AND CALORIES

Product	Quantity Exported Tons	Protein Exported gms x10^6	Calories Exported x10^6
Cows	2.692	0.503	6.2
Pigs	5.720	0.743	15.4
Chickens	75.075	13.503	184
Meat	3252.978	585.536	7156
Infant formula	7.034	0.703	28
Milk	0.064	0.002	0.038
Butter	17.912	0.232	132
Cheese	61.731	15.432	238
Eggs	686.82	82.412	1119.5
Honey	36915.88	------	108532.7
Fish	4062.88	780.073	6622.4
Wheat	5.608	0.560	22.4
Rice	2302.71	179.611	8266
Corn	630.31	54.83	2111.54
Other Cereals	12.160	1.05	40.73
Flour	79.816	7.74	146
Pasta	217.938	23.319	762
Bread	1048.79	94.391	3534
Fruit	9050.291	90.502	9502
Nuts & Coconut	292.712	10.244	863
Fats & oils	1388.657	8.331	11678
Potatoes	481.94	9.156	438
Legumes	996.694	22.933	328
Casava	4.318	0.034	6.3
Sugar	99371.144	------	381585
Processed coffee	1190.4	148.8	2678.4
Chocolate candy	76.624	2.413	350
		2133.933	546345.680

Source: Data taken from "Anuario Estadistico 1973, Vol. I," El Salvador

Figure 28

NUTRIENT PRODUCTION BY DEPARTMENT: CORN

Department	PRODUCTION*			Percent of Requirements**	
	Tons/year	Calories/year $x10^6$	Proteins/year gms $x10^6$	Calories	Proteins
Ahuachapan	28129	94232	2447	61	75
Santa Ana	43813	146773.5	3811.7	51	63
Sonsonate	29093	97461.5	2531	49	61
Chalatenango	39953	133842.5	3475.9	91	113
La Libertad	49511	165861	4307.4	68	84
San Salvador	18090	60601	1573.8	10	11
Cuscatlan	25575	85676	2225	66	82
La Paz	26303	88115	2288	55	69
Cabanas	16384	54886	1425.4	49	62
San Vicente	25466	85311	2215.5	63	80
Usulutan	25272	84661	2198.6	33	42
San Miguel	44937	150538.9	3909.5	54	67
Morazan	16627	55700.4	1446.5	41	51
La Union	32832	109987	2856.3	58	72
Whole Country	421985	1413646	36712	46	58

Source: *Data from "Tercer Censo Nacional Agropecuario - El Salvador-1971"

**Data calculated from Figure 15; see discussion on page 23 for details.

Figure 29

NUTRIENT PRODUCTION BY DEPARTMENT: BEANS

Department	Tons/year	PRODUCTION* Calories/year x10^6	Proteins/year gms x10^6	Percent of Requirements** Calories	Proteins
Ahuachapan	4062	12267	828.648	7.9	25
Santa Ana	8528	25754	1739.71	8.9	28
Sonsonate	1585	4786.7	323.340	2.4	7.8
Chalatenango	2945	8893.9	600.780	6	19
La Libertad	6947	2097.9	1417.188	8.6	27
San Salvador	921	2781.4	187.884	0.43	1.4
Cuscatlan	2442	7374.8	498.168	5.6	18.4
La Paz	1310	3956.2	267.240	2.5	8.1
Cabanas	3581	10814.6	730.524	8.0	31
San Vincente	1656	5001	337.8240	3.7	12.2
Usulutan	1055	3186	215.2200	1.2	4.1
San Miguel	1501	4533	306.204	1.6	5.2
Morazan	1277	3856.5	260.508	2.8	9.2
La Union	840	2536.8	171.360	1.3	4.3
Whole Country	38650	116.721	7884.5	4	12

Source: *Data from "Tercer Censo Nacional Agropecuario - El Salvador-1971"

**Data calculated from Figure 15; see discussion on page 23 for details.

Figure 30

NUTRIENT PRODUCTION BY DEPARTMENT: RICE

Department	Tons/year	PRODUCTION* Calories/year x10^6	Proteins/year gms x10^6	Percent of Requirements** Calories	Proteins
Ahuachapan	2832	10166	220.896	6.5	6.8
Santa Ana	2454	8809	191.412	3.0	3.1
Sonsonate	630	2261.7	49.140	1.1	1.19
Chalatenango	2374	8522.6	185.172	5.7	6.0
La Libertad	2398	8608.8	187.044	3.5	3.6
San Salvador	685	2459	53.430	0.38	0.4
Cuscatlan	1674	6009	130.572	4.6	4.8
La Paz	5063	18176	394.914	11.5	12.0
Cabanas	1125	4038	87.750	3.6	3.8
San Vicente	4734	16995	369.252	12.6	13.3
Usulutan	2729	9797	313.862	3.8	4.05
San Miguel	2276	8170.8	177.528	2.9	3.0
Morazan	276	990.8	21.528	0.7	0.7
La Union	1225	4397.7	95.550	2.5	2.4
Whole Country	30478	109401	2.367	4	4

Source: *Data from "Tercer Censo National Agropecuario - El Salvador-1971"

**Data calculated from Figure 15; see discussion on page 23 for details.

Figure 31

NUTRIENT PRODUCTION BY DEPARTMENT: MILK AND BY PRODUCTS

Department	Tons/year	PRODUCTION* Calories/year $x10^6$	Proteins/year gms $x10^6$	Percent of Requirements** Calories	Proteins
Ahuachapan	23979	14.38	0.815	3.38	9.1
Santa Ana	96539	57.93	3.282	7.32	19.8
Sonsonate	78835	47.3	2.680	8.6	23
Chalatenango	86936	52.16	2.955	12.9	35
La Libertad	45131	27	1.534	4	11.0
San Salvador	18012	10.8	0.612	0.6	1.6
Cuscatlan	23187	13.91	0.788	3.9	10.6
La Paz	46628	37.97	1.585	6.4	17.6
Cabanas	39473	23.68	1.342	7.8	21.39
San Vicente	46837	28.1	1.592	7.6	21.0
Usulutan	54842	35.08	1.988	5.0	13.0
San Miguel	96726	58	3.288	7.6	20.7
Morazan	58498	35.09	1.988	9.4	25
La Union	102217	61.33	3.475	11.87	32
Whole Country	821480	492.7	27.92	6	16

Source: *Data from "Tercer Censo Nacional Agropecuario - El Salvador-1971"

**Data calculated from Figure 15; see discussion on page 23 for details.

Figure 32

NUTRIENT PRODUCTION BY DEPARTMENT: EGGS

Department	Tons/year	PRODUCTION* Calories/year $x10^6$	PRODUCTION* Proteins/year gms $x10^6$	Percent of Requirements** Calories	Percent of Requirements** Proteins
Ahuachapan	28554	1.9	0.551	0.44	1.7
Santa Ana	48405	3.38	0.256	0.42	1.54
Sonsonate	35865	2.5	0.190	0.006	1.68
Chalatenango	50279	3.51	0.266	0.87	3.1
La Libertad	64532	4.51	0.342	0.67	2.4
San Salvador	36190	2.53	0.191	0.14	0.52
Cuscatlan	25897	1.81	0.137	0.50	1.84
La Paz	50572	3.54	0.268	0.8	2.9
Cabanas	49675	3.47	0.263	1.14	4.1
San Vicente	32304	2.26	0.171	0.61	2.2
Usulutan	46368	3.24	0.245	0.47	1.7
San Miquel	81915	5.73	0.434	0.75	2.73
Morazan	46338	3.24	0.245	0.87	3.17
La Union	62131	4.27	0.323	0.82	2.9
Whole Country	658025	45.89	3.48	0.54	1.99

Source: *Data from "Tercer Censo Nacional Agropecuario - El Salvador-1971"

**Data calculated from Figure 15; see discussion on page 23 for details.

Figure 33

NUTRIENT PRODUCTION BY DEPARTMENT: SUGAR

PRODUCTION

Department	Tons Cane/year	Tons Sugar/year	Calories/year $x10^6$	Proteins/year gms $x10^6$	% of Requirement Calories
Ahuachapan	35802	3365.3	12992.7	--	8.3
Santa Ana	67816	6374.7	24476.1	--	8.4
Sonsonate	240401	22597.6	86774.7	--	43
Chalatenango	59569	5594.4	21501.6	--	14.6
La Libertad	219808	20661.9	79341.6	--	32.6
El Salvador	351414	33032.9	126846.3	--	19
Cuscatlan	213274	20047	76980.4	--	
La Paz	44215	4156	15959	--	10
Cabanas	35565	3343	12837	--	11.6
San Vicente	118470	11136	42762	--	31
Usultan	9651	907.1	3482	--	1.3
San Miguel	60833	5718.3	21958.2	--	7.9
Morazan	51806	4869.7	18699.6	--	13
La Union	12954	1217.6	4675.5	--	2.4
Whole Country	1521578	143026	549286	--	18

Source: "Atlas Economico de El Salvador," Anuario de Estadisticas Agropecuarias de El Salvador, 1970, 1971 - Ministerio de Agricultura y Ganaderia.

Figure 34

NUTRIENT PRODUCTION BY DEPARTMENT: HONEY

Department	Liters/day	Calories/day $x10^6$	% of Requirements Calories
Ahuachapan	24324	74	17.4
Santa Ana	36807	112	14.16
Sonsonate	26865	82.2	15.0
Chalatenango	21702	66.46	16.49
La Libertad	32792	100.4	15
San Salvador	9952	30.47	1.75
Cuscatlan	5701	17.45	4.9
La Paz	5073	15.53	3.59
Cabanas	12185	37.3.	12.31
San Vicente	5513	16.88	4.59
Usulutan	10295	31.52	4.57
San Miguel	16514	50.57	6.65
Morazan	7557	23.14	6.2
La Union	8613	26.37	5.1
Whole Country	233893	684	8

Source: Data from "Tercer Censo Nacional Agropecuario - El Salvador-1971"

Figure 35

PERCENT OF CALORIE REQUIREMENT AVAILABLE AT DIFFERENT POINTS IN NUTRIENT FLOW

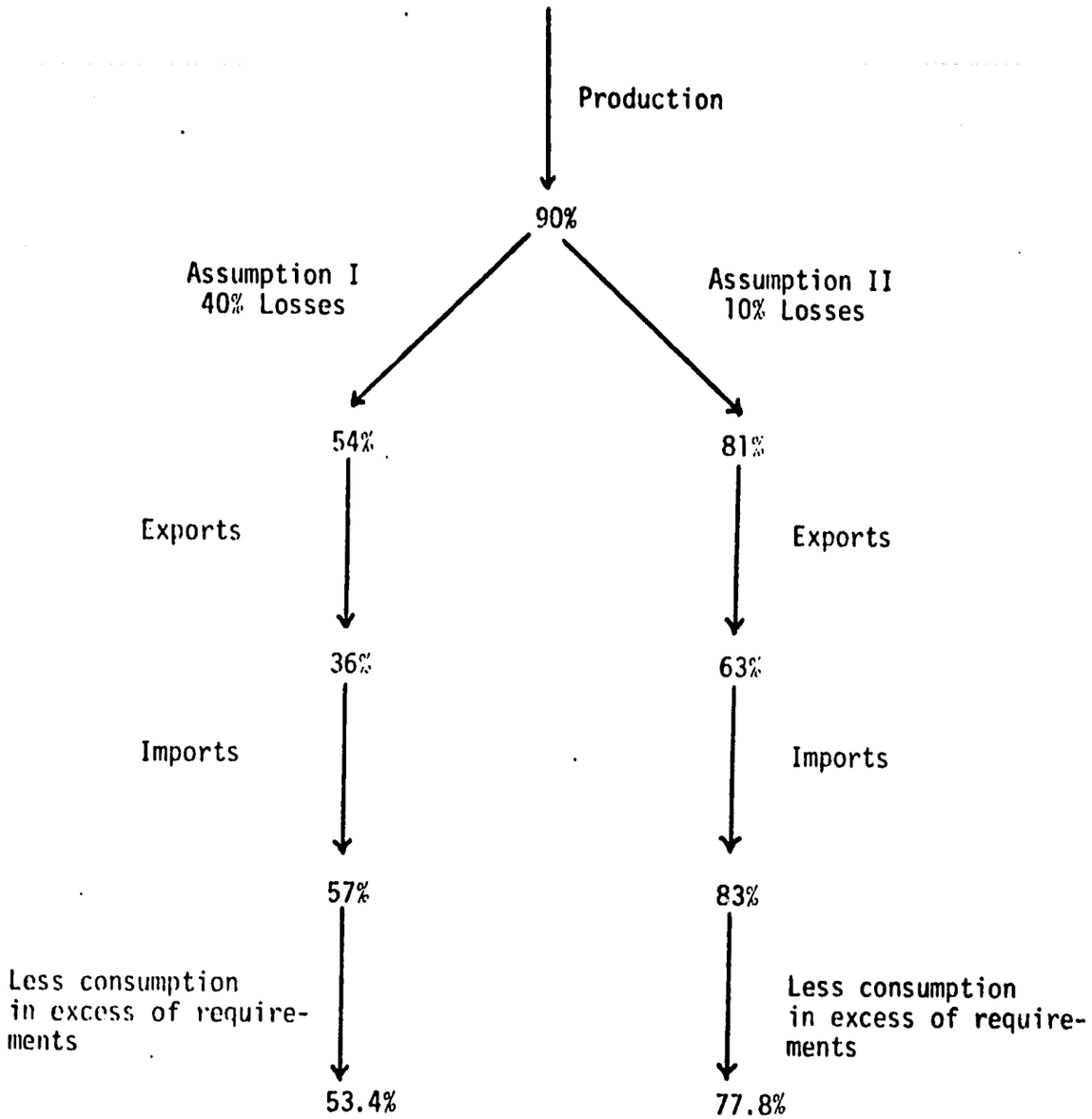


Figure 36

PERCENT OF PROTEIN REQUIREMENT AVAILABLE AT DIFFERENT POINTS IN NUTRIENT FLOW

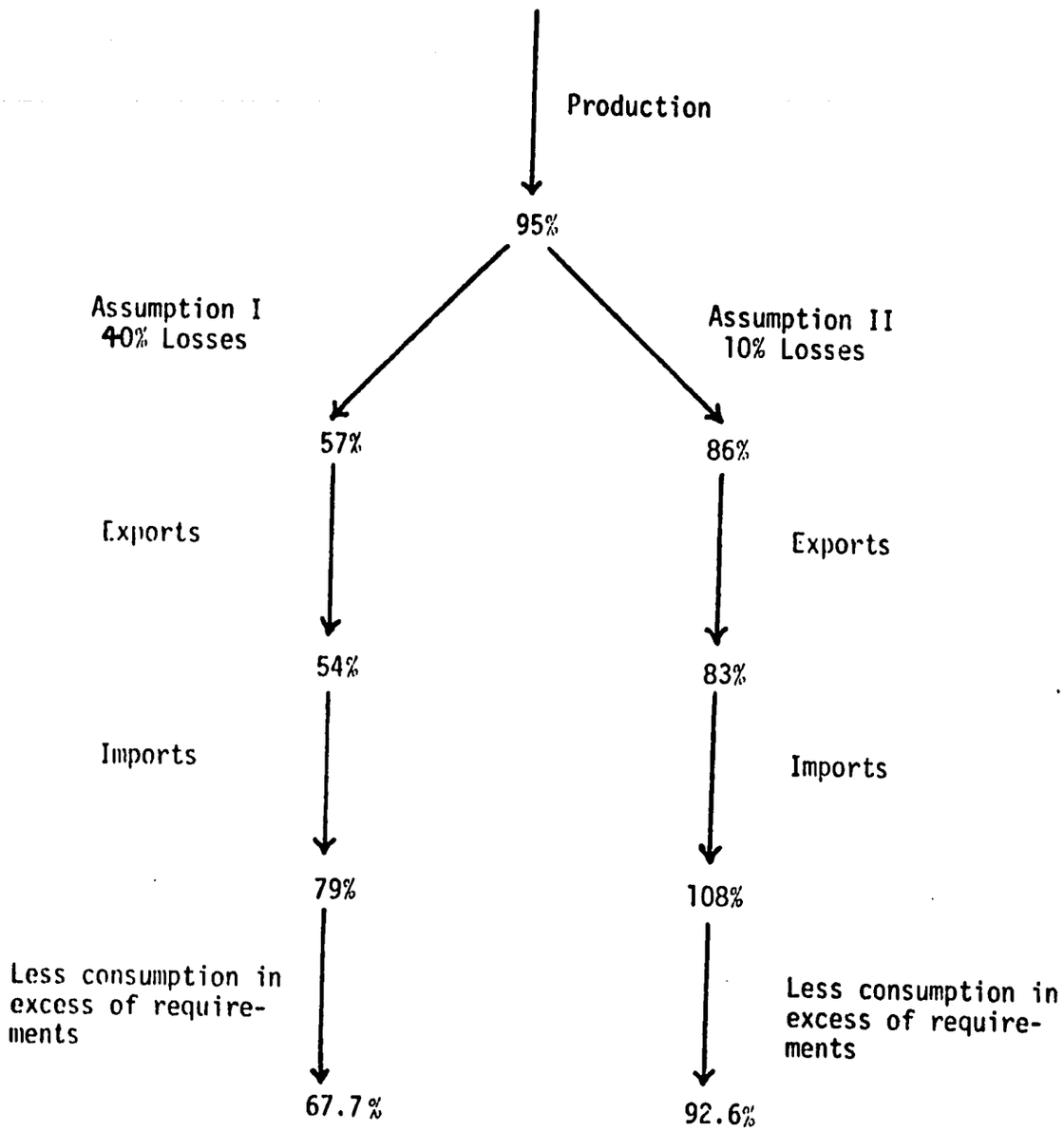


Figure 37

MALNUTRITION, DIARRHEA AND CONSUMPTION DATA

La Paz Department

	Mountains Region	Hill Region	Coast Region
Weight/Age 75% of Standard	14.0%	13.6%	14.5%
Weight/Height 90% of Standard	6.6%	7.7%	12.1%
Height/Age 85% of Standard	9.9%	10.7%	13.4%
Diarrhea (less than 1 year)	31.0%	33.0%	39.0%
Diarrhea (1-4 years)	17.2%	18.0%	22.0%
Protein Adequacy (1-4 years)	113.0%	121.0%	96.0%
Calorie Adequacy (1-4 years)	62.0%	65.0%	54.0%

Source: Data compiled from CDC-CARS study

Figure 38

RANKING, BY DEPARTMENT, OF FACTORS RELATED TO NUTRITION

Department	Per Capita Production		Malnourishment			Clinic Diagnosis of Diarrhea		Water Supply	Waste Disposal
	Calories	Protein	Wt/Age 75% Std.	Wt/Ht 90% Std.	Ht/Age 90% Std.	1 year	1-4 years		
Ahuachapan	10	10	4	7	1	9	5	3	3
Santa Ana	8	9	10	12	7	13	12	3	3
Sonsonate	11	5	11	11	8	14	4	3	3
Chalatenango	14	14	1	1	10	11	14	4	4
La Libertad	13	13	8	8	5	4	3	4	4
San Salvador	1	1	14	9	14	12	11	5	5
Cuscatlan	6	11	4	4	3	3	5	4	4
La Paz	7	6	12	13	12	7	13	1	1
Cabanas	8	3	1	1	10	8	8	1	1
San Vicente	12	12	4	5	4	9	7	1	1
Usulutan	2	2	12	14	9	5	10	2	2
San Miguel	4	5	9	9	6	6	9	2	2
Morazan	3	4	7	5	13	1	1	2	2
La Union	5	7	3	3	2	1	2	2	2

Note: A high rank with respect to a given factor represents a relatively "good" situation and a lower rank represents a relatively "poor" situation

APPENDIX B

Example Program Evaluation - CRS-Caritas

What follows here is a brief and partial analysis of the CRS-Caritas proposed program for 1978 with respect to Title II - food distribution. The analysis is based entirely on information in the "Program Plan". The purpose of this analysis is not to arrive at a definitive diagnosis of the value of the program, but rather to question certain assumptions which could lead to a better evaluation of the effect of the program.

In the Program Plan there are several important assumptions made which are not clearly identified as assumptions. These can be divided into three categories: transportation and storage, interfamily distribution, and intrafamily distribution. The first assumption is that all of the food which is shipped will reach the final recipients. That is, there will be no losses during transportation and storage. The Program Plan goes into considerable detail in controls in this area and hence the assumption seems reasonable.

The assumptions which pertain to interfamily distribution are those which are concerned with which families receive the food supplements. In justifying the need of the target population, the nutritional status of El Salvador is discussed. On page 6 of the Program Plan, an estimate of the 2nd and 3rd degree malnourished (weight for age) ranges from 250,000 to 500,000. (The variation is probably the result of careless extension to the total population, of results from limited and/or biased samples.) Since the number of recipients is 120,000, one might conclude that they are to be drawn from families with 2nd or 3rd degree malnourished children. However, on page 6 the recipients are described as "pre-school children suffering from various degrees of malnutrition". This could be interpreted to include 1st degree malnourished children. Also included are "all infants under one year of age, pregnant women and lactating mothers."

A more concise description is needed on which families will actually receive food supplements and how that food supplement will affect malnutrition. What

is the difference in effect (either in time for recuperation or end status achieved) between food supplementation for a family with a 1st degree malnourished child and one with a 2nd degree malnourished child?

On page 9 the Program Plan states that "the rations composition will be such that it provides a supplement which meets the caloric and proteic deficiency in the recipients diet". However, the plan does not discuss consumption deficits for El Salvador, nor does it propose to select recipients based on their consumption deficits equal to the supplement. While this assumption may be valid in some cases it is clearly not supported in the proposal.

The cost/effectiveness of the program is briefly alluded to on page 9. Such an estimate can not be taken seriously without a more concise description of the portion of the population to be affected and the process by which the supplement will improve nutritional status.

The assumptions related to intrafamily distribution are those concerned with which members within a recipient family actually realize the increase in consumption. The supplements are designed for and directed toward malnourished preschoolers and pregnant and lactating women; however, it is likely that any increase in consumption will be distributed among all members.

In most cases the food is taken home for consumption. The most reasonable assumption would be that the food is added to the family larder and is distributed in the same proportions as the rest of the food. In some cases the food supplements are consumed by the recipients at the point of distribution. Even in these cases it is not unlikely that the recipients undergo a reduction in consumption in the home as a result of the supplement received at the distribution center. In this way other family members effectively receive part of the supplement since their portion of home consumption may increase as the recipient member's home consumption portion is reduced.

The Program Plan assumes that all of the food supplement goes to increasing the recipients consumption. On page 4, calculations show that this results in the

preschooler increasing his caloric intake by 32.1% of his requirements. Likewise the pregnant or lactating woman is projected to increase her caloric intake by 18.7% of her requirements. It is of value to note how these figures change under different assumptions.

For the purpose of contrast, it is here assumed that the food supplement is actually distributed to all members of the family in proportion to their requirements. This is not the extreme case for it is conceivable that the food distribution within the family is biased heavily toward the economically more important members such as working adult men.

A sample family is selected to contain a father, a lactating mother, an adult male (in addition to the father), two school age children, and two preschool children (one of which is malnourished). This family would be eligible for two rations (one for the lactating mother and one for the malnourished preschooler) which would amount to a daily supplement of 1028 calories. The following table shows the amount received by each individual under the assumption of distribution in proportion to requirements.

Family Member	Recommended Daily Caloric Intake	Calories Provided By Supplement	Increase as % of Requirement
Father	3000	189.0	6.3
Lactating mother	2750	173.3	6.3
Adult male	3000	189.0	6.3
School age male	2258	142.3	6.3
School age female	2106	132.7	6.3
Preschooler (well)	1600	100.8	6.3
Preschooler (malnourished)	1600	100.8	6.3
Whole family	16314	1027.9	6.3

It is seen above that under assumptions different than those used in the Program Plan, the impact on the target recipients changes considerably. The increased caloric intake of each member of the family was 6.3% in contrast to the 18.7% for the lactating mother and 32.1% for the malnourished preschooler which is predicted by the Program Plan. If the assumptions in the hypothetical example were

used instead of the assumption that only recipient members increased their consumption, how would this change the program design? How would it effect the cost/effectiveness prediction on page 9?

The assumptions related to consumption are those which pertain to the total increase in consumption regardless of which families or family members are the recipients. It is assumed that consumption will increase by the amount of the supplement. This is not necessarily true due to what the economist calls substitution effects. For example, due to the wheat-soy blend in the donated supplement, a family may reduce its purchase of wheat flour. Likewise a family may reduce its purchase of rice as a result of the bulger in the donated supplement. Similarly a family which received donated oil will likely reduce its purchase of oil, vegetable shortening or animal fat.

To the extent that substitution is possible the food supplement effectively becomes an income supplement. If the donated items are completely substitutable in the quantities donated, then the effect of the program is approximately the same as an income supplement for the value of food items substituted. The fact that a food supplement is completely substitutable does not mean that there will be no increase in food consumption. The increase in food consumption would depend on the marginal propensity to spend as income supplement for the value of food items substituted. The fact that a food supplement is completely substitutable does not mean that there will be no increase in food consumption. The increase in food consumption would depend on the marginal propensity to spend income on food for the family in question.

It is not uncommon for poor families to spend as much as 85% of their income on food. However, the marginal propensity to spend additional income on food is probably somewhat less for these families since, as income rises the percent spent on food generally declines. In our opinion, if a value of 50% were assumed and if complete substitution were possible, then only half of the value of the food supplement would go toward increasing food consumption. The other half would go toward increasing non-food consumption.

The above assumptions on substitution and marginal propensity for food expenditure are subject to considerable error. In fact, very little is known about the economic behavior of poor families in developing countries although this type of information is extremely important for variety of potential nutrition programs.

The purpose of this sample analysis of a proposed nutrition program has not been to criticize the program nor imply that it may not be worth undertaking. Rather the purpose has been to demonstrate a procedure for evaluating proposed programs. The questions which have been raised may hopefully lead to improvements in the program. Food donations represent a large portion of the nutrition programs worldwide. In spite of the large investments in this type of program very little is known about its effect.

In the section on Benchmarks, the Program Plan describes indicators to be measured to determine the impact of the program. The concept of evaluation through monitoring certain indicators is important. However, before such an evaluation can be truly effective, it will be necessary to develop a much more complete and comprehensive theory of the processes which are operating when food supplements are distributed.

APPENDIX C

Nutrient Flow Theory

This theory was developed and is being tested by Community Systems Foundation as a nutrition planning methodology. Briefly, this methodology includes the following:

A Theory. This theory -- the Nutrient Flow Theory -- is a statement concerning the relationships among a set of factors thought to effect the prevalence of malnutrition in a community. Among the factors considered are agricultural production (land area, choice of crops, production, technology, etc.), the market (imports and exports of food), food losses before and after harvesting (rats, mice, birds, spoilage, etc.), distribution within a family (eating habits), environmental sanitation and health services.

A Diagnostic Procedure. With the Nutrient Flow Theory as a point of reference, a sequential procedure has been developed for diagnosing the cause(s) of malnutrition within a community. This procedure prescribes not only what and how information is to be collected, but also when it is to be collected, how it is to be analyzed and what conclusions may be drawn relative to the Nutrient Flow Theory and possible programs. The output of this procedure is a series of performance specifications for the implementation of these programs.

Design of Programs. Based upon the performance specifications, this stage analyzes specific program alternatives for their:

- potential for meeting the performance specifications;
- cost in meeting the performance specification; and,
- time required to meet the performance specifications.

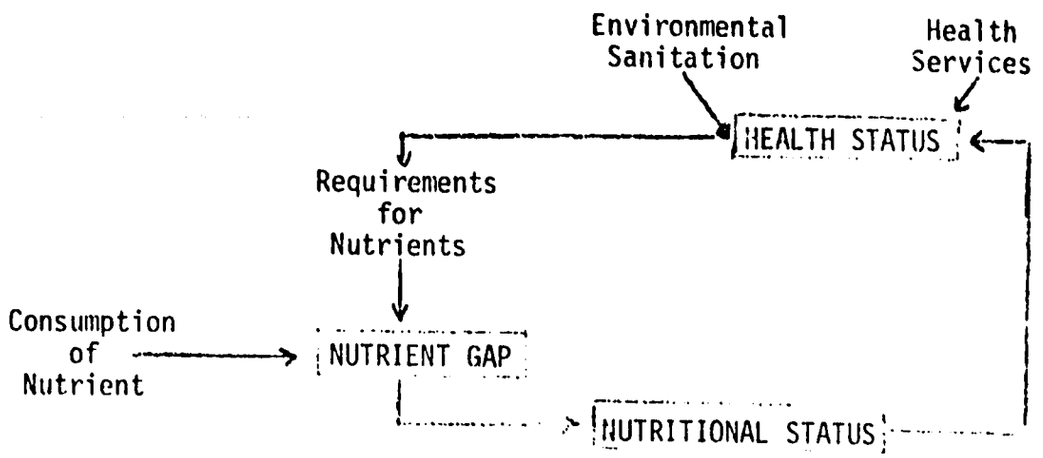
In this manner, an implementation procedure is designed for the proposed program(s).

Implementation of Program. A constant monitoring procedure is developed and conducted at the time of implementation to insure that the program specifications are being fulfilled.

Evaluation of Program(s). Once implemented, a procedure is developed for comparing the nutritional effects predicted in the design phase with the observed outcome of the program. The evaluation includes effectiveness, cost of the program, and/or cost of a set of programs (or projects within the larger context of a national program).

The Theory is presented as a conceptual model. The model can be described in

sections, the first of which consists of three variables: Nutritional Status, Health Status, and Nutrition Gap. These three variables are related as shown in Figure 1:



This section of the theory simply states that Nutritional Status is a function of the Nutrient Gap (the difference between requirements for nutrients and consumption of nutrients), and Health Status. In theory, a reduction in the Nutrient Gap will improve Nutritional Status, an improvement in Nutritional Status will improve Health Status, and improved Health Status will reduce overall nutrient requirements. The reduction in nutrient requirements for one cycle leads to a further reduction in the Nutrient Gap, etc. for another cycle.

Several statements can be made about this section of the model:

1. The cycle is reversible. For example, an increase in the Nutrient Gap can adversely affect Nutritional Status and Health Status, which in turn can lead to an even greater increase in the Gap by an increase in requirements.

2. There exist bounds for each of the variables. For example, the model does not account for large over-consumption of nutrients which can lead to no further improvement in Nutritional Status but a worsening in Health Status.

3. The Theory states that the three variables are interdependent. Thus, the effect of a change in Health Status on Nutrition Status can not be determined without knowledge of the value of the Nutrient Gap, nor can the effect of a change in consumption of nutrients on Nutritional Status be determined without knowledge of the value of Health Status.

4. Very little is known about the dynamic behavior of the model, and this knowledge has important implications for planning nutrition programs. For example, for a community which has implemented a measles vaccination program and thereby reduced the incidence of measles by 75%, what new value is expected for the Nutritional Status of the population, and what is the time period expected for the Nutritional Status of the population to reach that new value?

   Although analysis of an environmental sanitation program and the control of diarrhea by health promoters in Candalaria, Colombia* has produced some insight into the dynamic behavior of the model, much more experimentation is needed.

5. Programs can be classified into those primarily designed to increase nutrient consumption and those designed to reduce nutrient requirements. Agricultural production, food storage and preservation, food distribution, food stamps and some nutrition education programs are aimed directly at increasing the consumption of nutrients. However, the effect of increasing consumption can lead to a decrease in nutritional requirements through the interdependence of the variables and cyclical nature of the model.

   Environmental sanitation projects such as potable water, sewage disposal, education to modify sanitary behavior, and health programs (vaccination and disease control) are designed to effect a reduction in requirements for nutrients, and only very indirectly (following discussion) can such interventions effect consumption.

6. Programs which improve Health Status reduce requirements for nutrients within the community in the short run; however, if the program lowers the mortality rate, then the population of the community can increase, and this again increases the community requirements for nutrients.

Many experiments need to be conducted in the field and in the laboratory to test hypotheses about the dynamic relationships among the variables in the Nutrient Flow Theory.

The second section of the model could be labeled the "consumption section" (see Figure 2). It is similar to the national food-balance sheets which have been used for several years by FAO of the United Nations.

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*Reference: The Promotora Program in Candelaria: A Colombian Attempt to Control Malnutrition and Disease, 1968-74, William D. Drake and Luis F. Fajardo, Community Systems Foundation, Cali, Colombia, June, 1976.

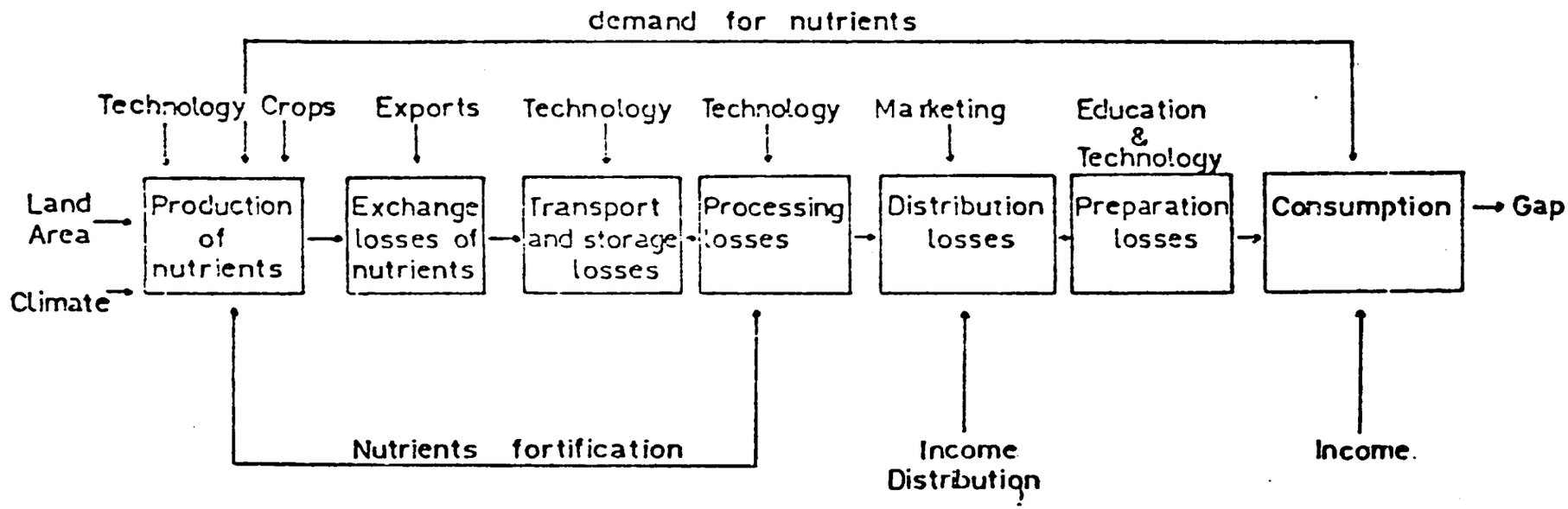

demand for nutrients
Technology
Crops
Exports
Technology
Technology
Marketing
Education & Technology
Land Area
Climate
Production of nutrients
Exchange losses of nutrients
Transport and storage losses
Processing losses
Distribution losses
Preparation losses
Consumption
Gap
Nutrients fortification
Income Distribution
Income.

Fig. 2

$$N_c = N_p - N_e + N_i - N_l$$

nutrients available for consumption	=	nutrients produced	-	nutrients exported	+	nutrients imported	-	nutrient losses

The nutrients available for consumption by a population depend upon the nutrients produced (all sources of production), plus the nutrients imported, minus the nutrients exported, minus the losses. The losses of nutrients are in various forms: harvesting losses, losses in storage and transport (from rodents, insects, birds, spoilage, etc.), losses in the market, losses due to unequal distribution among families of the community, food preparation losses (both home and commercial), and losses due to unequal distribution among members in a family.

In effect, the output of this section becomes the input for the first section of the model (Figure 1): the nutrients consumed are subtracted from the nutrient requirements to calculate the gaps for communities, families or individuals.

There is also a feedback loop from Health Status to the "consumption section" of the model. That is, if Health Status is improved, productivity should increase. Increased productivity can increase income which could effect consumption. For subsistence farmers, increased productivity could directly increase nutrient production and, in turn, increase nutrients available to be consumed or increase income to purchase more nutrients, or both.

The diagnosis and analysis of the causes of malnourishment in a community requires less effort when based upon a theory. In practice, less data needs to be collected and analyzed to determine the priorities for nutrition intervention(s) if the diagnosis of a community proceeds in a sequential manner (as a physician would do when examining a patient). An example of the sequential nature of the diagnosis of Colombian communities is as follows:

1. Measure Nutritional Status. If there is no malnourishment, then no nutrition programs are necessary and no other variables need to be measured or analyzed. In the field work in Colombia, we have established an arbitrary cut-off point of 50% malnourishment among children age 0-6. If there is less than 50% malnourishment another community is selected. Since the national average is 60%, this seems to be a reasonable procedure.

   If a malnourishment rate of 50% or more is observed, then the Nutrient Gap at the family level is analyzed.

2. Analyze Family Gaps. If families are consuming more nutrients than are normally required (considering age structure of the family, pregnant and lactating women, physical activities, etc.) and still these families have malnourished members, then the actual nutrient requirements must be substantially higher than normal, or the distribution of nutrients among family members is not in proportion to the requirements of the family members, or both. Measurements would then be made of:

   - consumption of individual members of families;
   - diarrhea rates (to test the need for environmental sanitation programs); and
   - mortality levels (to test the need for health service programs.

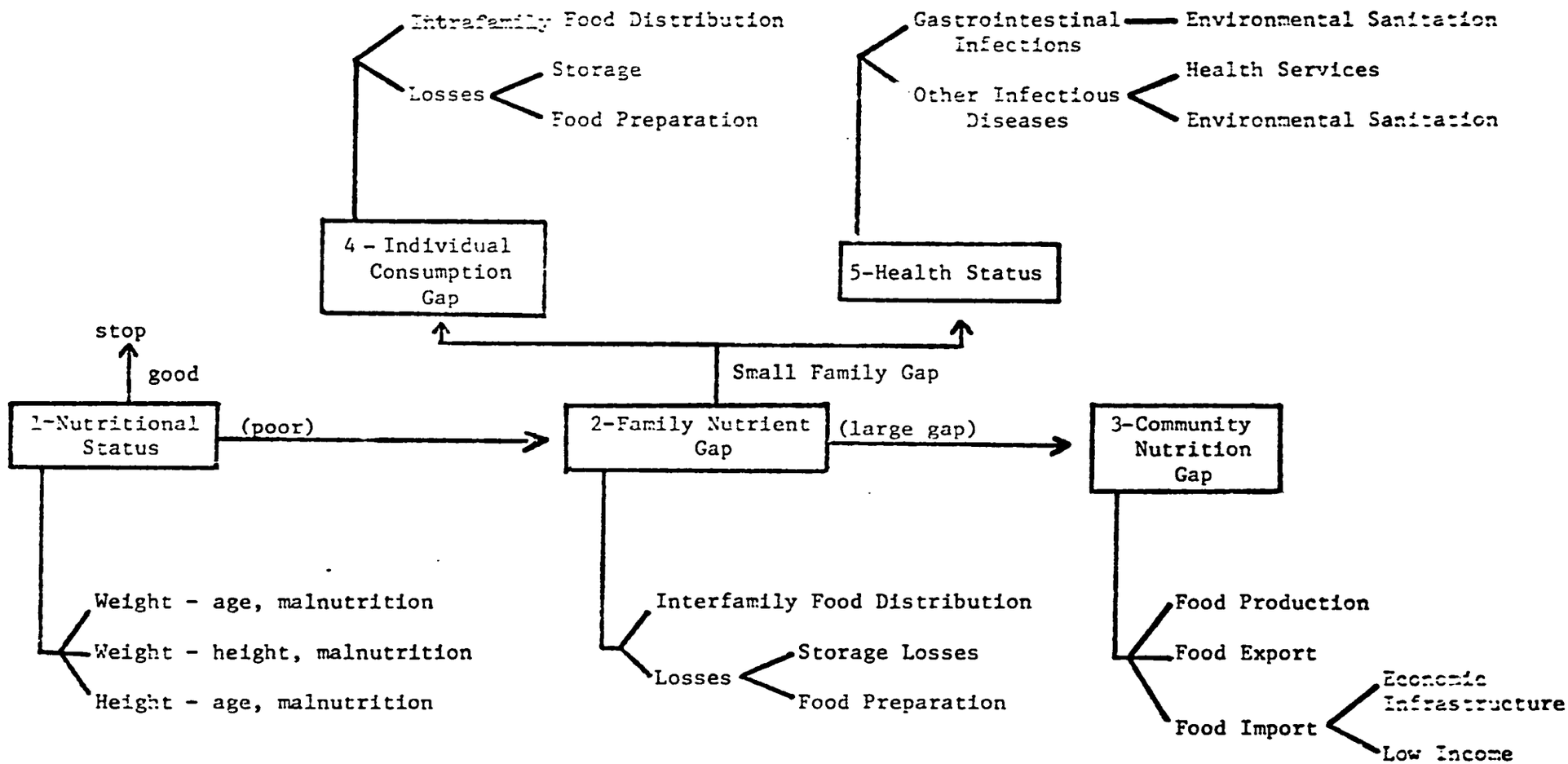
   If any combination of the above measures can explain the malnourishment observed in the community, no other measures need be made.

3. Analyze Community Gap. If, on the average, the families of a community have a nutritional deficit, then redistribution of the available nutrients can not solve their problem (although it may lessen the problem in severe cases). There simply aren't enough nutrients to go around. In this case, nutrient production, nutrient imports, and nutrient exports would be analyzed to seek ways to make more nutrients available to the families of the community.

   Production of nutrients, minus exports, plus imports yields the amount of nutrients available to the community. If the nutrient availability is greater than consumption, losses wihtin the community exist. In this case, the measurement and analysis of marketing and within-the-family losses of nutrients is indicated.

   If availability of nutrients is nearly equal to consumption -- and the average family experiences a deficit -- then programs in production and/or import are indicated.

Figure 3 illustrates the sequential diagnostic procedure, appropriate measurements, and analyses within the context of the Nutrient Flow Theory.



Diagnosis - analysis and associated field measurements

Fig. 3

OTHER USES OF THE MODEL

Planning is more than determining the performance specifications for programs. For example, in Villa Rica, Colombia, the diagnostic procedure indicates a need for potable water. There exist at least three alternatives for providing potable water to the community:

1. Purify the existing water system.
2. Extend the aqueduct from Puerto Tejada.
3. Extend the aqueduct from Caloto to Villa Rica.

The design question is: Which of these three alternatives is the most cost-effective in reducing malnourishment? The model can estimate the effectiveness for each alternative and the long-run stability for the proposed solution. If the alternatives are not yet known, the model can then be utilized to state the performance specifications. This latter step is a great advantage when searching for appropriate alternatives.

The model can also be utilized as an evaluation tool to assess the performance of programs once they have been implemented, for it predicts the expected new values of the variables (e.g., Nutritional Status, Nutrient Gap, consumption, losses, agricultural production, Health Status, morbidity, sanitary conditions, etc.). The model should also predict the time for the stated variables to reach those new values, and a separate cost model will predict the implementation cost of the program. Evaluation, then, is simply comparing these predicted values with the observed values.