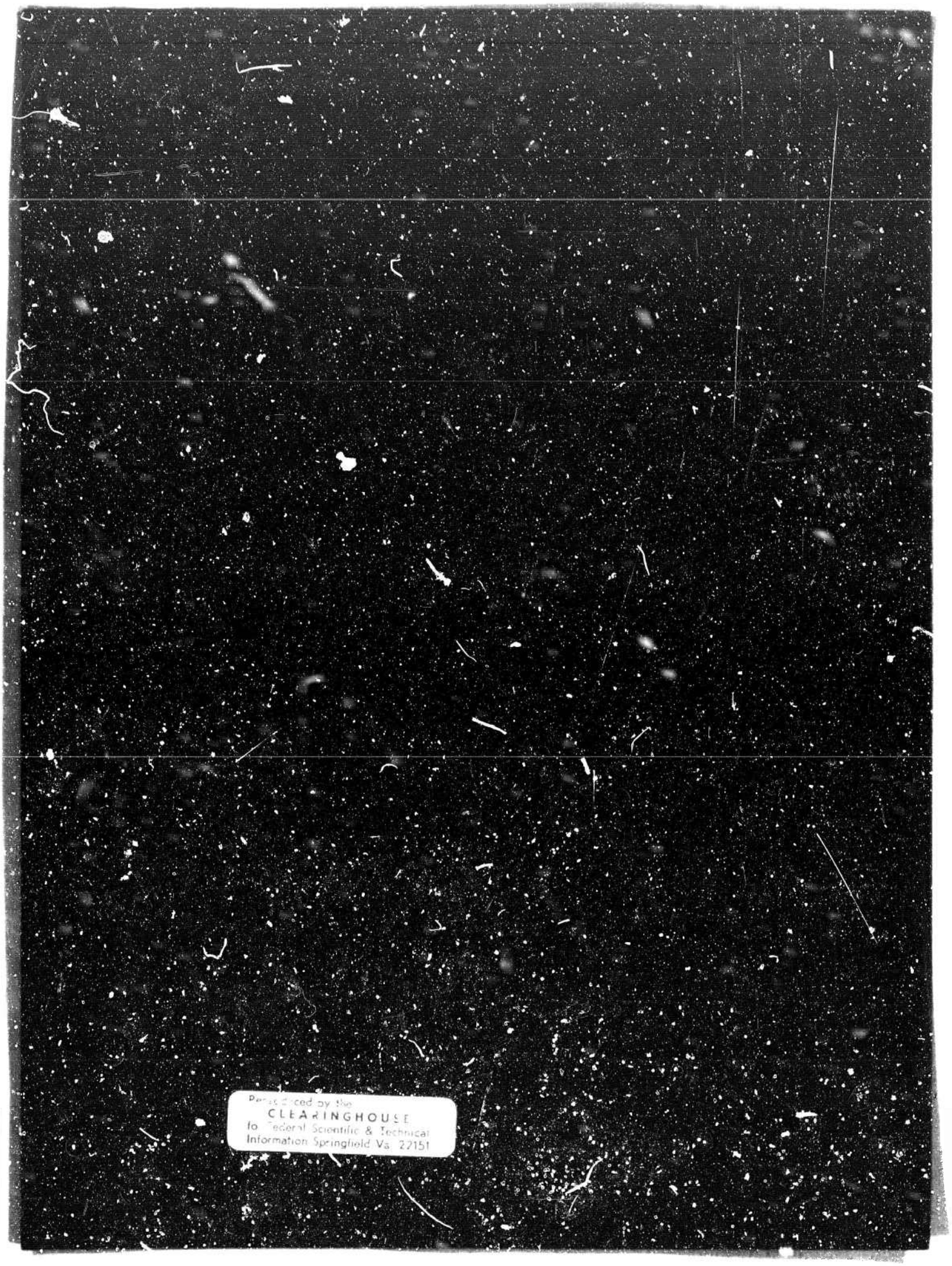

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TECHNICAL REPORT
68-39-ES

THE FOOD GEOGRAPHY OF MAINLAND SOUTHEAST ASIA

by

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Geography Division

June 1968

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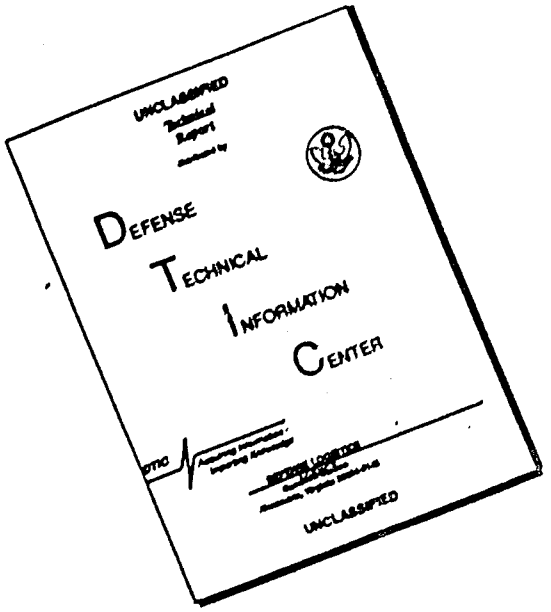

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FOREWORD

This report, prepared under project PROVOST, summarizes from available data the nature and extent of food resources, as well as dietary habits, food taboos, and nutritional status of people indigenous to Vietnam, Cambodia, Laos, Malaya, Thailand, and Burma. Its purpose is to help answer such questions as: How much food is available in Mainland Southeast Asia? In what sections is the food produced? What is the typical diet of the indigenous people? Are starvation and malnutrition widespread? Is sufficient surplus food produced to provide a source for military forces or must all food for such forces be imported?

This study should be useful in planning the food supply for indigenous and non-indigenous personnel during military occupation, civilian relocation, and relief activities in Mainland Southeast Asia. The report also will provide background and source material for instructional purposes.

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Earth Sciences Laboratory

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Brigadier General, USA
Commanding

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ABSTRACT

This report describes the food resources of Mainland Southeast Asia in terms of their adequacy, geographical distribution, and potential military significance. The study reveals that food resources in this area are reasonably satisfactory in comparison to other parts of Asia. However, diets are monotonous and often deficient in the protective foods such as animal proteins, vitamins, and minerals.

Because of primitive agricultural techniques, small landholdings, and lack of capital, food production per unit area and per individual is low in Southeast Asia. Despite this, several countries within the area produce more food than their people consume, and are exporters of food. Rice is by far the leading foodstuff produced. Fish constitutes the leading source of animal proteins and ranks second to rice in terms of importance as a food.

The large cities and major ports are points of maximum food availability. The sawah (wet-rice) areas also have fairly abundant food, whereas the extensive zones of shifting cultivation have only very limited amounts available. Surplus food produced by Thailand, Burma, Cambodia, and South Vietnam contributes significantly to the importance of this region. However, because of problems of food acceptability, most foodstuffs produced in Mainland Southeast Asia have very limited usefulness for personnel of Western nations.

THE FOOD GEOGRAPHY OF MAINLAND SOUTHEAST ASIA

I. Introduction

1. Purpose

The purpose of this study is to summarize the food resources of mainland Southeast Asia and to assess the region's capacity to feed itself. The method of approach is geographic: major consideration is given to the characteristics and availabilities of foodstuffs from place to place within the study area. This is supplemented by information on dietary habits and taboos and the general nutritional status of people indigenous to the region.

2. Definition of the Study Area

The study area consists of Burma, Cambodia, Laos, the mainland portion of Malaysia (hereafter referred to as Malaya), Singapore, Thailand, and North and South Vietnam (see Fig. 1). Occupying the extreme southeastern section of the huge Asian continent, the study area totals slightly more than 800,000 square miles, or about one-fifth the area of the United States. One of its most significant geographic attributes is its central position relative to three of the world's most populous and poorly nourished countries, namely: India, Indonesia, and China.

3. Factors Affecting Food Availability

The most important factors which influence regional differences in food availability are: (1) the physical environment; (2) the level of economic development; (3) the state of agricultural science and technology; and (4) cultural characteristics, such as food preferences and dietary habits.

a. The physical environment

Climate is the most important physical element affecting agriculture. In much of Southeast Asia, year-round high temperatures and plentiful rainfall are favorable for the growth of tropical and subtropical crops. Non-edible plant life also thrives in this "greenhouse" environment and competes vigorously with crops for sunlight, water, and soil nutrients. As a result of the rapid growth of weeds and the prevalence of crop-destroying insects, crop losses are usually severe unless preventive measures are taken. Furthermore, certain

temperate crops such as wheat and oats are not well adapted to these climatic conditions, nor are livestock ranching or dairying usually as rewarding in the tropics as they are in the mid-latitudes. Because of monsoonal control of precipitation, most of this area experiences an excessively wet season (summer) and a very dry season (winter). Consequently, summers are too wet for certain crops and winters are too dry, thus negating some of the advantages of the constantly favorable temperature regime.

The concentration of rainfall during the summer season is highly advantageous for wet-rice cultivation, the principal agricultural activity of Southeast Asia. Figure 2 indicates the relationship between mean annual precipitation and wet-rice cultivation. Other factors permitting, areas which average over 100 inches of precipitation per year are almost certain to have successful rice crops every year without irrigation. Areas which have between 50 and 100 inches of rainfall will have satisfactory crops most of the time. Areas with less than 50 inches of annual rainfall run considerable risk of crop failures or unsatisfactory yields unless supplementary water is provided by irrigation.

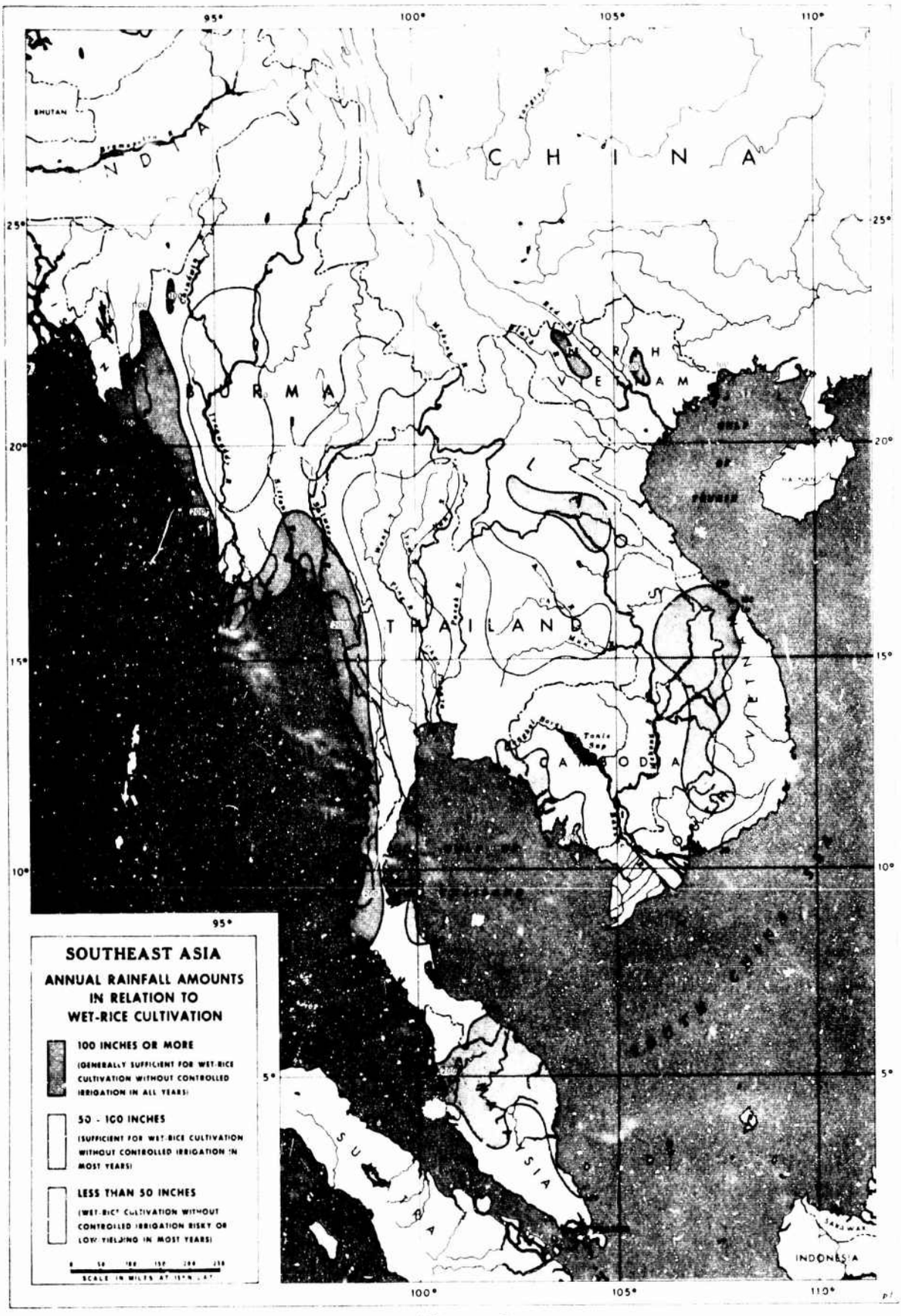
Landform conditions constitute another major control over food production. The general pattern of landforms in Southeast Asia is illustrated in Figure 3. This map shows that extensive portions of Southeast Asia are hilly or mountainous; for the most part, these areas are not well suited for intensive agriculture. The level-to-gently-rolling surfaces of the alluvial plains* and deltas of the great rivers occupy considerably less area, but are by far the most important for food production.

Soil is a third important natural determinant of food production; however, it is much more amenable to human influence than are climate or landforms. If soil is lacking certain plant nutrients, they can be added by fertilization; if soil has a poor structure for plant growth, it can be improved by proper management. Conversely, a naturally fertile, well-structured soil can be ruined by poor farming practices. Except for the rice paddies, which are normally well maintained, poor soil management is much more prevalent than good management in most of Southeast Asia. Although generalizations about soil can be misleading, it is basically true that most Southeast Asian soils are relatively infertile. The best soils are found in the alluvial plains, where the methods utilized in wet-rice cultivation help to maintain their fertility for long periods of time.

*Flat, or very nearly flat, tracts of land bordering rivers, built up by deposits of silt, sand, and clay when the river floods. Such plains are well adapted to wet-rice cultivation.


SOUTHEAST ASIA
POLITICAL DIVISIONS AND PRINCIPAL CITIES
INDIA
CHINA
BHUTAN
BURMA
NORTH VIETNAM
THAILAND
LAOS
CAMBODIA
SOUTH VIETNAM
MALAYSIA
INDONESIA
BANGKOK
VIENTIANE
PHNOM PENH
HAINAN
95°
100°
105°
110°
25°
20°
15°
10°
5°

Figure 1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BHUTAN
INDIA
CHINA
BURMA
THAILAND
CAMBODIA
VIETNAM
INDONESIA
SOUTHEAST ASIA
ANNUAL RAINFALL AMOUNTS
IN RELATION TO
WET-RICE CULTIVATION
100 INCHES OR MORE
(GENERALLY SUFFICIENT FOR WET-RICE CULTIVATION WITHOUT CONTROLLED IRRIGATION IN ALL YEARS)
50 - 100 INCHES
(SUFFICIENT FOR WET-RICE CULTIVATION WITHOUT CONTROLLED IRRIGATION IN MOST YEARS)
LESS THAN 50 INCHES
(WET-RICE CULTIVATION WITHOUT CONTROLLED IRRIGATION RISKY OR LOW-YIELDING IN MOST YEARS)

Figure 2

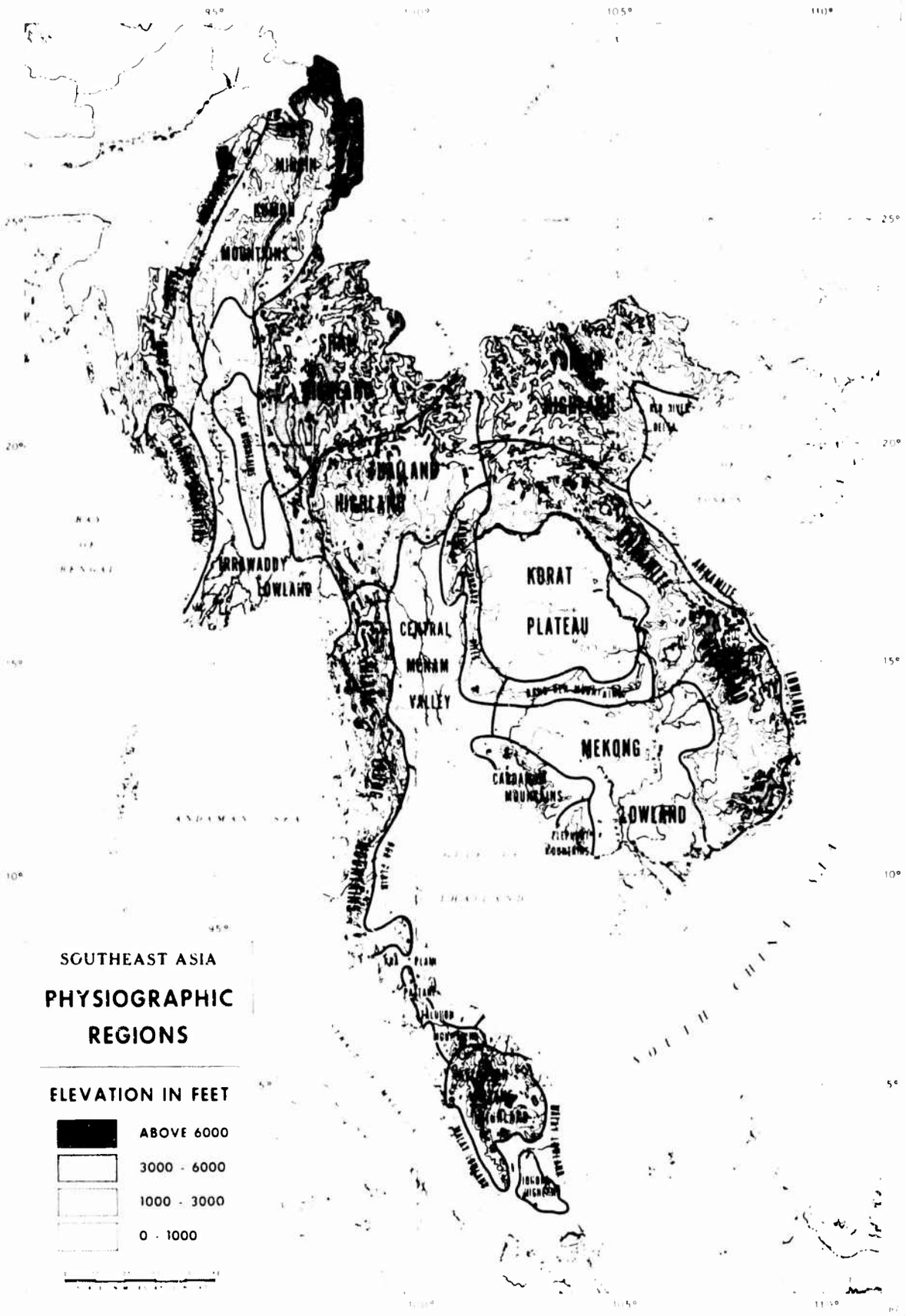

SOUTHEAST ASIA
PHYSIOGRAPHIC REGIONS
ELEVATION IN FEET
ABOVE 6000
3000 - 6000
1000 - 3000
0 - 1000
KORAT PLATEAU
CENTRAL MENAM VALLEY
MEKONG LOWLAND
IRRAWADDY LOWLAND
ANNAMITE MOUNTAINS

Figure 3

b. The level of economic development

The level of economic development in all the countries of Southeast Asia is low,* most of the population living by subsistence farming. A few food items are obtained by trade, but as a whole, farmers have little cash income and cannot afford to supplement their monotonous diets by purchasing supplementary food in the market places. Low national incomes also prevent the countries of Southeast Asia from importing large quantities of desirable foods. In addition, social customs and institutional factors such as rural indebtedness and feudalistic land tenancy arrangements dampen the farmer's incentives for improvement and tend to keep agricultural income at low levels.

c. The state of agricultural science and technology

In many respects agriculture in Southeast Asia is well adapted to the environment. However, there has been little application of a scientific approach to food production, except in the plantation-crop areas. This lack of technological progress results in low yields per acre and, especially, low productivity per agricultural worker. Among the more important requirements for increasing crop yields are: (1) better farming methods and equipment; (2) improved seeds; (3) greater use of fertilizer; (4) development of more irrigation facilities; and (5) improvement of livestock herds. The greatest barriers to technological progress are the shortage of capital and the low level of education.

d. Cultural characteristics

The cultural characteristics of the peoples of Southeast Asia also influence the availability of food. The food preferences of different groups are known to vary considerably, and methods of preparing food for consumption are often quite dissimilar among different cultural groups. It is difficult to trace the origin of food preferences; often, historical accident or pure necessity is the chief explanatory factor. It has been said that people do not eat what they like, but rather they like what they eat. If true, this would account for the strong preference for rice common to nearly all Southeast Asians: most

*Per capita incomes range from about $55 per year in Burma to $275 in Malaya. In the United States the comparable figure is $2,750. Although per capita income statistics are not necessarily a reliable measure of how well the people in a subsistence economy eat, they do give an indication of the funds available to the average family for the purchase of foods which they do not produce themselves.

of these people subsist largely on this grain from childhood on, as their ancestors have done for centuries before them. Many other cultural factors affect the food supply, especially social taboos and religious prohibitions, as, for example, the Buddhist interdiction against killing animals and eating their flesh. In traditional societies, such as those of Southeast Asia, food preferences are unlikely to change rapidly; however, the effects of improved education and rising standards of living may eventually result in notable alterations in dietary habits.

4. Military Significance of Food Geography

In evaluating the potential use of local foods as military rations, three factors, in addition to nutrition, appear to have significance. The major factor is acceptability. Southeast Asian foods differ from those normally included in the rations of American forces, and many items would either be unacceptable or have low preference ratings. Secondly, the labor force needed to procure and distribute sufficient quantities of indigenous foods is considerable. A third important factor is the possible alienation of the indigenous population, by disrupting normal supplies in areas where there is little surplus.

Another military application concerns the use of native foods by foraging troops. Foraging is normally engaged in only by isolated military units for short periods of time, and requires an intimate knowledge of the local landscape and the nature of the foods found in the area.

One of the duties of an army of occupation may be to provide for the care and feeding of indigenous populations. This obligation is particularly difficult to fulfill in wartime because of the disruptive effects of war on agricultural production. A forehand knowledge of the available food resources could be helpful in planning for such contingencies. Furthermore, the usefulness of indigenous labor to the military may be impaired by malnutrition, which lowers the vitality and impairs the health of a considerable segment of the population in Southeast Asia.

II. The Food Resources of Southeast Asia

Although the countries of Southeast Asia exhibit many physical and cultural differences and the region lacks political cohesion, the economies of the countries bear close resemblance to each other, and problems of food supply are markedly similar throughout most of the region. All of Southeast Asia is highly dependent on agriculture, particularly on

intensive rice cultivation. All countries, with the exception of Malaya, are either self-sufficient or surplus producers of rice, in sharp contrast to the major countries of the Far East and South Asia. Each country, again excepting Malaya, has a high proportion of its arable land in rice cultivation, and a major part of the average dietary allowance consists of rice.

Few people in Southeast Asia consume adequate quantities of the five basic nutritional elements (carbohydrates, fats, proteins, minerals, and vitamins). Because of the heavy dependence on rice, carbohydrates are provided in amounts that are nearly sufficient for most individuals. However, fats and proteins are deficient in many diets. The protein situation is complex, because there are several different kinds of proteins (containing different combinations of amino acids), some of which are more important to human diets than others. Proteins derived from animals (i.e., meat, fish, milk, eggs) are regarded by nutritionists as being of higher quality than those derived from vegetable sources. With the exception of those contained in fish, animal proteins are scarce. Unfortunately, it is difficult to increase the amounts of animal protein because of the large land areas and capital investments required, the more involved processing, and the consequent higher cost of the product. The general lack of sufficient protective foods also leads to shortages of vitamins and minerals in the typical Southeast Asian diet.

1. Agricultural Types

To understand the pattern of food availability in Southeast Asia, it is helpful to consider the agricultural systems which are utilized. Although other types could be identified, the four principal kinds of agricultural land-use are: (1) sawah* cultivation; (2) intensive dry-crop agriculture; (3) shifting cultivation; and (4) plantation-crop agriculture.

a. Sawah cultivation

Sawah cultivation is a complex system of agriculture in which rice is the dominant crop. The rice is grown in flat, embanked fields which are inundated with water during the growing season; consequently, sawah is also referred to as "wet-rice" cultivation. In many fields, fish fry (tilapia, carp, etc.) are "planted" along with the rice, thus enabling the farmer to harvest a "double crop" of rice and fish. A

*Sawah, an Indonesian word meaning a flooded rice field, is widely used throughout Southeast Asia.

tremendous amount of human and animal labor is required for successful utilization of the sawah system, but in return it produces yields per unit area greatly exceeding those of any alternative method of producing food in the humid tropics, and it has demonstrated an ability to maintain these yields for a long period of time. This is the most important form of food production in Southeast Asia, although it occupies a relatively small share of the total land area. It is one of the most successful types of land use in the world, as it supports between one-third and one-half of the world's population.

In Southeast Asia the water requirements for the production of wet-rice are supplied for the most part by direct rainfall or by overflow from flooding rivers. Controlled irrigation facilities are developed on only a small portion of the total crop acreage. Other crops in addition to rice are grown in the sawah areas, but rice is far more important than all the others together. These other crops are grown in drained fields during the dry season. Because of the large percentage of arable land that is planted to rice, there exists only a limited amount of land available for the grazing of animals. Only those animals needed for work purposes are usually kept, and even the feeding of these is a perpetual problem in the absence of pasture.

b. Intensive dry-field agriculture

Scattered throughout the sawah areas and in some of the adjacent uplands are many fields which cannot be flooded. Many of these fields are intensively cultivated. A wider variety of crops is grown than in the sawahs, including a field type of rice called dry-rice. In many areas, maize (corn), millet, pulses, wheat, cassava, or other foodstuffs replace dry-rice as the dominant crop. Usually, only one or two principal crops are produced in a dry-field area, depending primarily on local environmental conditions, particularly rainfall. A larger fraction of the total land is devoted to dry-field agriculture, but productivity per unit area is considerably lower than in the sawahs.

c. Shifting cultivation

A third major agricultural type, shifting cultivation, may be described as primitive subsistence farming. In shifting cultivation a clearing is made in the forest and several different crops are planted together. Relatively little attention is given to the crops until time for harvest. After two to four years of use, the clearing is abandoned because of the depletion of soil fertility. The people who live in this manner then migrate to a new area, clear the land, and repeat the crop cycle. The zones of shifting cultivation include most of the mountainous

parts of Southeast Asia and also the relatively inaccessible forested areas. Although the area encompassed is larger than that of any other type, the output of food and the number of people supported are inconsequential in comparison to the sawahs and intensive dry-field areas.

d. Plantation-crop agriculture

The fourth principal type is referred to as plantation-crop agriculture. This land-use system occupies much less territory than any of the other three types, but it is of considerable economic importance to several of the Southeast Asian nations. Most of the production enters world trade and thus helps to pay for imports. A large share of the plantation production consists of non-food commodities such as rubber, cotton, and jute, and quasi-foods like coffee and tea. Even the food crops that are raised such as pineapples, sugar cane, and coconuts are intended mainly for export to Western countries. However, monies derived from plantation-crop exports help to pay for the importation of much-needed foodstuffs. In Southeast Asia the principal plantation crop is rubber, but coconuts, tea, oil palm, and fiber crops have considerable local significance. Malaya is the leading plantation-crop producer, but South Vietnam, Cambodia, Thailand, and Burma also have significant outputs.

2. Availability of Food

The total amount of food available in any country is a function of the food produced in that country, plus imports, minus exports. Total food availability does not automatically equate with total food consumption. A considerable amount of food is lost by wastage, spoilage, rodent damage, improper cooking, and diversion to other uses such as animal feeds*, seed-stock, and industrial purposes. The loss of food from wastage and spoilage is high, and the lack of adequate transportation facilities limits the export and preservation of the perishable foods grown. The general inadequacy of storage facilities leads to considerable wastage from rotting, rodents, insects, and contamination.

*Some of the food used for animal feed will, of course, eventually be utilized by man if the animal is slaughtered for human consumption. However, about 7 vegetable calories, on the average, are required to produce 1 animal calorie. This is one of the prime reasons why animal products are scarce in the diets of Southeast Asian peoples. See, Georg Borgstrom, The Hungry Planet: The Modern World at the Edge of Famine, Macmillan: N.Y., 1965, pp. 25-39.

An analysis of the food resources of Southeast Asia must begin with rice, the preferred food of the majority of people and the basic element around which most meals are planned. There exists no single food of comparable importance in the diets of Americans or other Westerners. Given the climatic, topographic, and soil conditions of Southeast Asia, no other crop can produce as many calories per unit area. Of all the foodstuffs that can be grown in large and reliable quantities in this region, rice undoubtedly has the most useful proteins and the most digestible carbohydrates. Unmilled rice has a higher biological value* than any other grain (rice 85.1, wheat 83.0, rye 80.4, maize 84.7, and oats 82.1). The advantages of milled rice over other milled grains are even greater (rice 79.0, wheat 63.5, rye 69.7, and maize 36.2).

Table I shows rice acreage, total production, per capita production, and rice yields per acre for the major producing countries of Asia. In terms of total production the countries of Mainland Southeast Asia rank fairly low; however, in terms of per capita production, Burma, Thailand, Cambodia, and the two Vietnams rank higher than any other Asian countries. Their high per capita production permits them to export large quantities of rice. The table also indicates that the yield per acre is much lower in the study area than it is in Japan, Taiwan, and South Korea. In several of the countries listed in the table (e.g., China, India, and Japan), rice is only one of several important grains produced, whereas in Southeast Asia, no other grain has more than minor significance. This should be considered when evaluating the figures in Table I. Also, it should be noted that rice production fluctuates somewhat from year to year, although the long-range trend is upward.

Other foodstuffs in addition to rice are produced in Southeast Asia. Among the more important are maize (corn), millets, sesame, cassava, sweet potatoes, yams, pulses (beans and peas), a wide variety of vegetables and fruits, sugar cane, sugar palm, coconuts, and peanuts. Roots and tubers such as cassava and sweet potatoes are grown in moister areas, and it is thought that their production could be increased considerably. Whether this would be desirable is open to question, because the starchy tubers might tend to replace rice in the diet, and they are inferior to the grain in over-all nutritional value. Pulses such as soybeans and mung beans are not produced in as large quantities as they could be, nor are

*Biological value refers to the quality and relative absorption capacity of the amino acids contained in the various proteins. Specifically, it is the per cent of absorbed nitrogen retained in a body when the foodstuff indicated is the sole source of nitrogen. See, S. Davidson and R. Passmore, Human Nutrition and Dietetics, 2d Ed., Baltimore, Williams and Wilkens, 1963, pp. 81-82.

TABLE I. ACREAGE, PRODUCTION, AND YIELDS OF RICE IN ASIA: 1957 and 1965*

Country	Area (1000 Acres)		Total Production (1000 Metric Tons)		Per Capita Prod. (Pounds)		Yields (Pounds per Acre)	
	1957	1965	1957	1965	1957	1965	1957	1965
China (Mainland)	79,320	-	86,600	-	245	-	2,405	-
India	79,025	89,144	37,829	58,098	200	270	1,055	1,440
Pakistan	22,961	26,153	12,935	17,780	300	380	1,240	1,500
Japan	7,986	6,058	14,328	16,802	300	375	3,955	4,600
Indonesia	16,877	16,650	11,611	11,764	250	245	1,515	1,550
Thailand	11,307	14,814	5,724	9,625	610	695	1,115	1,430
Burma	9,558	12,296	5,828	8,151	595	720	1,345	1,460
South Vietnam	6,719	6,331	3,192	5,185	475	710	1,280	1,805
North Vietnam	-	5,995	-	4,512	-	615	-	1,660
Philippines	6,669	7,907	3,203	3,992	235	270	1,060	1,115
South Korea	2,592	2,953	3,086	3,974	210	305	2,625	2,965
Taiwan	1,935	1,890	2,287	2,795	410	480	2,605	3,260
Cambodia	3,027	5,792	1,200	2,570	550	915	875	980
Ceylon	1,131	1,305	658	1,054	125	210	1,280	1,780
Malaya	909	865	800	921	250	240	1,960	2,350
Laos	1,500	1,483	499	520	500	460	735	775

*Source: Food and Agriculture Organization, U.N., Production Yearbook, 1958 and 1965, Vols. 12 and 19, Rome, Italy, 1959 and 1966.

they regularly included as part of the daily fare. A greater emphasis on the pulses would help to augment the limited protein intake of Southeast Asian peoples; unfortunately, the pulses are less digestible and not as well liked as rice. Recent research indicates that housewives can be taught to mix protein-rich soybeans with rice or other staple foods, thereby making the pulse more palatable and helping to overcome protein deficiencies.

The animal foods of Southeast Asia consist principally of fish, both salt and fresh water varieties being important. Pork is the second most common animal product and is consumed at least occasionally by all people in the region except Moslems. Cattle, water buffalo, poultry, goats, and sheep are present but are not important sources of food for the bulk of the population. Cattle and water buffalo produce some milk, and poultry produce some eggs, but the amounts are grossly inadequate for the number of people living in the area. Fish, whether fresh, dried, salted, or in the form of a sauce or paste, is the only animal product that is a common ingredient in the diet of the rice eater. However, the relatively high price of fresh fish and the limited supply of processed fish, as well as their poor keeping quality in the tropics and inadequate marketing facilities, have denied most people the quantity of fish they need for good health. Even along the coastal waters and the numerous rivers and lakes, consumption is frequently lower than would be expected. This is partly due to inadequate fishing equipment, poor transportation and distribution systems, and unsatisfactory methods of preservation. Despite these problems, expansion of fisheries, including development of more fish ponds, probably represents the most economical and acceptable method of increasing animal-protein production in Southeast Asia.

Regional distribution of food resources in Southeast Asia is another important facet of the total pattern of food availability. Figure 4 illustrates this by showing the distribution of cultivated land for the entire region. Cultivated area comprises all the land that is regularly planted to crops. Zones of shifting cultivation are not included, because at any given time only a very small portion of this land is actually under cultivation. Comparison of Figure 4 with Figure 3 (Physiographic Provinces) indicates the close correspondence between cultivated areas and the alluvial plains and deltas of the great riverine systems.

Another method of showing the regional distribution of foodstuffs is to devise a system for showing food availability by regions. Four such types are shown in Figure 5: (1) Zones of Maximum Food Availability (major metropolitan areas and principal ports); (2) Zones of Secondary

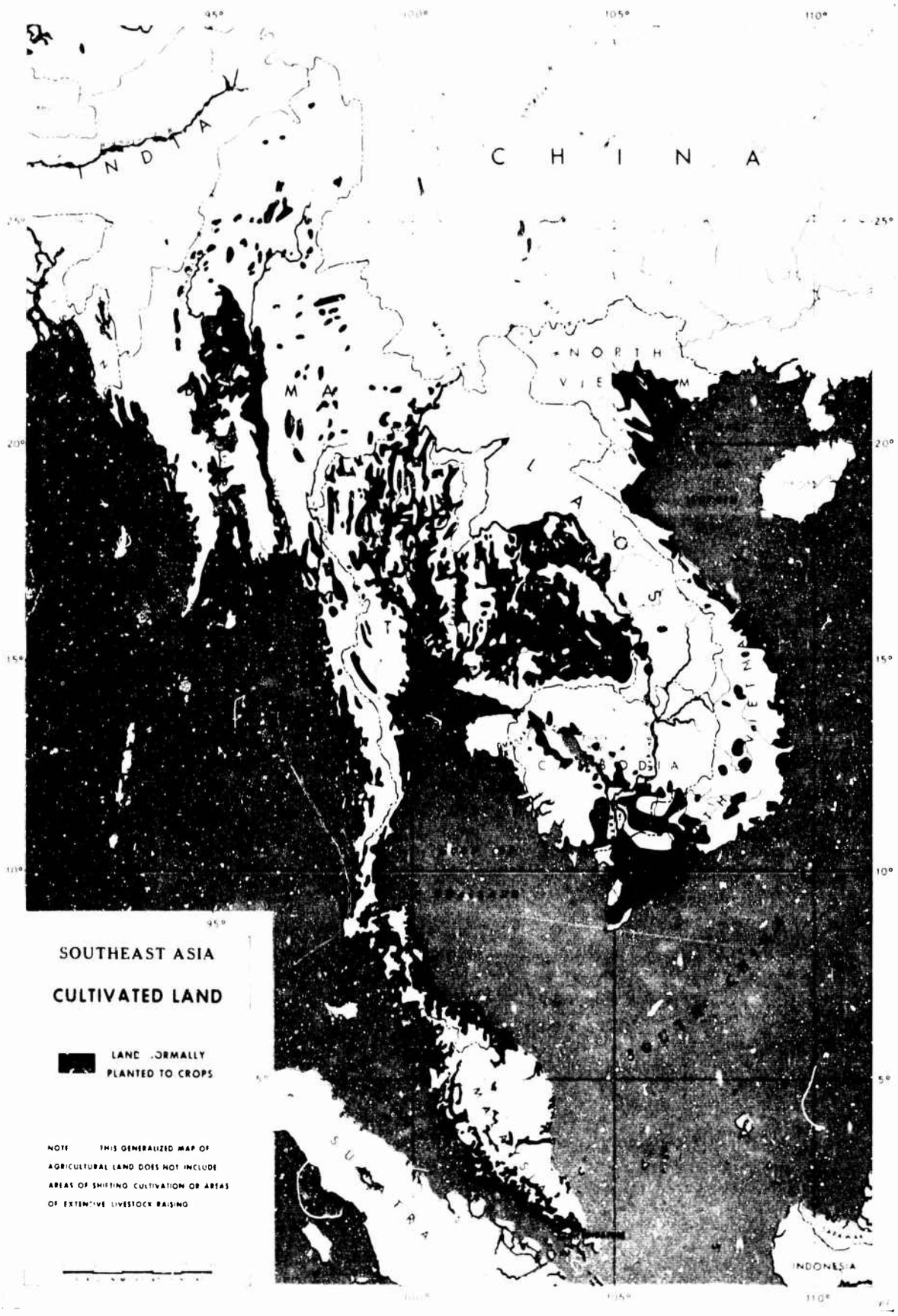
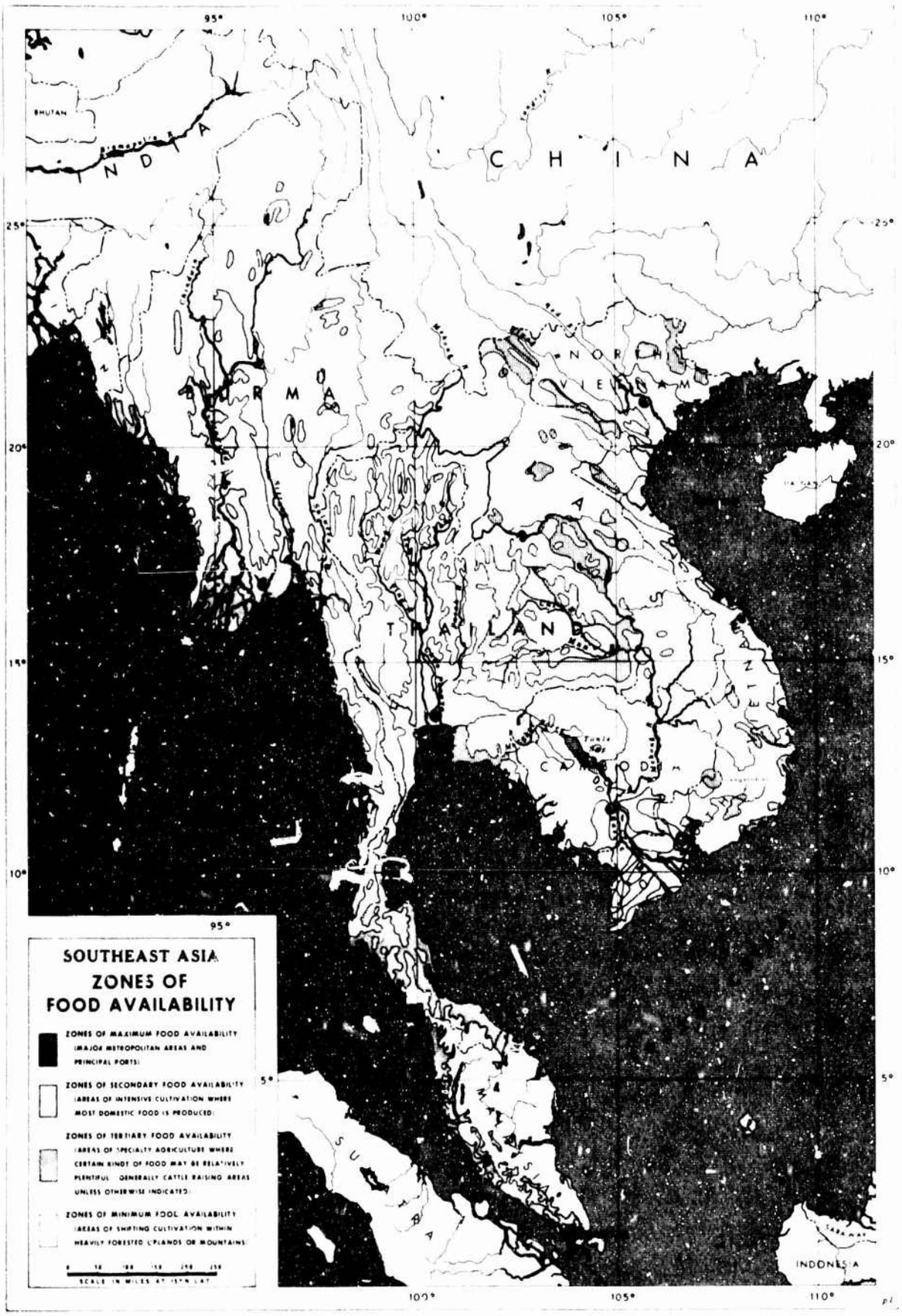

INDIA
CHINA
NORTH VIET
LAOS
CAMBODIA
INDONESIA
SOUTHEAST ASIA
CULTIVATED LAND
LAND NORMALLY PLANTED TO CROPS
NOTE THIS GENERALIZED MAP OF AGRICULTURAL LAND DOES NOT INCLUDE AREAS OF SHIFTING CULTIVATION OR AREAS OF EXTENSIVE LIVESTOCK RAISING

Figure 4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LAOS
THAILAND
CAMBODIA
INDONESIA
SOUTHEAST ASIA
ZONES OF
FOOD AVAILABILITY
ZONES OF MAXIMUM FOOD AVAILABILITY
(MAJOR METROPOLITAN AREAS AND PRINCIPAL PORTS)
ZONES OF SECONDARY FOOD AVAILABILITY
(AREAS OF INTENSIVE CULTIVATION WHERE MOST DOMESTIC FOOD IS PRODUCED)
ZONES OF TERTIARY FOOD AVAILABILITY
(AREAS OF SPECIALTY AGRICULTURE WHERE CERTAIN KINDS OF FOOD MAY BE RELATIVELY PLENTIFUL; GENERALLY CATTLE RAISING AREAS UNLESS OTHERWISE INDICATED)
ZONES OF MINIMUM FOOD AVAILABILITY
(AREAS OF SHIFTING CULTIVATION WITHIN HEAVILY FORESTED UPLANDS OR MOUNTAINS)
SCALE IN MILES AT 15°N LAT.

Figure 5

Food Availability (areas of intensive cultivation where most domestic food is produced); (3) Zones of Tertiary Food Availability (areas of specialty agriculture where a certain kind of food such as vegetables or cattle may be relatively plentiful); and (4) Zones of Minimum Food Availability (areas of shifting cultivation).

The larger cities (Saigon, Rangoon, Bangkok, Hanoi, and Singapore) are the places where the greatest abundance and diversity of foods can normally be found. Although little food is produced within the built-up portions of the city, the urban hinterland is usually an area of intensive vegetable and fruit production. All of the large cities of Southeast Asia, except Singapore, are situated in the heart of major agricultural areas. Their proximity to food resources, combined with their location at the foci of transportational networks, assure the large cities of a better food supply than other areas. Furthermore, many of the large cities are major ports; therefore, considerable quantities and varieties of imported foods arrive periodically, and most food exports pass through on their way to overseas markets. Most of the food processing industries of Southeast Asia are located in the urban areas because the cities represent the major market for processed foods. In summary, the large port cities are the only places in Southeast Asia where really substantial quantities as well as a wide selection of varieties of food are likely to be found in one place.

Ranking next to the metropolitan areas in terms of food abundance are the zones of intensive agriculture; these correspond closely to the sawah and intensive dry-field types. Although these areas generally have plentiful supplies, the food is evenly distributed over the land, and large quantities are not usually stored in one place. Rice constitutes the principal surplus food item, and it is generally stored in huts adjacent to the farmer's dwelling. In Southeast Asia farmsteads are clustered in small villages, and the typical village could probably supply reasonable amounts of food, particularly after the main harvest in November. In addition to rice, these areas grow many vegetables and fruits with some varieties being available throughout the year. Animals such as pigs, cattle, chickens, and ducks are commonplace in all zones, but generally not in great numbers. Fish can be caught in nearby sawahs, fish ponds, and rivers.

Areas of plantation-crop agriculture generally do not produce sufficient food to support the local population. Yet, food availability and diets on the plantations are among the best to be found in Southeast Asia. Incomes within the plantation-crop zones are higher, transportation facilities are good, and the managers of estates are usually sufficiently enlightened to realize the importance of good diets in maintaining the health and productivity of their workers. Consequently, these enclaves of deficient food production often have more and better edibles available than the surrounding areas.

Figure 5 also illustrates some of the zones of specialty agriculture. In such areas one kind of food may be relatively abundant although food in general is comparatively scarce. An example would be areas where cattle breeding is a specialty.

Areas of minimum food availability in Southeast Asia correspond approximately to those of shifting agriculture. Within these areas permanently cultivated land is scarce, transportation is primitive, and market facilities are practically nil. Shifting cultivation occurs principally in hilly or mountainous, highly inaccessible terrain, which comprises a large part of Southeast Asia.

3. Diseases Associated with Food Deficiencies

For Southeast Asia as a whole, malnutrition is not a serious problem, but it does exist to some extent. This situation is more the result of a lack of the protective qualities in foods than of insufficient quantities. Many deficiences are at least partially the result of primitive food customs and the general lack of public information concerning the proper composition of a balanced diet. Even some modern practices are injurious, such as the use of highly milled (polished) rice in place of the home-pounded variety. The milling process removes much of the thiamine, thereby increasing the risk of contracting beriberi, an incapacitating and potentially fatal disease. Regardless of whether they consume polished or home-pounded rice, most Southeast Asians have too high a proportion of rice in their diets and not enough protective foods such as meat, milk, eggs, pulses, and fruits.

No recent dietary surveys have been conducted in Laos or Cambodia, but studies have been completed in South Vietnam, Malaya, Thailand, and Burma. Although each country exhibits its own unique pattern of malnutrition, many problems are common to the entire region. The most pervasive and serious of these problems are thiamine and riboflavin deficiencies. Other common disorders are anemia (insufficient intake of iron) and goiter (lack of iodine). Protein and vitamin A deficiencies are serious in many areas, but they are confined mainly to the vulnerable groups--young children and pregnant or lactating women. Few problems relating to vitamin C or D intake have been noted by nutritional scientists in recent studies and, for most adults, protein consumption appears to be adequate. Nevertheless, the small stature of most Southeast Asian people may be due in part to the relatively low amounts of high-quality animal proteins in the diet.

The solution to the malnutrition problem appears to lie in effective education of the people in proper methods of cooking and preparation of balanced meals. Use of home-pounded rice rather than polished rice would do much to eliminate thiamine deficiencies, but the polished variety is much more popular with most of the people. Vitamin enrichment of rice, and encouragement of a greater use of pulses, liver, milk, eggs, nuts, yeast, iodized salt, and vegetables high in iron content, would substantially reduce the other principal deficiencies. One of the quickest and most certain means of reducing malnutrition would be to expand and modernize the fishing industries of the various countries. Fish are highly acceptable to most Southeast Asian peoples, and increased quantities could raise riboflavin, calcium, and animal protein intakes to acceptable levels.

Throughout Southeast Asia other food-related diseases are known to occur as a result of poor domestic and public hygiene. Typhoid and cholera are two of the best known epidemic diseases which may be spread by the use of human excrement for fertilizer, poor sanitation in the home and marketplace, and the use of contaminated water. The use of human manure, a practice prevalent in several Southeast Asian countries, greatly increases the danger of transmitting fecal-borne diseases by eating uncooked food. Many foodstuffs become contaminated as a result of poor processing techniques or in the unsanitary marketplaces, thereby resulting in a wide variety of diseases. Polluted water is common throughout the region and is a major cause of intestinal ailments, including debilitating parasitic infestation.

4. Potential Military Applications

a. For indigenous forces

The indigenous military forces of each of the Southeast Asian nations are primarily dependent on the food production of their own country. Small amounts of food are imported to supplement and diversify the basic menu, but the bulk of the rations is purchased from domestic suppliers. There are few problems of food acceptability because military diets are similar to those of civilians. In all cases, however, military personnel receive better balanced and more nutritious meals than does the average civilian.

Rice is the principal element in the military diet just as it is in the civilian. Many members of the military forces become accustomed to overmilled (polished) rice during civilian life, and this preference continues after induction. Leaders in the military services realize that

undermilled rice has a much higher content of thiamine, which prevents beriberi, than the overmilled variety has. Although several of the military forces provide undermilled rice two or three times a week, they generally find a low level of acceptability for it. This is a major problem for all the military establishments in Southeast Asia. Vitamin supplements and enriched rice have been suggested as alternatives, but additives are expensive.

Under normal garrison conditions the transportation facilities of most Southeast Asian nations are adequate for supplying fresh food. When troops are in the field, particularly in the more isolated border areas, it becomes difficult to assure a constant supply of fresh food. The lack of adequate refrigeration and storage facilities leads to rapid spoilage, especially during periods of excessive humidity. In the dry season, food may become contaminated by dirt, sand, and dust during periods of high wind. Fortunately for the indigenous military forces, rice, dried fish, and dried pulses--foods which constitute a large part of their dietary allowance--do not spoil easily during storage, even under the most adverse conditions.

b. For non-indigenous forces

It is a foregone conclusion that any Western military force operating in Southeast Asia must be supplied primarily from its home base. Nevertheless, a military force expecting to remain in Southeast Asia for a period of time could develop local supplies of food. In most parts of Southeast Asia--the sawahs excepted--there is considerable unused land that could be converted to vegetable gardens or fruit orchards. The highland or plateau areas are particularly suited to this type of cultivation, and many of the familar mid-latitude vegetables and fruits can be grown in these cooler areas. Raising animals for a meat supply is also feasible in the highlands, although this would be more expensive and might require specialists in animal husbandry.

All Western personnel in Southeast Asia should be aware of the problems posed by the use of human excrement as a fertilizer. Almost all raw food procured in this region is susceptible to such contamination, and all local foodstuffs should, therefore, be inspected by an expert before procurement. Ailments such as bacterial infections and helminthiasis (infestation by intestinal worms) are not likely to be a problem when military personnel are under the discipline of garrison or bivouac living, but for individuals on pass or for groups foraging about the countryside, there is a strong possibility of consuming contaminated food.

c. Emergencies and survival

It is possible for individuals or small groups to become separated from their main units and their normal mess facilities. Unless well supplied with field rations, such detached units may be compelled to seek emergency foods for survival purposes. Tropical areas offer possibilities for year-round foraging. For emergency purposes food is generally available in one form or another in nearly all parts of Southeast Asia throughout the year.

If men become lost in a densely populated area such as the sawah areas, they will probably find a plentiful supply of rice and a wide variety of other foodstuffs available for purchase in the village marketplaces. Rice is easy to prepare since it can be cooked simply by boiling in a small amount of water in a sanitized container. Adding the meat and vegetable portion of a "C" ration, or any flavoring agent, to the rice produces a good field meal.

Foreigners in any part of Southeast Asia should be cautioned against eating native food without first thoroughly cooking it. An exception is fruit, which may be consumed after washing with clean water and peeling the skin. In this area it is the custom of some people to eat raw fish. This is very dangerous for Westerners, particularly if they eat fresh-water fish. Non-poisonous fish caught in salt water are usually safe, but many of the fish in the seas around Southeast Asia are poisonous. It is always advisable to cook native foods in order to eliminate the danger of producing serious bacterial infection and worm infestation.

In sparsely populated areas it is doubtful if food can be procured from local farmers or marketplaces. However, there is hardly a place in Southeast Asia where small numbers of men cannot survive off the land when motivated by acute hunger. Under such adverse conditions anything that has nutritional value and is non-poisonous can and should be eaten.

The best method of becoming acquainted with the emergency foods of Southeast Asia is through personal identification in the field, preferably with instruction by experienced teachers. If one lacks experience or information, a few general survival rules may be of some help:

(1) Proteins and fats can be obtained by shooting or trapping small animals such as dogs, cats, rats, frogs, snakes, turtles, badgers, weasels, squirrels, etc. (Animals such as various species of deer, wild boars, honey bears, wild oxen, and fowl are more desirable but usually much more

difficult to obtain.) Even wormy or maggot-infested meat has good nutritional value and can be consumed after thorough cooking. Many insects (e.g., cicadas, ants, grasshoppers, caterpillars, giant waterbugs, termites, grubs, crickets, etc.) are nonpoisonous and very nutritious. They should be fried or roasted and the legs removed before eating.

(2) There are many edible fruits in Southeast Asia, most of which have good nutritional value, particularly in vitamin content. Unfortunately, only a few produce good fruit in the wild, forested regions. Bananas abound throughout Southeast Asia, but the uninitiated will find it difficult to distinguish them from plantains, which should be cooked before eating. Wild or semi-wild mangos are pear-shaped, have yellow to black skins, and a delicious yellow fruit. The large, melonlike fruits of the papaya tree are excellent food and are especially rich in vitamin C. Toxic fruits are rare in this area.

(3) The roots, stalks, leaves, or other parts of many plants found in Southeast Asia are edible after they have been cooked in a small amount of water. It is wise to avoid those which taste disagreeable or have a milky sap as these are likely to be poisonous.

(4) When in doubt about the edibility of a plant, it is good policy to seek the advice of friendly natives, if possible. They know which plants are edible and which are poisonous.

(5) If the area is inhabited by monkeys, observe the food that they eat and attempt to obtain the same. It will usually be safe.

III. The Food Resources of North and South Vietnam

In 1954 the Geneva Agreement divided the former colony of French Indochina into four independent political units: (1) North Vietnam; (2) South Vietnam; (3) Laos; and (4) Cambodia (see Fig. 1). Despite the present political schism, the two Vietnams have many physical and cultural similarities. The most important of these similarities is the domination of both countries by the Annamese (or Vietnamese), an ethnic group with strong cultural ties to the Chinese. Physiographically, both north and south have large deltas, narrow coastal plains, and extensive interior highlands. Climatically, both sections are influenced by the Asian monsoon; yet temperature seasonality is notably more pronounced at the higher latitudes in the north where winters are significantly colder. Agricultural land-use is basically similar in the two sections, although the south is normally a surplus producer of food while the north is a deficit area.

1. Regional Differences

The two Vietnams, like most other parts of Southeast Asia, are primarily producers of rice. Many other foodstuffs are grown, but none of these approach rice in terms of importance to the Vietnamese diet. Animal foodstuffs are dominated by fish, with several other products available in smaller quantities. Vietnam has one of the best natural endowments for agriculture in Southeast Asia, and in normal times it can provide its population with reasonably adequate diets. Probably it could greatly increase its food production. The distribution of some of the principal crops produced in Vietnam is shown in Figure 6, and production statistics for selected agricultural commodities and livestock are given in Table II.

In terms of the character and availability of food, Vietnam (considering North and South together) may be divided into five principal regions (see Fig. 6): (1) the Mekong Delta; (2) the Central Highland; (3) the Coastal Lowland; (4) the Red River Delta; and (5) the Northern Highland.

a. The Mekong Delta

The Mekong Delta, which comprises the southern one-third of South Vietnam, is one of the most important agricultural regions of Southeast Asia. Its alluvial deposits constitute an extensive area of very flat and fertile land with abundant water provided by the annual floods. This agriculturally-favorable physical environment has the further advantages of a dependable supply of human and animal labor and the impetus supplied by French investments in the area. The result is that this formerly swampy region is now the leading rice producer of Vietnam. This region has the highest proportion of land converted to rice fields, the highest average yields per acre, and the highest production per worker of any part of South Vietnam. In normal times, the delta has a large surplus of rice for export to other parts of the country or to overseas markets.

Despite its predominance, agricultural methods practiced in the Mekong Delta are not as intensive as in certain other sections of Vietnam. Most of the rice grown in the delta does not have the benefit of controlled irrigation; instead, reliance is placed on the floods of the Mekong. Also, considerable cultivable land in the area is not used for crops, and that which is used is not normally double-cropped (i.e., planted to two crops in one year). If controlled irrigation were introduced, the unused land planted to crops, and the practice of double-cropping instituted, the Mekong area could increase its production considerably.

TABLE II. PRODUCTION OF PRINCIPAL CROPS AND LIVESTOCK, NORTH AND SOUTH VIETNAM: 1964*

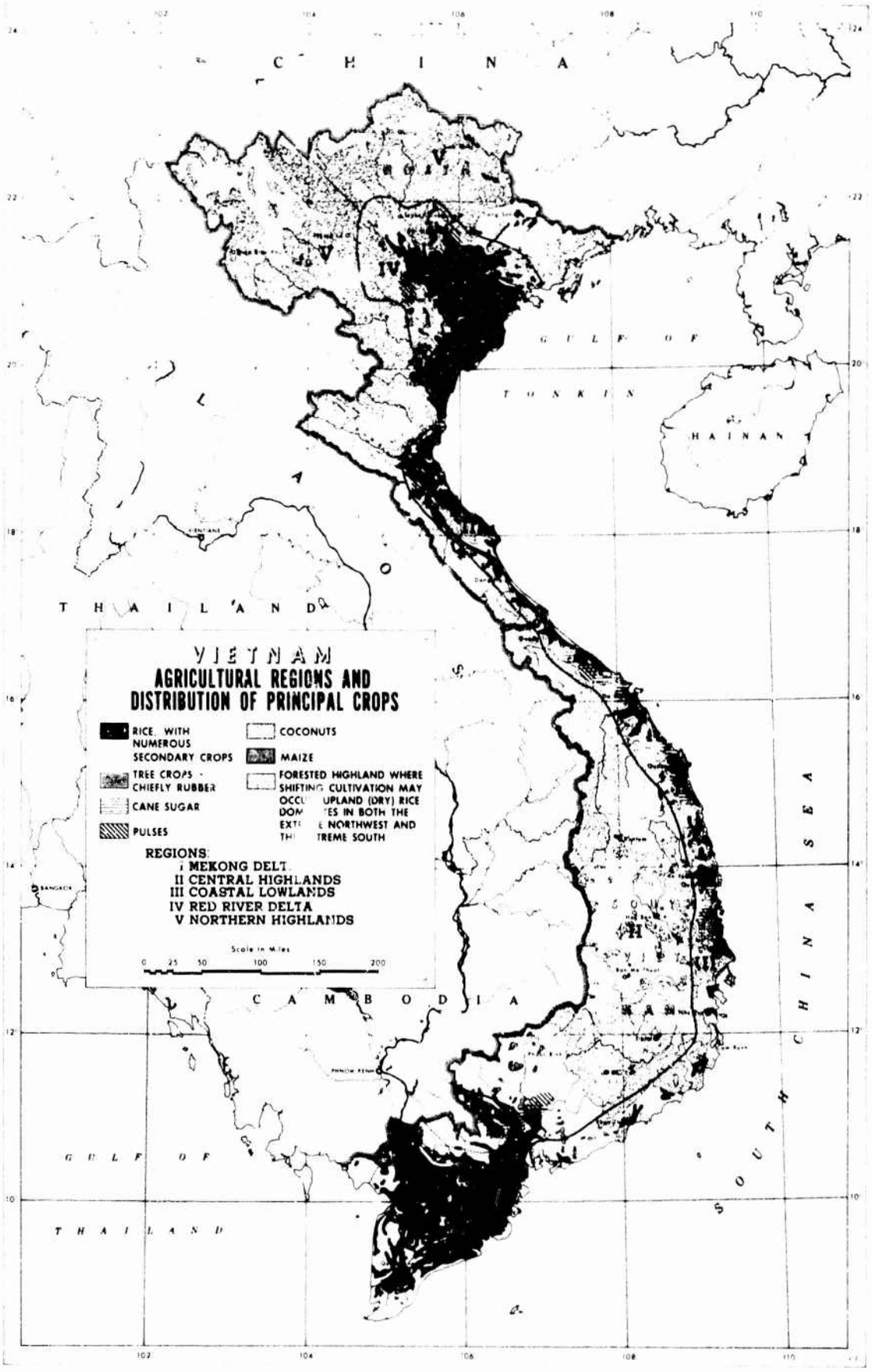
North Vietnam

Crop	Area (acres)	Production (metric ton)	Yields (lbs/acre)
Rice, paddy	5,992,220	4,512,000	1,660
Cassava	296,400	864,000	6,430
Sweet potatoes & yams	454,480	811,000	3,935
Sugar cane	46,930	732,000	34,390
Maize	582,920	274,000	1,036
Peanuts	96,330	42,000	960
Dry beans	153,140	13,000	190
Soybeans	64,220	9,000	310
Cottonseed	46,930	4,000	190
Tea	29,640	4,000	300
Livestock (numbers)			
Pigs	4,208,000		
Buffaloes	1,508,000		
Cattle	790,000		

South Vietnam

Crop	Area (acres)	Production (metric tons)	Yields (lbs/acre)
Rice, paddy	6,328,140	5,185,000	1,805
Sugar cane	83,980	1,055,000	27,700
Sweet potatoes & yams	118,560	301,000	5,600
Cassava	106,210	289,000	6,000
Bananas	44,460	237,000	11,755
Rubber	-------	74,200	-----
Pineapples	-------	57,000	-----
Maize	91,390	46,000	1,110
Peanuts	86,450	36,000	920
Copra	-------	24,000	-----
Dry beans	49,400	14,000	625
Tea	24,700	5,400	480
Potatoes	494	3,000	13,390
Livestock (numbers)			
Pigs	3,331,000		
Cattle	1,183,000		
Buffaloes	848,000		
Goats	34,000		
Sheep	3,000		

*Source: FAO, United Nations, Production Yearbook, 1965, Vol. 19, Rome, 1966.


C H I N A
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T H A I L A N D
VIETNAM
AGRICULTURAL REGIONS AND
DISTRIBUTION OF PRINCIPAL CROPS
RICE, WITH NUMEROUS SECONDARY CROPS
TREE CROPS - CHIEFLY RUBBER
CANE SUGAR
PULSES
COCONUTS
MAIZE
FORESTED HIGHLAND WHERE SHIFTING CULTIVATION MAY OCCU UPLAND (DRY) RICE DOM ES IN BOTH THE EXT E NORTHWEST AND TH TREME SOUTH
REGIONS
I MEKONG DELT
II CENTRAL HIGHLANDS
III COASTAL LOWLANDS
IV RED RIVER DELTA
V NORTHERN HIGHLANDS
Scale in Miles
0 25 50 100 150 200

Figure 6

The only other food crops of more than local significance grown in the Mekong Delta are coconuts and sugar cane. Coconuts, the source for copra and oil, are raised in groves along the sandy coast of the delta. Sugar cane is grown on the northern margins of the region in the vicinity of Saigon. Mulberries, cotton, and other sources of fiber are also widely cultivated but do not contribute to the food supply of the area. Most farmers in the delta raise maize (corn), cassava, vegetables, and fruit, but usually only enough for their families and perhaps a small surplus for sale in the local marketplace. Each family keeps a few ducks, chickens, and pigs, and catches fish in the numerous canals and streams of the delta. Although farming is basically of the subsistence type, generally there is surplus rice which can be sold in the village. During the dry winter season, the peasant seeks to supplement his income through temporary employment in one of the larger villages or the Saigon-Cholon metropolitan area.

b. The Central Highland

The Central Highland is the largest agricultural region of South Vietnam but the least productive. The region is a series of hills, mountains, and plateaus occupying all the land north of the delta and west of the narrow coastal plain. Prior to 1956, agriculture in this sparsely populated and heavily forested area was limited to the shifting cultivation of montagnards (mountain people) and some plantation production of rubber, tea, and coffee. In recent years the Vietnamese government has opened the region to agricultural settlement by farmers from the overpopulated coastal and deltaic areas. Development has been slow, owing in large measure to Viet Cong and North Vietnamese insurgents. With an estimated five million acres of arable land, the Central Highland has the potential to become an important producer of certain foods that are in short supply in Vietnam, such as animal products, vegetables, and peanuts. However, much of the agricultural production of this region will probably become oriented toward industry and export crops, with fibers, rubber, and tea likely to dominate. In terms of present production, the region is not very significant except for isolated areas of cattle breeding and the recently developed vegetable farms in the vicinity of Dalat.

c. The Coastal Lowland

The Coastal Lowland is the smallest but most intensively developed agricultural region of South Vietnam. The region consists of a narrow coastal plain and a series of small deltas situated between the South China Sea and the Central Highland. Most of the agricultural development is located in the small deltas, none of which approaches the size of the Mekong or Red River Deltas. These small patches of

alluvium have been cultivated for centuries and nearly all the arable land is planted to crops. Rice is the principal crop; unlike the Mekong Delta, however, there is considerable use of controlled irrigation and double-cropping, indicating more intensive land use. Nevertheless, yields are lower on the average in the Central Lowlands than in the Mekong Delta. Population density is high in this region, and the annual harvest of over one million tons of unmilled rice does not quite satisfy its needs. The deficit is usually made up from surpluses in the Mekong Delta.

The Coastal Lowland also produces substantial amounts of sugar cane, coconuts, and subsistence crops such as cassava, beans, vegetables, fruit, and tobacco. Most farmers raise poultry and pigs for their own consumption. However, population densities are so high in some areas that far too little land remains for the proper care and grazing of animals. This region cannot be expected to have large increases in food production because almost all the good land is being utilized at or near its maximum capacity.

d. The Red River Delta

The Red River Delta is the most important agricultural region of North Vietnam. Like the Mekong Delta, this region is dominated by wet-rice cultivation. However, the northern delta differs from its southern counter-part in several respects. Controlled irrigation is used throughout the Red River system, although the primary purpose is to regulate destructive floods rather than to supplement insufficient rainfall. Population densities are exceedingly high and land-use practices are more intensive with higher yields than in the Mekong Delta. Even so, the Red River area is a deficit producer of rice.

In addition to rice, most of the other subsistence crops mentioned in connection with the other regions of Vietnam are grown in the northern delta. As indicated in Table 2, sweet potatoes, yams, and cassava are well represented. In the Red River Delta, great emphasis is placed on maize (corn) as a dry-season crop, because of its high yields under sunny skies and controlled irrigation. Corn is often planted in fields where rice, for one reason or another, cannot be double-cropped. Plantation-crop agriculture has never been of more than minor significance in any part of North Vietnam, and certain strictly tropical crops such as the banana and the coconut do not thrive in the slightly colder winters of the north.

The Red River Delta has an average population density of about 1,000 people per square mile, with some provinces exceeding 2,000 people per square mile. These densities are among the highest in the world, and

give testimony to the intensity of agricultural production in this area. Almost no usable land remains for future expansion of agriculture. At present, there is little land available for the pasturage of animals. In some places there is not sufficient land to accommodate draft animals, and there human labor is used exclusively.

e. The Northern Highland

The last of the agricultural regions of Vietnam is the Northern Highland. This region is similar in many respects to the Central Highland, and the two are joined by the Chaine Annamitique (Annamite Mountains). Both are primarily zones of shifting agriculture inhabited by primitive tribesmen. An important difference is the existence of terraced rice fields in the Northern Highland along the Chinese border. This is due to Chinese influence. Over-all food production in the region, however, is scanty and scattered.

2. Procurement of Food

The Saigon-Cholon metropolitan area, situated in the northeast corner of the Mekong Delta, is the point of maximum food availability in South Vietnam. Saigon is connected with the fertile delta by canals and waterways which are excellent avenues for transporting surplus rice to the city for milling and marketing. It is also near the center of the principal sugar cane area of South Vietnam. The city is connected by road with the vegetable farms of the Dalat area in the Central Highland. Saigon is the principal port of South Vietnam and thus has maximum access to imported foods as well as being the leading shipping center for exports.

With respect to food supplies, Hanoi is the northern equivalent of Saigon except that it lacks the port function. This capital and largest city of North Vietnam is located close to the center of the highly productive Red River Delta. Railroads, canals, and roads connect Hanoi with the port of Haiphong on the Gulf of Tonkin as well as other important points in the delta. Farther south, in the Coastal Lowland, the smaller cities of Vinh and Dong Hai are points of secondary food availability, based on the productivity of their small deltas. They may be compared with the South Vietnamese coastal cities of Da Nang, Hue, and Nha Trang in terms of available food.

The great river deltas--the Mekong and the Red--rank next to the major cities with respect to available food. The smaller deltas along the coast are secondary areas. The extensive territory of the Central Highland and Northern Highland is dominated by shifting cultivation and has relatively little food for procurement. In some parts of the highlands there are cattle breeding and vegetable farms, but these are exceptions to the general rule.

3. Dietary Habits and Taboos

Rice is the principal foodstuff in Vietnam and constitutes the basis of the typical diet for all ethnic groups in the cities, lowland villages, and highlands. Some distinctions can be made in certain of the secondary foods consumed, and class differences exist with respect to amount and quality of food eaten. Most authorities agree that there is no area of recurrent famine and no genuine starvation in Vietnam. It is estimated that the average Vietnamese consumes about 2,100 calories per day, and many--especially in the cities--have much greater intakes. In the quantitative sense, this diet is very nearly adequate. However, caloric requirements vary considerably for children, adult males, and adult females, and also depend on the occupation of the individual. A manual laborer needs more calories than a sedentary office worker (although in Vietnam the office worker is likely to receive more). Calculated requirements for Vietnamese civilians range from 1,120 calories for a child less than one year old to 2,682 calories for a young man between the ages of 16 and 19.

A dietary survey involving Vietnamese military personnel, military dependents, and civilians was completed in December 1959. The nutritional status of the military forces was found to be superior to that of the other groups. The civilian sample was the most poorly nourished, but most civilian diets were reasonably adequate. Among the civilians surveyed, inhabitants of Kontum province in the Central Highland were the worst fed, while urban children attending schools were the best nourished. The upper classes in all areas have better than average diets which include many Western and Chinese foods. The poorer classes subsist largely on rice and fish. The following tables (III and IV) present a general picture of the diets of South Vietnamese military and civilian groups.

The data in Table IV were obtained by questionnaire, and are undoubtedly too low because the average Vietnamese does not take into account the snacks consumed every day and would not report them to an investigator. The typical Vietnamese views his daily food intake in terms of three kinds of meals: (1) a filling meal, the only one that is likely to be mentioned to an investigator; (2) a cooling meal, usually consisting of beverages; and (3) a "greed" meal, represented by sweetmeats and a number of locally-prepared delicacies. Many of these cooling and greed meals are purchased from street vendors who practice their trade on all city streets and most roads between villages. They offer a wide variety of food stuffs, including such items as sliced pineapple, lemonade, soup, and green papaya. The amount of all such foods consumed during a day is dietarily significant but defies exact computation.

TABLE III. THE BASIC GARRISON RATION OF VIETNAMESE SOLDIERS AND SEAMEN: 1959*

Administrative Foods (Purchased centrally for entire military forces)	Grams/Man/Day
Rice, dry	700
Tea	15
Salt	25
Sugar	25
Cooking oil	30
Nuoc Mam (fish sauce)	15
Other Fo (Perishables, purchased locally)	
Fresh vegetables	200
Fresh fruits	200
Fresh fish, or	400
Fresh pork, or	240
Fresh beef, chicken, or duck	300

NOTE: The entire ration averages about 3,290 calories per man per day.

TABLE IV. DAILY NUTRIENT INTAKE PER INDIVIDUAL FOR VIETNAMESE CIVILIANS: 1959*

	Highland Dwellers	Coastal Dwellers	Delta Dwellers
Calories	1,692-3,011	1,543-1,944	2,000-2,078
Protein			
Total (grams)	66-83	55-69	69-71
% of calories	11.1-17.0	11.3-17.9	13.3-14.2
Animal (grams)	16-50	13-26	11-29
% of calories	2-10	2.7-6.7	2.1-5.8
Fat			
Total (grams)	11-40	6-11	27-28
% of calories	12.3-14.4	2.9-5.4	11.6-12.8
Carbohydrate			
Total (grams)	381-579	292-417	365-390
% of calories	71-77	75.7-85.8	73.0-75.1

*Source: U.S. Interdepartmental Committee on Nutrition for National Defense, Republic of Vietnam Nutrition Survey: October-December 1959, Washington, D.C., July 1960.

The civilian diet differs from the military ration primarily in total calories and quantities of fresh meat consumed. Rice constitutes 60 to 80 percent of the total calories in the civilian diet. The remaining nutrients are derived chiefly from sugar, starchy roots, fresh vegetables and fruits, fish, nuoc mam*, and beverages, of which tea is by far the most popular. The typical diet is poor in meat, milk, eggs, and other foods that are high in protective values. Generally, civilian families eat meat only two or three times a week, usually as pork "fatback", chicken, or duck. Eggs are well liked by the Vietnamese, but are too expensive for regular consumption by the average family.

In terms of food preferences, it should be noted that the Vietnamese (like the Chinese) have a traditional dislike for milk. This antipathy has been overcome among some Westernized urbanites, but milk production and consumption remain low. A detrimental food habit that has developed in recent years is the preference for overmilled (polished) rice (see page 12).

As in other sections of Southeast Asia there are numerous dietary taboos in South Vietnam, especially for young children and pregnant or lactating women. Children are often forbidden to eat certain foods in the belief that the foods might cause worm infestation, or be harmful in some other way. Pregnant women often refuse to eat sufficient food or certain types of food because of their desire for a small child. Many taboos regarding children and women have no scientific basis and do considerable nutritional harm.

4. Vulnerability of the Food Supply

Because of the subsistent nature of most Vietnamese farming, the people are less seriously affected by war and other national calamities than the population of those countries dependent on trade for much of their food. Vietnam has shown that it can survive and feed itself during wartime, as it did during the World War II period of 1939-1945, and again in the postwar conflict with the French. However, South Vietnam is now confronted with a situation that is seriously taxing its ability to develop its resources. Viet Cong and North Vietnamese military and guerilla activities have prevented needed improvements in food production and distribution, despite the initiation of new agricultural programs and considerable American aid. Since Viet Cong guerillas live primarily off the land by expropriating local food supplies, their operations tend to reduce the amount of food available to civilians. Also, the insurgents have been successful, at times, in disrupting movements of food from the Mekong Delta into the Saigon area. Withdrawal of the Viet Cong from an area usually results in an improvement in the food supply.

*Nuoc Mam is a pungent fish sauce made by fermenting and pickling small fish in salt. It is very popular with all segments of the population and because of its valuable proteins, is highly nutritious (J. May, p. 83).

In some years Vietnam's food production is adversely affected by natural disasters. If rainfall is exceptionally heavy during the early summer monsoon, flooding may destroy part of the rice crop. Too little rain at this time, on the other hand, will reduce considerably the yields obtained from the principal rice harvest. Destructive flooding is rare on the Mekong and its distributaries, but when it does occur it is often very serious because of a lack of forewarning. On the Red River Delta in North Vietnam ruinous floods were common occurrences until the development of irrigation facilities brought them under control. Natural or artificial destruction of key dams or sluices at a critical time of year could result in disaster to the rice crop. The Coastal Lowlands and Red River Delta of Vietnam are subject to occasional late summer typhoons which sweep in from the Pacific Ocean accompanied by high winds and torrential downpours. Typhoons are particularly destructive to mature rice and sugar cane.

IV. The Food Resources of Cambodia

In relation to its area and population, Cambodia has an agricultural potential as great as any nation in Southeast Asia. With a population density of 85 people per square mile*, and with nearly three-quarters of its land area arable, Cambodia is free from the severe population pressure that burdens many Asian countries. In fact, Cambodia is probably underpopulated in terms of optimum utilization of its available land, a most unusual situation for Asia.

The three most important geographic features in Cambodia are the Mekong River, the Tonle Sap (Great Lake), and the Cambodian Plain. The latter is a low, flat area of alluvium adjacent to the Mekong and Tonle Sap and encompasses about three-fourths of the total land area. The Mekong, originating in the Tibetan Plateau, has a general north-south orientation through Cambodia, but as it enters Vietnam, the river course shifts to the southeast. The Mekong is connected to the Great Lake by the Tonle Sap River. Both the Mekong and the Great Lake are subject to annual flooding, a fact of considerable significance in the agricultural utilization of the land. The lowlands formed by the plains adjacent to the Mekong and Tonle Sap are the principal focus of population and agricultural production in the country. The peripheral sections of Cambodia consist of hills, mountains, or plateaus (except in the southeast), but these are neither extensive nor exceptionally rugged.

*Based on a population of 6 million and an area of nearly 70,000 square miles.

1. Regional Differences

Cambodia does not exhibit the degree of regional contrast in food availability that is evident in Vietnam, because most of its territory is alluvial plains and thus arable. Only the border areas are sufficiently rugged to preclude intensive agricultural development. However, a large part of the Cambodian Plain is not used for agriculture because the country lacks sufficient people to settle all of its arable land. Although differences are not great, it is possible to delimit five agricultural regions in Cambodia: (1) the Mekong-Bassac-Tonle Sap River Confluence; (2) the Southeast Region; (3) the Kompong Cham Redlands; (4) the Western Region; and (5) the Peripheral-Upland Region. These regions are illustrated in Figure 7.

a. The Mekong-Bassac-Tonle Sap Confluence

This region is one of the oldest and most important areas of food production in Cambodia. Near the center lies the capital and largest city, Phnom Penh. The principal feature is the strong development of sawah (wet-rice) cultivation made possible by the use of floodwaters from the Mekong River for irrigation. This region is characterized by three separate land-use bands paralleling the rivers. A schematic illustration of this agricultural pattern is given in Figure 8.

Immediately adjacent to the rivers are natural levees, parts of which normally remain above floodwater. The levees are generally fertile and are well adapted to a wide range of crops and crop-production practices. In the vicinity of Phnom Penh the levees are utilized primarily for commercial vegetable gardening. Levee lands not used for vegetable crops are usually planted to field crops such as corn, field beans, tobacco, peanuts, sweet potatoes, soybeans, sesame, and various kinds of fruits. An interesting feature of this zone is the continuous cycle of planting and harvesting made possible by the slow retreat of the summertime floodwaters which gradually exposes freshly fertilized land.

The second land-use zone in this region consists of a strip of marshland lying behind the levee. This relatively narrow band is usually deeply flooded during the summer, parts of the region being used for production of "floating" rice (a variety that grows rapidly above the rise of the floodwaters). During the dry season, if the floodwaters recede sufficiently, corn may be grown in these areas.

The third band, usually 20 miles or more in width, is the zone of intensive rice cultivation. Here, nearly all the land is planted to rice. The rice is grown under floodwater conditions, supplemented by direct rainfall. There is little controlled irrigation in this region.

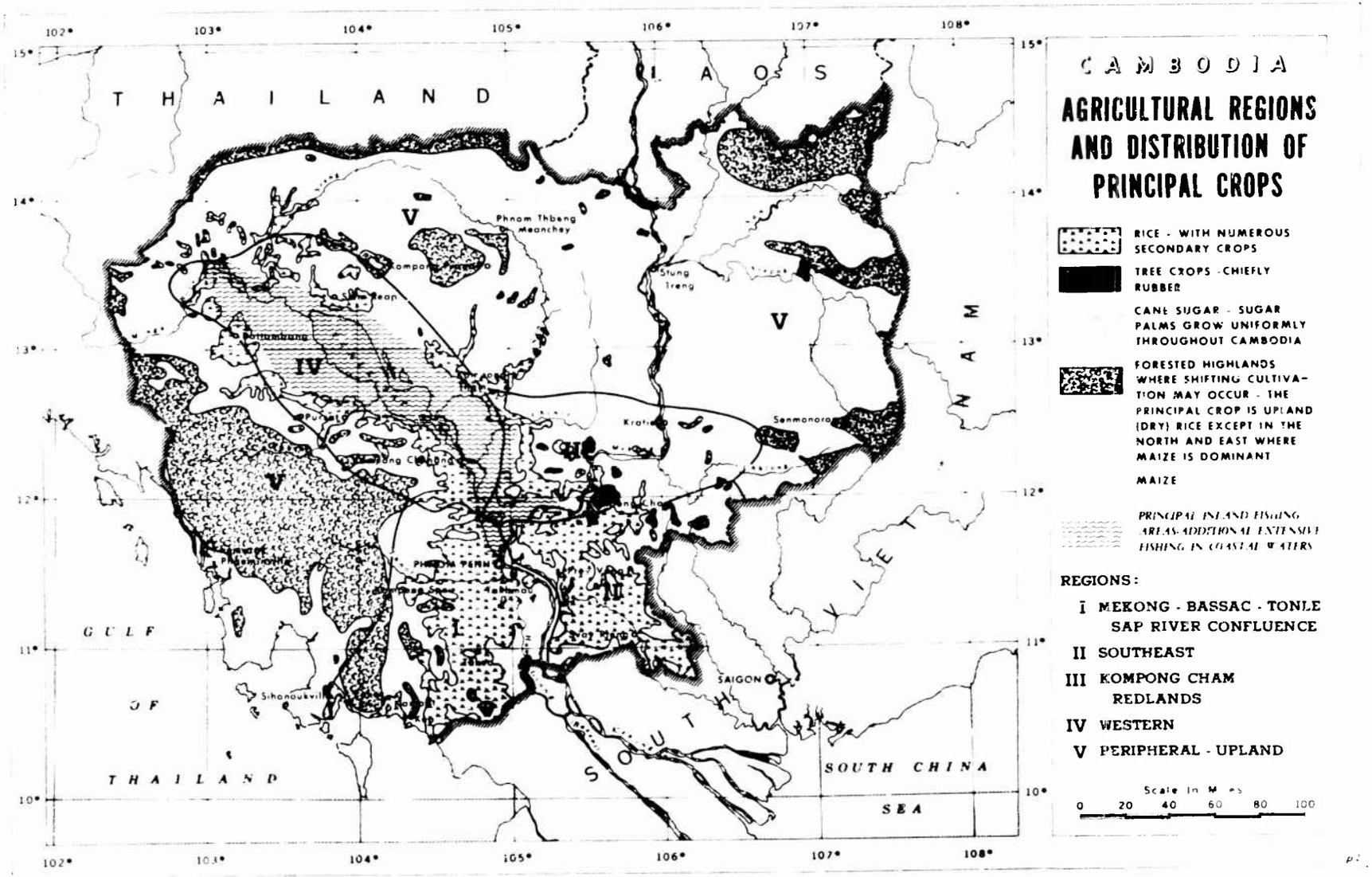
CAMBODIA
AGRICULTURAL REGIONS AND DISTRIBUTION OF PRINCIPAL CROPS
RICE - WITH NUMEROUS SECONDARY CROPS
TREE CROPS - CHIEFLY RUBBER
CANE SUGAR - SUGAR PALMS GROW UNIFORMLY THROUGHOUT CAMBODIA
FORESTED HIGHLANDS WHERE SHIFTING CULTIVATION MAY OCCUR - THE PRINCIPAL CROP IS UPLAND (DRY) RICE EXCEPT IN THE NORTH AND EAST WHERE MAIZE IS DOMINANT
MAIZE
PRINCIPAL INLAND FISHING AREAS-ADDITIONAL EXTENSIVE FISHING IN COASTAL WATERS
REGIONS:
I MEKONG - BASSAC - TONLE SAP RIVER CONFLUENCE
II SOUTHEAST
III KOMPONG CHAM REDLANDS
IV WESTERN
V PERIPHERAL - UPLAND
Scale in Miles
0 20 40 60 80 100
THAILAND
LAOS
VIET NAM
GULF OF THAILAND
SOUTH CHINA SEA
PHNOM PENH
SAIGON
Sihanoukville
Phnom Thbeng Meanchey
Stung Treng
Senmonorom
102° 103° 104° 105° 106° 107° 108°
15° 14° 13° 12° 11° 10°

Figure 7

Figure 8. Cambodia: Sketch of Land-Use Along the Mekong River

b. The Southeast Region

The Southeast Region comprises most of the territory of Prey Veng and Svay Rieng provinces on the western periphery of the Mekong Delta. Although there is some flooding of the Mekong in the immediate vicinity of the river, the distinguishing feature is the dependence of the rice farmer on direct rainfall and its impounding. Various diking and drainage techniques are employed which control the water level somewhat more effectively than is the case in the Mekong-Tonle Sap region. The Southeast is primarily a rice producer with some corn along the Mekong and sugar cane near the Vietnamese border.

c. The Kompong Cham Redlands

North of the Southeast Region, centered in Kompong Cham province, lies a slightly elevated region with fertile red soils of volcanic origin. This is the Kompong Cham Redlands. Part of the region is situated along the Mekong and produces a moderate amount of rice. However, the agricultural value derives principally from its suitability for rubber, cotton, tobacco, and corn. Of these crops, rubber is by far the most important in terms of both acreage and value.

d. The Western Region

The Western Region is centered around the Great Lake (Tonle Sap) and has several differentiating characteristics. Of primary significance is the annual flooding of the lake, a result of backing up of the waters of the Mekong River. As the level of the lake rises, it usually floods about 400,000 acres of the surrounding floodplain. These flooded lands, where not too deeply inundated, are used for rice cultivation, much of the rice being of the floating variety.

Rice production is highest west of the lake in Battambang province. This area was essentially unused until the French opened it for sawah cultivation. The French aimed at a system of large-scale tenure as offering the best economic return on the heavy capital outlay involved. Thus, while moderate-sized holdings remained typical in the areas of pre-French settlement, the Battambang area has much larger units. The large farms of this region are more adaptable to mechanical cultivation than most other rice-growing areas in Southeast Asia. Also, the soils are very fertile and plentiful irrigation water is available from the Mongkol Borey River. Battambang province is now the leading rice-producing area of Cambodia.

e. The Peripheral-Upland Region

This region includes the remaining territory of Cambodia. Most of it is forested and part is mountainous or hilly. The principal mountains are the Elephants in the south, the Cardamoms in the southwest, the Dang Rek in the north, and a spur of the Annamites in the east. The most numerous inhabitants of this region are the Khmer Loeu (upper Cambodians), a more primitive group than the predominant Khmer of the lowlands. The major agricultural practices are shifting cultivation and extensive cattle grazing. Upland (dry) rice is the principal crop; corn, yams, and tobacco are also raised. Some small and isolated tribes do not farm but live entirely by hunting game and foraging for wild yams. Very little surplus food is produced in this region.

In all the agricultural regions, rice is the dominant food crop. It is also Cambodia's leading export. In 1963-64 Cambodia exported 487,000 metric tons of rice valued at $57 million. The production of maize has increased considerably in recent years, and this grain is now the second most important food crop and one of the country's leading exports. Cambodia's favorable climate, fertile soils, and good drainage conditions are well suited for the intensive cultivation of a number of other crops. However, instead of multiple cropping, only a single crop is raised on most of the cultivated lands. In some areas 65 to 90 percent of the arable land is devoted to rice.

A substantial part of Cambodia's agricultural output consists of a non-food crop, rubber. Indirectly, this helps the food situation, because the income derived from rubber exports permits Cambodia to import foods that are not produced in sufficient quantities domestically. (Other agricultural exports include livestock, pepper, kapok, soybeans, fish, and sesame seed. The principal imported foods are milk and other dairy products, flour, and sugar.) If the demand for natural rubber should increase in the future, Cambodia could easily expand its acreage of trees without any decrease in food productivity. Production of supplementary crops could likewise be increased without sacrificing rice acreage.

By Southeast Asian standards, Cambodia is a prolific livestock producer. Most farm families keep cattle or water buffalo which, however, are used more for draft purposes than for food. A small group of Moslems (the Cham-Malay) near Phnom Penh raises cattle commercially to supply the urban demand for meat and for export to Vietnam and Hong Kong. The estimated livestock count on Cambodian farms in 1965 was: cattle, 1,400,000; buffalo, 500,000; and pigs, 845,000.

Far more important than livestock as a source of animal protein are Cambodia's fisheries. Over 100,000 tons of fish are caught annually, mostly fresh water carp. Since the great majority of villages in the agricultural regions are located on waterways, practically all farm families have a member or two engaged in fishing on at least a part-time basis. The Great Lake constitutes a highly productive source for both subsistence and commercial fishing.

The extremely large catch of fresh water fish is made possible by a unique freak of nature. During July the heavy monsoon rains cause the Mekong to flood. The floodwaters are unable to enter the congested distributaries of the delta, thereby causing a back pressure which reverses the flow of the Tonle Sap River. The reversed flow backs up into the Great Lake resulting in an increase of its surface from 2,700 square kilometers to 10,000 square kilometers. At the time of the rising waters, young fish born in the Mekong swim toward the Great Lake where they are attracted by an enormous amount of food from the inundated lands. As a result of the abundance of food, certain species of fish, whose length never exceeds 6 inches when caught in the Mekong during the dry season, reach 14 to 16 inches when caught in the Great Lake.

In November the waters begin to recede, and when the fish attempt to return to the Mekong many are caught in trees and bushes where they are easily taken by fish "pickers". Traps are placed along known paths of migrating fish, resulting in large catches. Numerous additional fish are taken by nets or tackle. The fish density of Tonle Sap at the height of the season is estimated to be eight tons per square kilometer, or about eight times that of the North Sea, which is one of the world's richest fishing grounds. The three months of maximum catch are December, January, and February. Since refrigeration facilities are lacking, the fish are processed as soon as possible, usually by drying or salting.

Table V summarizes production of the principal agricultural commodities of Cambodia, giving data on total production and yield per acre.

2. Procurement of Food

The point of maximum food accessibility is Phnom Penh, the capital and largest city (400,000 population), and the only true urban center in Cambodia. The city is located at the confluence of the Mekong, Tonle Sap, and Bassac Rivers, and is thus situated in the heart of a major agricultural region. The city is centrally located and has adequate transportational links with the other agricultural regions of the country. In addition to the rice production from the sawahs, nearby cattle and vegetable farms supply produce for the urban market. The main transportation routes of Cambodia focus on the capital, and the bulk of its exports and imports funnel through the city. Most of the surplus rice grown throughout Cambodia is shipped to Phnom Penh for milling.

TABLE V. PRODUCTION OF PRINCIPAL CROPS IN CAMBODIA: 1964*

Crop	Area (acres)	Production (metric tons)	Yields (lbs/acre)
Rice, paddy	5,789,680	2,570,000	980
Maize	348,270	220,000	1,390
Bananas	44,460	160,000	7,935
Rubber	100,225	50,000	1,100
Sweet potatoes & yams	9,880	31,000	6,920
Sugar	5,235	27,300	11,500
Peanuts	46,930	19,000	890
Mung beans	111,150	18,000	360
Cassava	2,470	15,000	13,390
Tobacco	41,990	8,500	450
Soybeans	17,290	6,000	765
Copra	------	5,400	------
Sesame seed	12,350	3,100	555

*FAO, U.N., Production Yearbook, 1965, Vol. 19, Rome 1966

The alluvial plains of southeastern Cambodia in Kandal, Takeo, Prey Veng, Soai Rieng, and Kampong Cham provinces are the principal areas of agriculture. Here, large quantities of rice as well as supplementary food stuffs are grown. The periphery of Tonle Sap constitutes another important rice region, and produces more surplus food because of lower population densities and the outstanding productivity of the Battambang area. Throughout the remainder of the country, production of foodstuffs is very scattered and limited in amounts, although each river usually has a few rice paddies along its course. In the mountains, plateaus, and the forests and savannas away from the rivers, very little food is produced.

3. Dietary Habits and Taboos

The diets of most Cambodians do not differ greatly from those of other inhabitants of Southeast Asia. Khmers, Chinese, and Vietnamese, the three principal ethnic groups in Cambodia, eat similar foods. Basic elements of the typical meal are rice and fish, flavored with a wide variety of spices. Fish, because of their abundance, are consumed in one form or another at nearly every meal, especially during the season of maximum catch. The three meals of the day are similar, but variety is provided by snacks obtained from the street vendors who are common in

all populated sections of the country. Fruits are generally eaten only in season, and consumption of pulses and leafy vegetables is lower than it should be. The Chinese population adds pork, a variety of leaves and shoots, and protein-rich soybeans to their diets. Many of the Vietnamese and some Chinese work on plantations which provide better and more varied meals than the average Cambodian receives. Tuk trey (similar to the Vietnamese nuoc mam), a sauce made of fermented, highly spiced fish oil, is a dietary staple for people at all social levels. Prahoc, a paste made of salted, dried fish allowed to ferment in jars, is also an important element in the typical fare.

The upper classes have better diets than those of other civilian groups. In Phnom Penh, where Western customs are more prevalent, many people consume soft drinks, ice cream, and other non-Cambodian delicacies. The poorest diets in the country are those of the Khmer Loeu, upland people who practice shifting cultivation. These primitive people are believed to have considerable malnutrition. Although no recent nutritional surveys of the Cambodian population have been made, it is estimated that the average caloric intake is about 2,000 per day.

As in other parts of Southeast Asia, there are several superstitions or taboos that affect diets. Large, protuberant stomachs in children are considered by many Cambodian mothers as evidence of excessive consumption of fish, although the actual cause is either insufficient protein intake or intestinal worms. Solid foods are sometimes withheld from infants until they are at least 10 months old, the belief being that these foods are too rich for the baby's stomach. The first menstrual period of a girl is the occasion for a change in her diet. The girl is cloistered for a period that may vary from a few days to a few months, depending on the rank and social status of the father. During this time she must refrain from eating foods other than rice, fruits, and vegetables. The diet of pregnant women is limited by the desire to keep the child small, but there are few taboos against specific foods. A majority of the population of Cambodia is Buddhist and is therefore prohibited from slaughtering animals. However, they are permitted to eat meat slaughtered by non-Buddhists, and there is no prohibition against killing fish.

4. Vulnerability of the Food Supply

In normal times Cambodia's food supply is adequate. The country's subsistence economy is well adapted to survive most war-time situations, except perhaps for an all-out conflict or a long period of insurgency. There is no record of starvation or acute malnutrition occurring in Cambodia during World War II when communications with the outside world were completely severed.

Natural disasters normally do not have great influence on Cambodia's food production. Rainfall is not highly variable and flood conditions are fairly consistent from year to year. Overflooding or underflooding (with respect to normals) do not usually pose serious problems, although they may necessitate a temporary shift to new lands to maintain the level of productivity. Construction of water control projects and irrigation facilities would provide a greater measure of assurance for the constancy of the food supply.

V. The Food Resources of Laos

Subsistence agriculture dominates the economy of Laos to a degree unsurpassed in any other country of Southeast Asia. The people of Laos have reasonably adequate diets largely because of this reliance on home-grown food products. Yet, little surplus food is available for export, probably because this aspect of the economy has not been emphasized. As part of former French Indochina, Laos received only limited attention from France in comparison to its neighbors. Its principal ethnic groups tend toward conservatism and, because of the mountainous, inaccessible nature of the land, have been subjected to long periods of cultural isolation. Consequently, agriculture has tended to remain relatively primitive. Even today, it is estimated that 95 percent of all Laotians earn their living from types of subsistence farming that have changed little for centuries.

Several aspects of the geography of Laos are of importance in understanding the nature of the country's dietary problems. It is the only landlocked country in Southeast Asia, and it suffers the disadvantage of having no ocean port within its own territory. Laos shares common boundaries with six nations; namely, Thailand, Burma, North Vietnam, South Vietnam, Cambodia, and China. It is, therefore, entirely dependent on its neighbors for contact with the outside world, a condition posing grave diplomatic and military problems for a small, weak state such as Laos. In terms of physical geography, the country has a higher proportion of its land in hilly or mountainous terrain than any other state in Southeast Asia. The only substantial area of alluvial plains is situated along the Mekong River, but the territory encompassed by these plains is small in comparison to other countries in the study area. Partly because of its rugged topography and partly because of its primitive economy, Laos has the least developed transportation system in Southeast Asia.

1. Regional Differences

Laos has an estimated population of approximately 2.5 million people, most of whom are farmers living in small villages. Although the country has numerous ethnic groups, the population may be conveniently

divided into lowland dwellers who live along the Mekong River and upland dwellers who inhabit most of the remaining territory. The lowland dwellers are predominantly Lao, the most important ethnic group in the country. The upland areas are sparsely populated by tribal Tai, Kha, and Meo people who practice shifting cultivation. Despite these differences of location and ethnic types, most Laotians grow rice as their principal crop, although in the lowlands it is wet-rice and in the uplands it is dry-rice. The average density of population for the whole country is about 36 people per square mile, but densities are considerably higher in the rice-growing valleys. Arable land comprises only about 8 percent of the total land area, and agricultural land per capita is only 2 acres.

Most of the supplementary crops grown in Laos, such as maize, spices, vegetables, and fruits are typical of other parts of Southeast Asia. Laos differs from its neighbors principally in the extreme primitiveness of its agriculture and consequent low yields of rice and other crops. Unlike other countries within the study area, Laos has never had a substantial development of plantation agriculture, largely because the French considered transportation costs too high to warrant investment in the area. Cash crops make only minor contributions to the Laotian economy, although there is some scattered production of coffee, rubber, opium poppies, tea, cotton, and tobacco.

Before World War II, Laos produced substantial quantities of livestock, primarily cattle and water buffalo. Output was sufficient to satisfy domestic needs and to provide a small surplus for export. Long years of warfare, with consequent decimation and neglect, have depleted the herds. The government is attempting to rebuild the livestock population to the point where exports are again possible. Several of the plateau areas of Laos are considered to be well adapted to cattle grazing.

The principal source of animal protein is fish. Laos has no salt-water fisheries, but the Mekong and its tributaries are rich sources of fresh-water fish. Most of the catch is used for subsistence by the fishermen and their families, but a small quantity reaches the market-places of the villages and the larger centers of population. "The Laotians are noted for their love of fishing, and the typical rice farmer spends a considerable portion of his time in this activity, which to him is a source of pleasure as well as an important addition to his diet."*

*LeBar, Frank and Suddard, Adrienne, editors, Laos: Its People, Its Society, Its Culture, New Haven, Connecticut: Human Relations Area Files Press, 1960, p. 205

Laos has only two agricultural regions that are sufficiently different to be distinguished here. The most important is the area of alluvial floodplains along the Mekong and its tributaries. This region is composed of several disconnected subregions bordering the river, with most of the cultivated land adjoining the principal settlements of Luang Prabang, Vientiane, Savannakhet, and Pakse. Production of wet-rice predominates in all the floodplains. The southern part of the Mekong Valley has a larger and more reliable output of rice than the north. In the north, supplementary crops, particularly corn (maize), are grown to insure against food shortages resulting from below average rice yields. In addition to the two major subsistence crops, most farmers grow a wide variety of fruits and vegetables in family gardens.

The other agricultural region of Laos is a diverse area of hills, mountains, and plateaus. Agriculturally, it is an area of shifting cultivation, which in Laos is called ray. Most of the primitive tribal groups living in this region use a slash and burn technique for clearing the land. Dry-rice is the primary crop, although a few groups in the north prefer to grow maize. The hill people supplement their meager agricultural output by gathering edible plants (fruits, greens) and hunting wild animals both large and small.

The agricultural regions and cultivated land of Laos are illustrated in Figure 9. Table VI gives data on the production and yields of the major crops raised in Laos.

TABLE VI. PRODUCTION OF PRINCIPAL CROPS AND LIVESTOCK IN LAOS: 1964*

Crop	Area (acres)	Production (metric tons)	Yields (lbs/acre)
Rice, paddy	1,482,000	520,000	775
Maize	98,800	19,000	425
Potatoes (white)	4,940	14,000	6,250
Sweet Potatoes & yams	4,940	12,000	5,355
Cassava	2,470	9,000	8,035
Cottonseed	14,820	3,000	450
Tobacco	12,350	3,000	535
Peanuts	4,940	1,000	450
Livestock (numbers)			
Pigs	600,000		
Buffaloes	450,000		
Cattle	300,000		

*Source: FAO, United Nations, Production Yearbook, 1965, Vol. 19, Rome, 1966

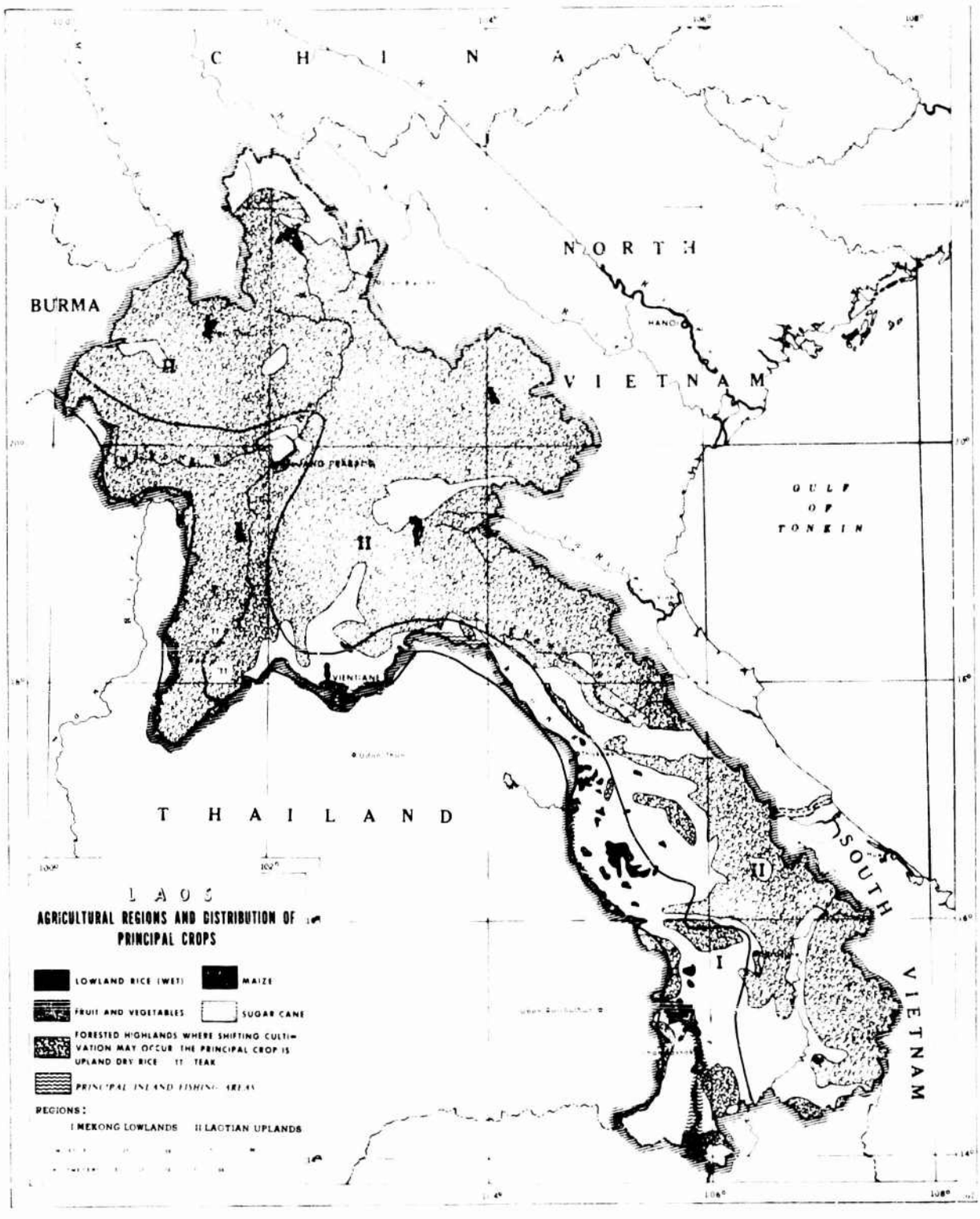
C H I N A
NORTH
VIETNAM
BURMA
HANOI
GULF OF TONKIN
VIENTIANE
T H A I L A N D
SOUTH VIETNAM
LAOS
AGRICULTURAL REGIONS AND DISTRIBUTION OF PRINCIPAL CROPS
LOWLAND RICE (WET)
MAIZE
FRUIT AND VEGETABLES
SUGAR CANE
FORESTED HIGHLANDS WHERE SHIFTING CULTIVATION MAY OCCUR THE PRINCIPAL CROP IS UPLAND DRY RICE II TEAK
REGIONS:
I MEKONG LOWLANDS II LAOTIAN UPLANDS

Figure 9

2. Procurement of Food

Laos has been, in recent years, a net importer of food (principally rice from Thailand), and consequently it has little surplus food available for procurement. The locus of maximum food availability is along the Mekong, which is the principal food-growing region and the main transportation artery of the country. Vientiane, with a population of about 75,000 is the only settlement of any appreciable size and is the leading market center. However, it ranks far below Saigon, Hanoi, or even Phnom Penh in terms of food availability. In fact, most of the food produced in Laos is consumed in the small farm villages clustered along the Mekong or hidden in the hills, and very little finds its way into commerce.

3. Dietary Habits and Taboos

Although no nutritional surveys have been conducted in Laos, it is reasonably certain that the Laotian diet is similar to that of the Cambodian or Vietnamese. One slight difference is the preference for glutinous (or sticky) rice in Laos, as opposed to non-glutinous rice in the other countries. The mainstays of the Laotian diet are rice or maize, vegetables, fish or fish sauce, meat, eggs, and fruit. Meat is usually eaten only on special occasions, but fresh fish and eggs are consumed more often. Many meals consist of little more than glutinous rice and pimentoes, with the addition of padek, the universal fish sauce or paste that is similar to the Vietnamese nuoc mam. Exactly how much of these foods is consumed is impossible to state, but, with allowance for the belief that the typical Laotian eats with moderation, it is estimated that the average adult ingests about one pound of rice per day.

The Laotian exhibits few food prejudices and his diet apparently is not greatly influenced by taboos. When crop failures occur, he will eat nearly anything to survive, including insects, frogs, and wild plants. The foods traditionally disliked and rarely consumed by Laotians are milk and milk products such as butter and cheese. Many town dwellers, however, have acquired a taste for sweetened canned milk recently and attempts have been made to establish dairy cattle in some of the plateau areas.

4. Vulnerability of the Food Supply

Although it has been necessary to import some rice from Thailand in the last several years, Laos normally has a nearly self-contained economy. The majority of the people rely on trade for a very minor part of their food supply. Because of this relatively high level of

self-sufficiency, Laos' food economy is less vulnerable to war than any other country in Southeast Asia. It is likely, however, that the food supplies of the cities would be drastically reduced if enemy forces gained control of the Mekong River, preventing movement of food from the agricultural areas. No appreciable change in the food habits of the people was noted during World War II, but the recent insurgency of the Pathet Lao has been cited as a factor in the slightly smaller crop production of the last several years.

The climate of Laos is relatively uniform from year to year, but rainfall may be either too light or too heavy, or it may arrive at an inopportune time for maximum agricultural benefit. If weather conditions deviate from normal, the Mekong may respond with below-or-above average floodwaters. Either event can lead to a greatly reduced rice crop. Underflooding is a greater threat in the north: for this reason dry crops such as maize are often planted as a hedge against drought. Excessive flooding is more likely in the south. Water control projects along the Mekong would do much to remove the danger of potential famine.

VI. The Food Resources of Malaya* and Singapore

Malaya is the only political unit in Southeast Asia where rice acreage ranks second to that of another crop. The area devoted to culture of the rubber tree is considerably larger than the space alloted to rice cultivation. However, rice is the leading food crop by far. Because of Malaya's emphasis on rubber production, a large proportion of its foodstuffs must be imported. No other Southeast Asian country imports as high a percentage of its food requirements. With large exports of rubber and tin, Malaya has experienced a high level of prosperity in recent years and, despite food deficits, is able to provide its citizens with the best diet in this part of the world.

In many respects Malaya is a geographic anomaly within the study area. Climatically, it stands alone as the only truly equatorial section of Southeast Asia. Except in the far north, Malaya has no dry season and the temperature regime is remarkably similar throughout the entire year.

*Malaya is that part of the Federation of Malaysia which occupies the southern portion of the Malay Peninsula. The remainder of Malaysia is not included in this discussion because it is not a part of Mainland Southeast Asia. The state of Singapore, an island at the southern tip of the peninsula, is now politically independent but still retains a close geographic and economic association with Malaya. Therefore, it is included in this chapter.

In terms of population composition also, Malaya is unique. It is the only country in which two important ethnic groups vie for numerical supremacy. The Malays comprise about 49 percent of the total population of 8 million and the Chinese about 39 percent. However, in Singapore (population 2 million) and Malaya together, Chinese are slightly more numerous than Malays. A third group, Indians, constitutes over 10 percent of the population and is an important minority. The Malays are the only substantial representation of the Moslem religion and the Indians are the only large body of Hindus in Mainland Southeast Asia. The great economic contrast between the prosperous Chinese and the relatively poor Malays represents a major problem for this country.

In many other respects, Malaya resembles its neighbors to the north. Rice is the dominant foodstuff here as elsewhere. Fish is the leading source of animal protein. Much land goes unused or is given over to shifting cultivation. Many of the supplementary foods used in Malaya are also consumed in other parts of Southeast Asia. And the patterns of malnutrition in Malaya are not greatly different from those found elsewhere in the study area.

1. Regional Differences

In terms of the character and availability of domestic foods, Malaya may be divided into three regions: (1) the West Coast; (2) the East Coast and (3) the Upland Interior. Figure 10 indicates the location of these regions and the distribution of the principal crops produced in Malaya.

a. The West Coast

The alluvial plains and low lateritic hills of the west coast constitute the principal agricultural province of Malaya. Here, conditions are generally better suited for most crops than they are in the remainder of Malaya. Sawah-grown rice is the dominant food crop in this region, although rubber trees occupy considerably more land and have greater value. Rice production tends to be concentrated in the north and central portions of the coast where alluvial soils are more abundant and the climate is more favorable. In addition to rice and rubber, other important crops are coconuts, oil palm, and pineapples, all of which are grown mainly in the south. Pineapple, a leading cash crop, is cultivated exclusively in the extreme southwest where modern, scientific methods of agriculture are employed on large estates.

Many additional subsistence and cash crops are raised in the west, but none occupies a large percentage of the cultivated area. Numerous small farms have orchards with such fruit trees as durian, rambutan, mangosteen, banana, and mandarin orange. Vegetables are also grown on

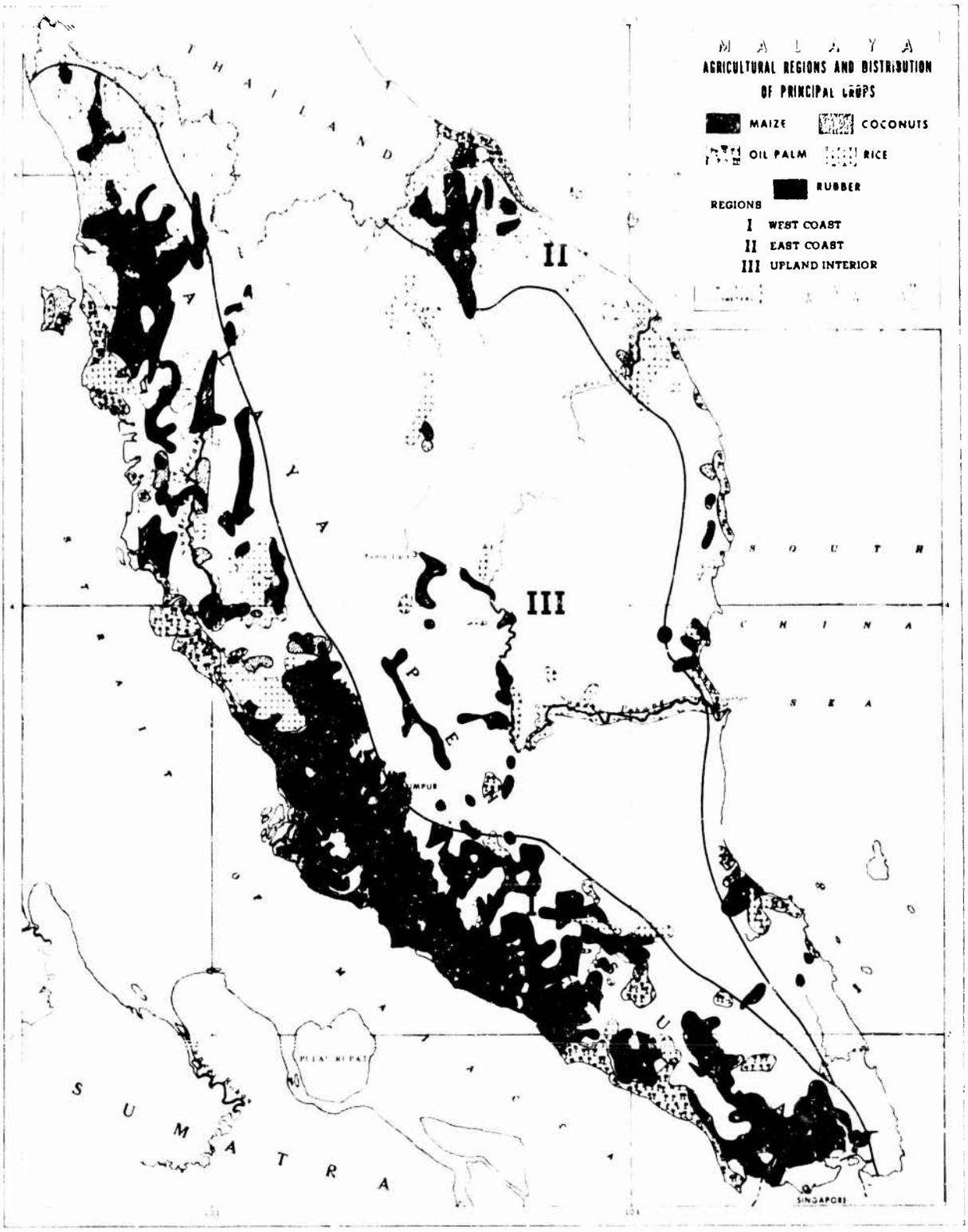
M A L A Y A
AGRICULTURAL REGIONS AND DISTRIBUTION OF PRINCIPAL CROPS
MAIZE
COCONUTS
OIL PALM
RICE
RUBBER
REGIONS
I WEST COAST
II EAST COAST
III UPLAND INTERIOR
THAILAND
II
III
SOUTH CHINA SEA
SUMATRA
SINGAPORE

Figure 10

most farms, although there is an increasing tendency for them to be concentrated around the large cities. Chinese gardeners generally achieve the highest vegetable yields as a result of their use of fertilizers and chemical pesticides. Cassava, tea, cocoa, and coffee are produced in small quantities. A few cattle, many pigs, and considerable poultry are raised in the west coast; however, most people depend on the fish catch for their primary source of animal protein.

b. The East Coast

Agriculture on the east coast is similar to that of the west coast except that there is much less of it. This is due in part to the lack of readily available arable land and in part to the northeast monsoon which subjects the area to drenching rains from November until March. Unlike the west coast, where there is a nearly continuous band of cultivation from north to south, production along the east coast is concentrated in a few isolated pockets. The bulk of the rice, rubber, and coconut crops are produced in the extreme northeast.

c. The Upland Interior

The interior of Malaya is a mountainous area of thick jungles and tropical rainforests, where little food is produced. Agriculture consists for the most part of a primitive shifting cultivation practiced by a relatively small number of aborigines. However, there are a few sites where a more advanced agriculture has developed, especially along the larger rivers emanating from the mountains. Small quantities of rice and rubber are grown in these areas. In places where transportation facilities are available, Chinese gardeners have established terraced hillside farms where they are able to raise temperate-climate vegetables such as tomatoes, cabbage, carrots, and peas for the urban market.

Most of the food production of Malaya is in the hands of Malay subsistence farmers, who are unable to grow sufficient food to feed the entire population. Consequently, it has been necessary to import considerable quantities of food, although in recent years domestic production of rice and a few other crops has increased substantially. Much of the increase in rice production is the result of recently developed irrigation facilities and the adoption of double-cropping in areas where only single-cropping had been practiced before.

The general food situation for the Federation of Malaya (prior to the creation of Malaysia) is shown in Table VII.

TABLE VII. FOOD BALANCE SHEET, FEDERATION OF MALAYA: 1961*

Food	SUPPLY		CONSUMPTION	
	Production (1000 metric tons)	Net Imports (1000 metric tons)	Nutrients per Capita per year** Protein (Gms)	Calories
Meat	30	10	852	14,200
Milk	20	136	741	12,300
Fats (coconut, peanut, animal)	79	-13	---	80,900
Fish	159	-20	2,915	22,350
Poultry (chicken, duck)	19	2	380	5,600
Eggs	13	7	457	5,560
Sugar	---	181	---	97,600
Rice	615	320	8,850	468,000
Wheat	---	132	1,860	63,500
Maize	---	33	410	16,150
Peanuts	2	9	245	5,300
Soybeans	---	14	714	6,720
Other dry pulses (mung beans, gram)	---	23	762	10,800
Potatoes	---	18	54	2,250
Sweet potatoes & yams	24	---	60	3,980
Other vegetables (long beans, onions, cabbage, etc.)	195	---	410	8,250
Total per capita per year			18,710	823,460
Total per capita per day			51	2,250

NOTE: The above table does not include cassava, fruits, or wild game.

*Source: U.S. Interdepartmental Committee on Nutrition for National Defense, Federation of Malaya Nutrition Survey: September-October 1962, Washington, D.C., 1964.

**Based on an estimated population of 7,200,000.

As Table VII indicates, the bulk of the milk, sugar, and wheat consumed in Malaya is imported. About one-third of the country's rice supply is purchased from Thailand and Burma. Malaya could further reduce her rice deficit, but there is little immediate likelihood that its dependence on foreign sources for milk, wheat, and sugar can be eliminated. as long as demand for these foods remains high.

2. Procurement of Food

Because of its diverse population and relatively strong economic position, Malaya has a somewhat greater variety of foodstuffs available for procurement than the other Southeast Asian countries. However, quantities are not large because the total population is only about 8 million and the country is not a surplus producer of food. The points where the most food is available are the port cities, the most important of which are Singapore, Malacca, Port Swettenham (serving the nearby capital, Kuala Lumpur), and Penang. Singapore, although politically independent, is the leading port for Malaya; because of its function as an entrepot, it always has a considerable quantity and diversity of foods available. The various ports serve as gathering and distributing points for the imported foodstuffs which arrive from many different lands. Singapore, with over one million people, and Kuala Lumpur, with over 300,000 have both attracted considerable vegetable gardening and cattle raising to their vicinities.

Distribution of food in Malaya is aided by two favorable circumstances. The internal transportation system, especially along the west coast, is well above average for Southeast Asia. This facilitates the rapid movement of foodstuffs from one part of the country to another. Food processing and storage facilities are also above average for this part of the world, although they are not as well developed as in a typical Western country. In Malaya, where temperatures and humidities are high throughout the year and food spoils rapidly, it would be advantageous for food processing and storage equipment to be developed to a greater extent.

3. Dietary Habits and Taboos

Malaya has more variability of dietary habits than the other countries of Southeast Asia. The three racial groups--Malay, Chinese, and Indian--are notably different in their eating habits. The middle-income class, a large group in Malaya, has better diets than the lower-income class. Yet, for all classes and races, rice and fish are the staples that provide the bulk of the nutrients.

The Chinese, primarily urban dwellers or plantation workers with higher incomes than Malays or Indians, have the best diet of the three groups. They are more likely to consume Western foods such as bread, jelly, canned milk, and eggs, and they also consume large amounts of protein-rich soybean products. Another beneficial Chinese dietary habit is the embellishment of rice or other main dishes with fresh ingredients such as leaves, shoots, flowers, seeds, and roots.

The Malays have the poorest diet of the main ethnic groups. Their preference for hot, spicy condiments is harmful to their health. Garlic and onions are often added to hot sauces or relishes to stimulate the appetite. The Malays eat very small amounts of greens or other vegetables despite the fact that these are plentiful. Many of their meals consist only of rice, fish, and red peppers or other spices.

The Malays appear to have traditional prohibitions against certain foods for certain categories of people, although recently these have been decreasing under the impact of modern education. Among these are a taboo against fish for young children and the denial of certain foods to pregnant or lactating women. In extreme cases such women are allowed no meat, fish, or fruit, and must subsist entirely on rice and vegetables. The problem of nutritional disorders is greatest among the rural Malays whose food intake lacks sufficient quantities of animal proteins, vitamin A, thiamine, riboflavin, and iron.

The Indians prefer to eat their rice with curries. They also drink milk when it is obtainable, and consume various pulses such as gram and chick peas which are not normally part of the diets of the other groups. Depending on the caste to which they belong, the Hindu Indians are restricted either wholly or partly to vegetarian diets.

4. Vulnerability of the Food Supply

Because of its great dependence on imported foods and its nearly insular position, Malaya is extremely vulnerable to blockage of her few ports. If this were to occur (as during World War II), domestic food production would be insufficient to maintain the present standard of living; in fact, many people might face starvation. For these reasons it has been the policy of the Malaysian government to encourage self-sufficiency by devoting more attention to subsistence crops. In recent years this policy has resulted in significant reductions of the food deficit.

The most serious natural disasters are the torrential downpours which can cause severe soil erosion and ruin agricultural land. To control erosion it is necessary to keep a large percentage of the land under forest cover. With the exception of a few crops such as rubber and wet-rice, intensive agriculture cannot be extended into the hills and mountains without inviting serious soil erosion and destructive floods.

VII. The Food Resources of Thailand

The Kingdom of Thailand is the leading food producer of Southeast Asia, ranking slightly ahead of Burma. In recent years Thailand's rice output has increased sharply, with the result that the country has become the world's leading exporter of rice, a position formerly occupied by Burma. Production of certain other foodstuffs has also increased dramatically, and the food resource base is presently as good as that of any country in this region. Thailand's major problem lies in the strong possibility that its population growth rate will eventually exceed the rate of increase for food production, thereby lowering the standard of living. Its population of over 30 million is already the largest in Southeast Asia, and its growth rate of about 3 percent per year is among the highest on the continent.

Thailand is about the size of France and has a compact shape except for the elongated panhandle in the south. The ethnic Thais constitute a sizable majority of the population, but there are important minorities of Chinese, Malays, and various tribal groups; the last live primarily in the hilly uplands. Bangkok, a growing metropolis of nearly 2 million inhabitants, is the largest city, principal port, and economic center of the country. Between 85 and 90 percent of the people of Thailand are rural, and agriculture is by far the leading economic activity.

In terms of physical geography, Thailand's terrain features resemble those of other sections of Southeast Asia. These include a large central plain and an extensive delta dominated by a major river (Chao Phraya), a large plateau in the northeast (the Korat), a narrow, hilly peninsula in the south, and mountainous uplands in the north and west. Climatically, the country is subject to the same monsoonal influences as the rest of Southeast Asia, but, because of the sheltering effect of its mountains, the interior is somewhat drier than the coastal areas.

1. Regional Differences

Like the other countries of Southeast Asia, Thailand's food economy is based on rice. Approximately two-thirds of the cultivated land is devoted to this crop, including both wet and dry varieties.

Several other crops are produced in large quantities. The more important of these include sugar cane, maize (corn), cassava, bananas, yams and sweet potatoes, and peanuts. Table VIII summarizes production statistics for the principal crops and livestock raised in Thailand during 1965.

In terms of the character and availability of food, Thailand may be divided into four principal regions: (1) the Central Plain; (2) the Northern Region; (3) the Northeastern (Korat) Plateau; and (4) the Peninsula. Figure 11 shows the location of these regions and also indicates the distribution of the principal crops produced in Thailand.

a. The Central Plain

Central Thailand, from the Gulf of Thailand northward to the mountains, is dominated by a large plain variously referred to as the Central Plain, the Chao Phraya Plain, or the Menam Plain. This region leads all other sections of the country in acreage of arable land and rice production. It is the economic core of the country. There are over 6 million acres of intensively cultivated land in the Central Plain, and the region produces a very large rice surplus. The Chao Phraya (also called Menam) River and its numerous connecting canals are the most important physical features of the area. The river provides water for irrigation and is also a major transportation artery. Trade activity within the region focuses on Bangkok which is situated on the banks of the Chao Phraya.

The type of agricultural economy that has developed in the Central Plain is very nearly monocultural. In the delta of the Chao Phraya, where most of the land remains flooded until January or later, the raising of a second crop is nearly impossible. Except for small but intensively cultivated areas of Chinese market gardens in the vicinity of Bangkok and other towns, the region is "one vast sea of paddy."* Apart from rice cultivation, only fishing and duck keeping are of much importance. However, on the fringes of the plain, particularly in the southeast and along the coast, a little more variety is apparent. The southeast, where elevations are higher and rainfall greater, produces substantial quantities of cassava and sugar cane, along with the non-food crop of rubber. Coconut groves and fruit orchards are conspicuous near the mouth of the delta and in the coastal sections of the southeast. On the northern, eastern, and western edges of the delta, where drainage is better, considerable corn (maize) is grown.

*Fisher, Charles A., Southeast Asia: A Social, Economic and Political Geography. London, Methuen, 1964, p. 496.

TABLE VIII. PRODUCTION OF PRINCIPAL CROPS AND LIVESTOCK IN THAILAND: 1964*

Crop	Area (acres)	Production (metric tons)	Yields (lbs/acre)
Rice, paddy	14,810,650	9,625,000	1,430
Sugar cane	370,500	4,750,000	28,200
Cassava	271,700	2,025,000	16,430
Maize	1,071,980	950,000	2,090
Bananas	261,820	707,000	5,955
Pineapples	-------	303,000	------
Sweet potatoes and yams	69,160	208,000	6,630
Cabbages	79,040	171,000	4,770
Peanuts	237,120	120,000	1,115
Dry beans	244,530	116,000	1,046
Soybeans	86,450	40,000	1,020
Green beans	39,520	35,000	1,950
Onions	34,580	32,000	2,040
Cottonseed	172,900	32,000	410
Cauliflowers	9,880	22,000	4,910
Sesame seed	46,930	17,000	800
Livestock (numbers)			
Buffaloes	7,087,000		
Cattle	5,347,000		
Pigs	4,283,000		

*Source: FAO, United Nations, Production Yearbook, 1965, Vol. 19, Rome, 1966.

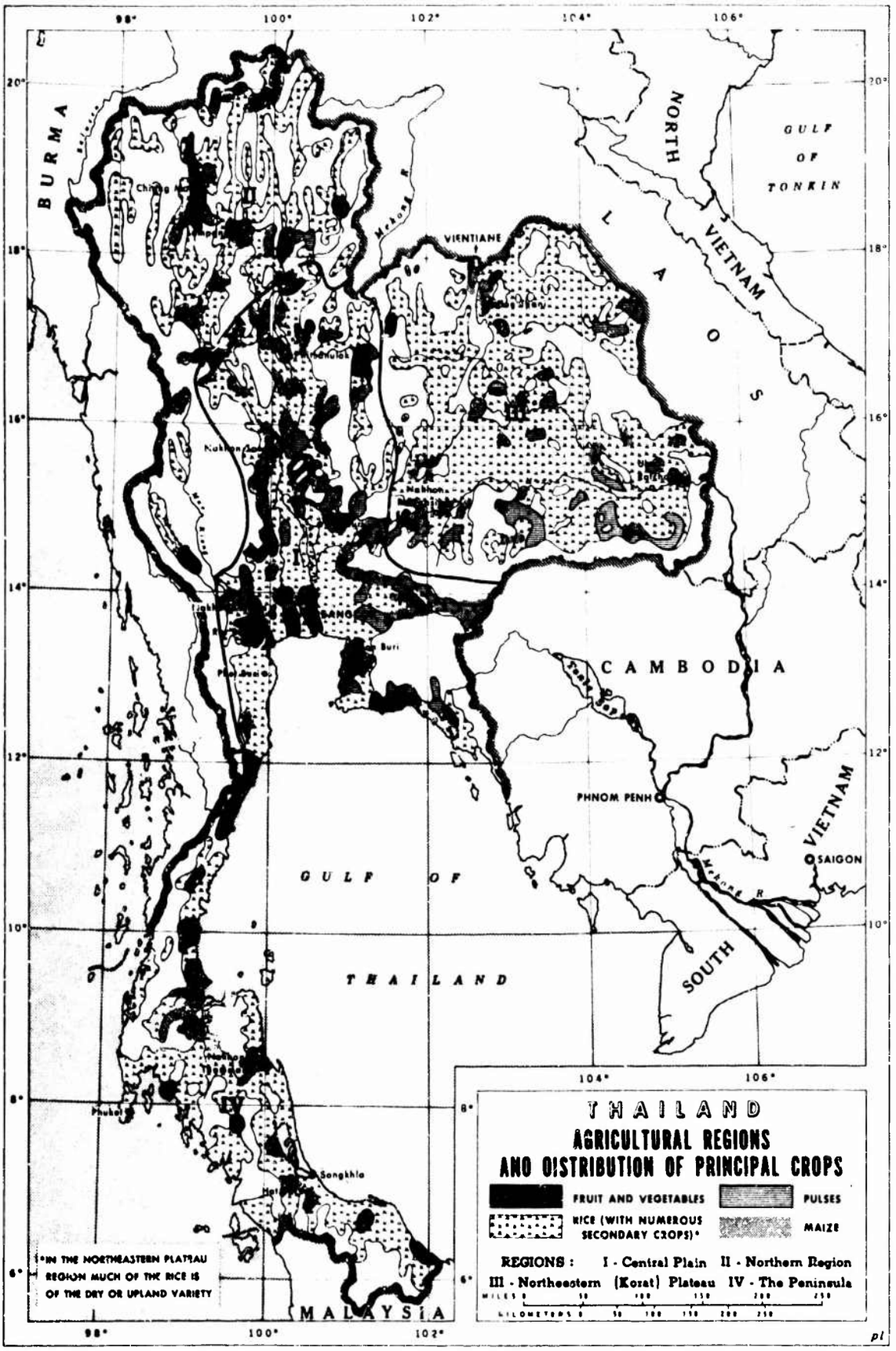
BURMA
LAOS
CAMBODIA
THAILAND
MALAYSIA
VIETNAM
NORTH VIETNAM
SOUTH VIETNAM
GULF OF TONKIN
GULF OF THAILAND
VIENTIANE
PHNOM PENH
SAIGON
Mekong R.
Songkhla
Phuket
98°
100°
102°
104°
106°
20°
18°
16°
14°
12°
10°
8°
6°
THAILAND
AGRICULTURAL REGIONS
AND DISTRIBUTION OF PRINCIPAL CROPS
FRUIT AND VEGETABLES
PULSES
RICE (WITH NUMEROUS SECONDARY CROPS)*
MAIZE
REGIONS : I - Central Plain II - Northern Region
III - Northeastern (Korat) Plateau IV - The Peninsula
MILES 0 50 100 150 200 250
KILOMETERS 0 50 100 150 200 250
*IN THE NORTHEASTERN PLATEAU REGION MUCH OF THE RICE IS OF THE DRY OR UPLAND VARIETY
pl

Figure 11

b. The Northern Region

This region, which includes the western section of Thailand in addition to the north, is sometimes referred to as the Northern Highlands because of its decidedly mountainous character. Despite the generally unfavorable terrain, a certain amount of farming is possible on the gentler slopes and valley floors. However, farms occupy less than 6 percent of the total land area in this densely forested area. Teak logging, rather than rice farming, is the leading economic activity. Over much of the region, shifting cultivation (here called tamrai) is the only form of agriculture. Intensive rice cultivation is possible only in the four broad, open valleys of the rivers Ping, Wang, Yom, and Nan, which are major tributaries of the Chao Phraya. Irrigation is a necessity because of low rainfall and a relatively short growing season, but the river valleys are well adapted to the use of simple water-distribution techniques. A fairly intensive system of agriculture has developed in the valleys, based on rice as the wet-season crop and beans, vegetables, peanuts, cotton, and tobacco as secondary crops in the dry season. The shortness of the summer growing season requires planting a fast-ripening glutinous type of rice, the grains of which stick together when cooked. In part because of the small overseas demand for glutinous rice, and in part because of the great distance from seaports, no serious attempt has been made to develop export production.

c. The Northeastern Plateau

The northeastern section of Thailand is dominated by a gently rolling to hilly plateau called the Korat, surrounded by higher land on all sides except the southeast. The northeast has more arable land than the north, but it is of poorer quality. Like the north, this region has a relatively short growing season, and it has an even lower average rainfall. The prevailingly sandy, porous soils are the least fertile in Thailand. Except in the wide and seasonally inundated valleys of the two main rivers, the Mun and Chi, very little intensive wet-rice cultivation is possible. In the past irrigation facilities were not well developed, but in recent years the government has been sponsoring water-control projects which are beginning to effect a substantial increase in the food production of this poverty-stricken area.

Despite its adverse environment, the Korat plateau produces a considerable surplus of rice, and is responsible for about 20 percent of Thailand's rice exports. No other cash crop is very important, although cotton, tobacco, and maize are raised throughout the region. The most important economic activity of the region is cattle raising for sale in other parts of the country as well as for local use. Approximately half of Thailand's 7 million buffaloes and a similar fraction of its 5 million cattle are concentrated in the northeast. This is sufficient to provide a surplus

for sale and to furnish a useful amount of manure for the nitrogen-poor soils of the region. Away from the rivers, and more especially in the outer foothills and mountains, shifting cultivation of dry-rice and other subsistence crops is commonly practiced both by tribal groups and the more sophisticated Thais.

d. The Peninsula

The peninsula section of Thailand, beginning at the western mountains and extending southward to the Malayan border, is the most tropical part of the country. The region is noted for its production of non-food products, principally tin and rubber. Some rice is grown, but amounts are insufficient for local needs. Coconuts abound, and sugar cane and maize are important supplementary crops. Because of a long coastline in relation to its total area, fishing is proportionately more important here than in any other region of Thailand.

2. Procurement of Food

Thailand is one of the leading granaries of Southeast Asia and normally exports large quantities of rice and maize. Several other foodstuffs are also produced in relative abundance. Rice is the country's leading export; in 1963-64, for example, rice exports totaled 1,898 million metric tons with a value of $211 million and represented 36 percent of Thailand's export trade. The only major foods imported are milk, sugar, and wheat flour. As a consequence Thailand has larger quantities of food available for military procurement than any other country in Southeast Asia. Food production is constantly increasing and is much greater now than 10 years ago. However, the trend toward increased production may be interrupted by occasional poor-crop years. Thailand's advantageous food situation will probably continue as long as the rate of increase for food production remains ahead of the rate of increase for population.

The capital and largest city, Bangkok, is the point of maximum food availability in Thailand. The city is situated near the southern margin of the country's most important agricultural region, and its connections with this and other agricultural provinces are the best in the Kingdom. Bangkok is a port city on the Chao Phraya River, the most important internal transportation artery in the country; thus it serves as a natural collection point for much surplus food which is destined for export. The railroad network of Thailand also focuses on Bangkok and considerable food arrives by rail. Bangkok's marketplaces and storage facilities are among the best stocked in Southeast Asia.

No other city in Thailand is comparable to Bangkok in terms of food availability, though each village in the Central Plain is capable of supplying modest amounts of surplus foods. In the north there is little excess food, because the principal cash crops are tobacco and cotton.

In the northeast livestock are present in appreciable quantities. On the peninsula the only abundant surplus item is coconuts. Most of the hilly and mountainous parts of Thailand are used only for shifting cultivation, and there is little surplus food in these isolated sections.

3. Dietary Habits and Taboos

The dietary habits of the Thai are much the same as those of the peoples already considered. The familiar reliance on rice and fish for calorie and protein requirements is apparent everywhere. Unfortunately, much of the rice now consumed in Thailand is the highly milled variety, which is dangerously lacking in thiamine. Although fish production is substantial, it is not enough to provide sufficient protein intake for the people throughout the country. Fish catches could be, and are being considerably increased, thus adding significantly to the nutrient value of the Thai diet. The fish catch rose from 213,000 tons in 1955 to 615,000 tons in 1965, and consumption per individual nearly doubled.*

Fresh fruits and vegetables are available in large quantities in some parts of the country, but are often in short supply in the dry northeast. Even when fruits and vegetables are available and cheap, many Thais do not eat sufficient quantities to maintain good health. Under the urging of the government, vegetable production has risen markedly in the last several years. In 1959, production was only 262,000 tons, but by 1964 it had risen to 565,000 tons. Fruit production has increased more slowly.

Pulses (beans and peas) constitute a potentially rich source of proteins and vitamins, but until recently they were eaten in very small quantities. The Thai eat them sprouted, as noodles, in sweet cakes, and in curries; however, these dishes are considered special and are consumed mostly on festival or weekly-market days rather than as daily staples. The Thai government has attempted to increase production of pulses because they have prestige value and are popular with the people.

Eggs are eaten in very small quantities by most people although they are produced in nearly every homestead in rural areas. Most farmers sell them for cash in the cities where they are consumed by the well-to-do. Considerable meat is produced in Thailand, but the average peasant consumes little of it. In 1964 the total registered slaughter of livestock was 42,395 buffaloes, 50,000 cattle, and 558,614 pigs. When one considers that Thailand has a population of 30 million people, it is obvious that per capita consumption of meat is low.

A summarization of the diet of the average civilian is provided in Table IX, a food balance sheet for Thailand:

*Thailand, Division of Agriculture Economics, Ministry of Agriculture, Thailand Agricultural Statistics, Bangkok, October 1966.

TABLE IX. FOOD BALANCE SHEET FOR THAILAND: 1958*

Food	SUPPLY: Production (1,000 m. tons)	SUPPLY: Imports (+) or Exports (-) (1000 m. tons)	CONSUMPTION: Food per Capita per Year, (lbs.)	CONSUMPTION: Calories per Capita per Day
Cereals				
Rice	4,582	-1,133	317.0	1,420
Wheat	--	+36	2.6	10
Corn	186	-163	2.2	10
Starchy roots tubers	213	-125	9.0	10
Pulses, nuts, seeds	186	-26	13.0	60
Vegetables	559	-4	51.0	15
Sugar	166	+17	19.0	85
Fruits, including coconuts	1,481	--	107.0	210
Meat	209	--	22.0	65
Eggs	110	-7	11.0	20
Fish	600	-9	60.0	135
Milk	2	+88	9.0	125
Total calories per person per day =				2,185

*Source: U.S. Interdepartmental Committee on Nutrition for National Defense, The Kingdom of Thailand Nutrition Survey: October-December 1960, Washington, D.C., May 1963.

It is obvious from the above table that far too much of the caloric intake in the Thai diet is derived from rice, and insufficient amounts come from such protective foods as meat, vegetables, eggs, and pulses. However, these data are for 1958, and diets have improved somewhat since that time.

Many of the food taboos associated with other nations of Southeast Asia are pertinent to Thailand also, especially those that are applicable to children and pregnant or lactating women. Eggs and fish, for example, are often forbidden to these groups. Many taboos are disappearing under the impact of modernization and improved education, although they tend to persist in the more isolated rural areas. Because of the teachings of their Buddhist faith, the Thai do not kill livestock, but many will eat meat that has been slaughtered by non-Buddhists.

4. Vulnerability of the Food Supply

Since both the Thai diet and economy are highly dependent on the availability of rice, anything that affects this crop is of great significance. Under the present conditions of huge rice surpluses, which are mostly destined for export to other Asian countries, probably nothing short of all-out war encompassing the entire countryside would markedly reduce the amount of rice available to the average Thai. War could seriously impede the movement of rice and other foodstuffs into and out of Bangkok, which, of course, would cause food shortages in the city. Also, if Thailand were unable to export her rice surpluses, the entire economy of the country would be affected, and it is possible that much good rice-land would be abandoned.

Insufficient rainfall is an ever-present threat to Thailand's food production. With the exceptions of the peninsula and the extreme southern delta, Thailand is drier than most other rice-growing areas of Southeast Asia. In this marginal environment, below-average rainfall can cause substantial reductions of the rice crop. (An examination of production statistics indicates that rice output, in particular, fluctuates considerably from year to year.) In the past there was little development of irrigation facilities to help reduce the risk of drought, but today the Kingdom has several important projects in operation and more are planned. Excessive rainfall or destructive floods rarely cause problems in Thailand.

VIII. The Food Resources of Burma

The Union of Burma has the largest area of any state in Southeast Asia. Viewed in terms of this area, its total population of 25 million is comparatively small, and its average density of about 95 people per square mile is lower than all other countries in this study except Cambodia and Laos. Burmans are the dominant ethnic group, but significant minorities exist, particularly in the peripheral areas of the country. As a major theater of operations during World War II, Burma received more war-inflicted damage than any other nation in Southeast Asia. A British colony prior to the war, the Union has been plagued by numerous political and economic difficulties since gaining independence, and is

still in the process of achieving stability. Because of these problems, Burma's agricultural growth has been slow. This is indicated by the fact that for many years Burma was the world's leading exporter of rice, but now ranks second to Thailand.

Burma's physical geography is much like that of its neighbor, Thailand. Both have a large central plain and delta, a plateau in the northeast, a hilly, peninsular extension in the south, and enclosing mountain ranges in the north and west. Of prime economic importance to the Union are two great river systems, the Irrawaddy and Sittang, which furnish water for agriculture and serve as transportation arteries. (A third major river system, the Salween, has relatively little economic importance except for floating timber.) The coastal areas, with upwards of 150 inches of rainfall annually, are exceptionally wet for Southeast Asia; in contrast, the center of the interior plain averages less than 40 inches of rain per year.

1. Regional Differences

Because of its size, topographic diversity, and latitudinal extent, Burma has more distinct agricultural regions than any other Southeast Asian country. The major regions are: (1) the Arakan Coast; (2) the Tenasserim Coast; (3) the Irrawaddy Delta; (4) the Dry-Zone; (5) the Valley Land; and (6) the Upland Zones of Shifting Cultivation. The agricultural regions are shown in Figure 12.

a. The Arakan Coast

The western littoral of Burma, north of the Irrawaddy Delta, is called the Arakan Coast. It is a rugged area of mountain and valley topography lying transverse to the southwest monsoon; as a consequence, it receives over 200 inches of precipitation per year. Although the cultivated area is relatively small, the valleys are fertile and normally produce sufficient rice for local needs and a moderate surplus for export. Other crops are produced chiefly for subsistence and include tobacco, vegetables, fruits, maize, and millet. Fish constitutes a dietary mainstay.

b. The Tenasserim Coast

The coastal area south of the Irrawaddy delta and adjacent to Thailand is called the Tenasserim coast. It is similar to the Arakan coast in terms of topography and rainfall but, because of its lower latitude, it produces rubber and coconuts in addition to the usual rice crop. It is a producer of surplus rice though total amounts are not large. Sugar cane, tropical fruits, and vegetables are the other leading food crops in this region. Salt-water fish are the most important source of animal protein.

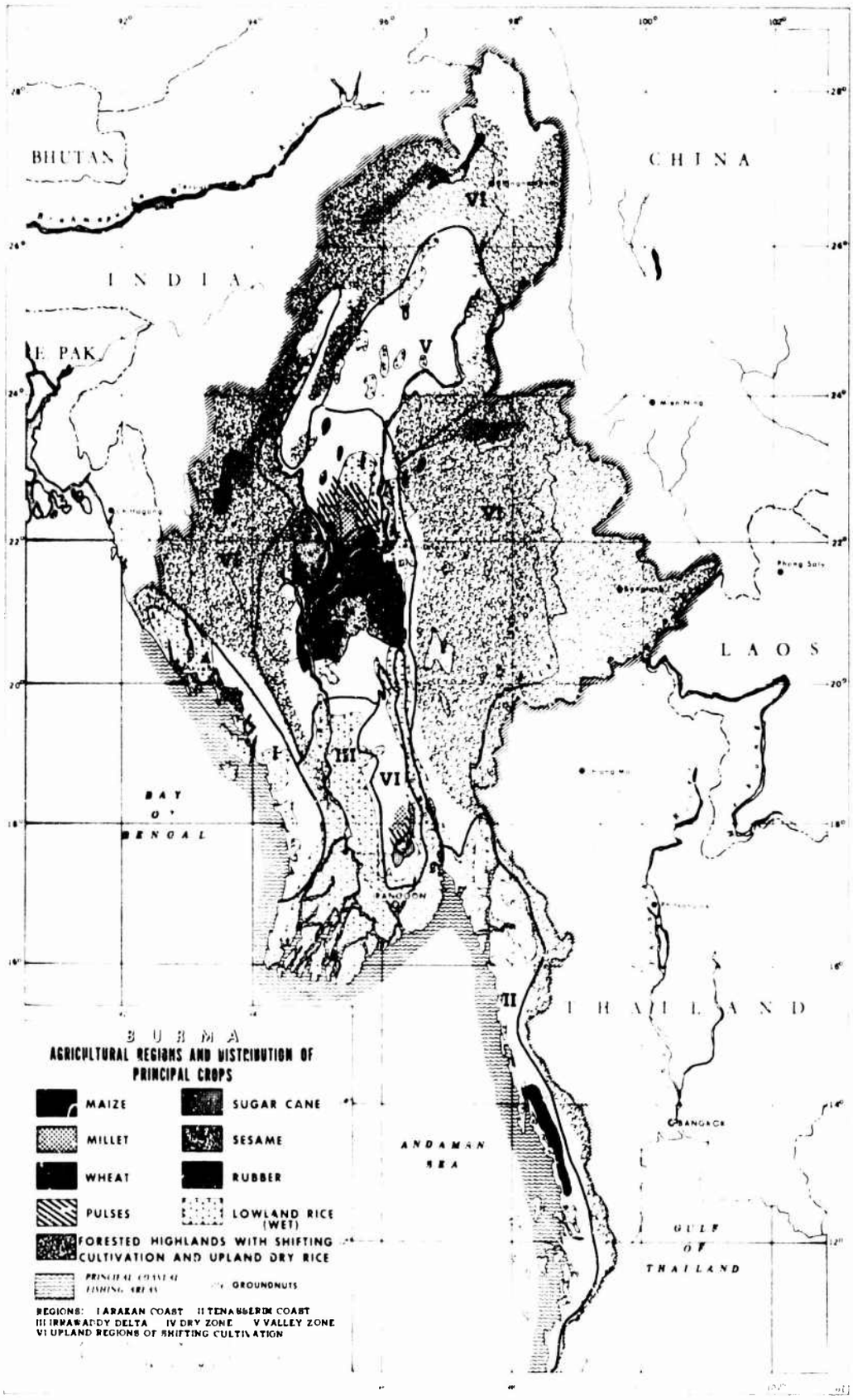
BHUTAN
CHINA
INDIA
E. PAK.
LAOS
BAY OF BENGAL
THAILAND
ANDAMAN SEA
GULF OF THAILAND
BURMA
AGRICULTURAL REGIONS AND DISTRIBUTION OF PRINCIPAL CROPS
MAIZE
SUGAR CANE
MILLET
SESAME
WHEAT
RUBBER
PULSES
LOWLAND RICE (WET)
FORESTED HIGHLANDS WITH SHIFTING CULTIVATION AND UPLAND DRY RICE
GROUNDNUTS
REGIONS: I ARAKAN COAST II TENASSERIM COAST
III IRRAWADDY DELTA IV DRY ZONE V VALLEY ZONE
VI UPLAND REGIONS OF SHIFTING CULTIVATION

Figure 12

c. The Irrawaddy Delta

The delta of the Irrawaddy River is a flat, formerly swampy plain with an annual rainfall ranging from 130 inches in the south to 50 inches in the north. The alluvial soils of the region are well adapted to wet-rice cultivation. It is the largest continuous area of sawah land in Burma and one of the largest in all Southeast Asia. Although rice completely dominates the agricultural picture, maize, pulses, vegetables, tobacco, sugar cane, and a wide variety of fruits are also grown. Sittang valley on the eastern margin of the delta is the leading sugar cane area of Burma.

d. The Dry Zone

North of the delta, topographic features become more irregular and rainfall decreases to less than 50 inches per year. This region is called the Dry Zone. Over most of the area rainfall averages less than 40 inches per year, an insufficient amount for wet-rice cultivation without supplementary irrigation. Considerable development of irrigation facilities in the Dry Zone has taken place over the years. A good deal of conventional irrigation (tanks, channels, dams, canals) was developed by the Burmese kings in the Kyaukse area and other places and, between 1906 and World War II, the British completed several projects in this region. Several new irrigation facilities are now in operation or are planned. Most of the irrigated land is used for rice cultivation. Nevertheless, this densely populated region remains a rice-deficit area.

A unique characteristic of the Dry Zone is its diversity of crops, which helps to insure against a potential disaster resulting from the failure of a single crop. Among the many foodstuffs and industrial crops produced in significant quantities are millet, sesame, peanuts, gram beans, onions, wheat, maize, tobacco, and cotton.

e. The Valley Land

To the north of the dry-zone lie the valleys of the upper Irrawaddy and Chindwin Rivers. Both are bordered by densely forested hills that rise to 5,000 feet. Rainfall gradually increases northward until it reaches 90 inches in the vicinity of Myitkyina. Irrigation is relatively easy on the alluvial valley floors; consequently, there is a small surplus of rice for export. Other crops include sugar cane, maize, pulses, and vegetables. The region is self-sufficient in these foods but imports some fruit from other parts of the country.

f. The Upland Zones of Shifting Cultivation

The remaining sections of Burma consist largely of hills, mountains, and plateaus too rugged for intensive agriculture. Most of the inhabitants of these areas belong to tribal groups that are neither

Burman nor Buddhist. Their principal occupation is shifting cultivation, although a few small groups subsist largely by hunting and foraging. The total agricultural production and number of people supported by shifting cultivation are relatively small. Dry-rice, temperate climate fruits, wheat, and millet are some of the more important crops. The only area of substantial wet-rice production is along the floodplain of the Salween River which bisects the Shan plateau in eastern Burma. Several upland areas are well adapted to livestock raising and produce sufficient cattle and buffaloes for export to other parts of the country.

In terms of agricultural production for the entire country, rice is by far the leading crop. It is also Burma's number one food staple and leading export. The average Burmese consumes an estimated 302 pounds of rice per year, representing about 62 percent of his total caloric intake. In 1963-64 Burma's rice exports amounted to 1,898 million metric tons. These shipments had a value of $147 million and accounted for 62 percent of the country's foreign trade.

The second leading foodstuff in Burma is fish. Though Burma has 1,200 miles of coastline, deep sea fishing is not well developed, most fishermen continuing to use outmoded equipment and methods. Modernization of the deep-sea fishing industry could greatly increase the supply of fish. At present, however, the Burmese prefer fresh-water fish such as carp and tilapia which are much in demand and therefore fairly expensive.

Figure 11 shows the distribution of the principal crops grown in Burma. Production statistics are summarized in Table X.

2. Procurement of Food

The Irrawaddy Delta is the leading "rice bowl" of Burma and produces the largest food surpluses. The Arakan and Tenasserim coasts also are producers of surplus rice, whereas the mid-zone and the dry-zone grow more pulses, peanuts, and maize than their people consume. Much of Burma's excess food finds its way to Rangoon, where it is processed and subsequently redistributed or exported. Rangoon has also attracted vegetable gardening and cattle raising. The city is the point of maximum food availability in Burma, and is one of the leading marketplaces in all of Southeast Asia. Rangoon is favored by its position as the number one seaport of Burma, and has the best transportation connections with the most productive areas of the country. Other urban centers such as Mandalay, Moulmein, and Bassein also have plentiful amounts of food in their warehouses and marketplaces

TABLE X. PRODUCTION OF PRINCIPAL CROPS AND LIVESTOCK IN BURMA: 1964*

Crop	Area (acres)	Production (metric tons)	Yields (lbs/acre)
Rice, paddy	14,807,650	8,150,000	1,460
Sugar cane	121,030	1,084,000	22,120
Peanuts	1,306,630	345,000	580
Sesame seed	1,736,410	100,400	130
Onions	44,460	84,000	4,165
Chick peas	343,330	73,000	470
Maize	81,580	67,000	1,810
Wheat	197,600	54,000	600
Potatoes (white)	37,050	46,000	2,740
Millet	355,680	41,000	255
Dry peas	56,810	13,000	505
Livestock (numbers)			
Cattle	6,069,000		
Buffaloes	1,230,000		
Pigs	815,000		
Goats	513,000		
Sheep	135,000		

*FAO, United Nations, Production Yearbook 1965, Vol. 19, Rome, 1966.

The larger cities have most of the better food-storage facilities. For the country as a whole, these are grossly inadequate, even though substantial improvements have been made in recent years. Most of the food industries are primitive. The majority of these establishments are rice mills, only a few of which are equipped with modern machinery. Many food processors use antiquated techniques involving unsanitary practices. However, Burma is making progress in food processing, and profound changes can be expected. The quality of foodstuffs produced in the modern plants is generally much higher than that of foodstuffs produced by traditional methods, yet the price is often no higher.

3. Dietary Habits and Taboos

Like other Southeast Asian peoples, the Burmese rely heavily on rice and fish for their nourishment. A wide variety of other foods are included in the typical diet, but only rice is consumed in the quantities generally considered necessary for good nutrition. Because of the diversity of ethnic and religious groups in Burma (Burmans, Shans, Karens, Kachins, Chins, Indians, Pakistanis, and others), there are considerable variations in diets, some groups occasionally substituting other foods for rice as their primary staple.

The Burmese usually eat only two meals a day, one in the morning and the other in the evening, although a small snack may be consumed around noon. Rice is the primary constituent of both main meals, with fish, fish sauce (ngapi), and vegetables furnishing much of the remaining nutrients in the diet. Unfortunately, most housewives wash rice from 3 to 6 times before cooking and then drain off the excess water prior to boiling, thereby losing much of its vitamin content. Refrigerated storage for fresh vegetables and meat is not available for most people. Therefore, perishable products are used as soon as possible after purchase. Fresh meat, in particular, is a problem and must be used the same day it is purchased. Fruits and vegetables, though perishable, have a longer shelf life and can be used from 3 to 7 days after purchase without any marked loss of nutritional value.

Information on the total supply and consumption of food in Burma is given in Table XI.

TABLE XI. FOOD BALANCE SHEET FOR BURMA: 1958*

Food	SUPPLY		CONSUMPTION		
	Production (1000 metric tons)	Imports + Exports - (1000 metric tons)	Total** (1000 m. tons)	Per Capita Per Year (lbs.)	Per Capita Per Day (Calories)
Rice	5,226	-1,494	3,255	354.0	1,585
Wheat	10	+29	28	3.0	15
Maize	44	-27	14	1.5	5
Millet	81	--	67	7.3	30
Sugar	185	+33	200	22.0	100
Potatoes	50	--	48	5.3	5
Peanuts	157	--	21	2..	15
Other Pulses	300	-88	183	19.8	80
Other Vegetables	1,200	--	1,080	117.3	30
Fruits	814	+10	723	78.5	60
Meat	87	--	87	9.2	25
Fish	500	+25	525	57.0	45
Total fats	75	+19	88	9.5	105
Whole milk	359	+24	364	4.0	30
Eggs	92	--	97	10.6	20
Total calories per person per day =					2,150

*Source: U.S. Interdepartmental Committee on Nutrition for National Defense, Union of Burma Nutrition Survey: October-December 1961, Washington, D.C., May 1963.

**Total consumption adjusted for changes in stock and for industrial use of food crops.

The Burmese have many of the food preferences and taboos typical of other groups in Southeast Asia. There is a tendency toward overuse of hot, spicy curries, and most people consume a very salty, pungent fish sauce called ngapi. Occasionally, a large, fierce species of red ant known as Ka Gyin is eaten with the fish sauce. The majority of the food taboos of Burma apply to children and pregnant or lactating women. Many expectant mothers reduce their food intake because they fear that a rich diet will produce a large baby, resulting in painful labor. The foods most commonly avoided are green vegetables, fruit, eggs, and milk. The thiamine intake of many lactating women is so low that it causes beriberi in nursing infants. Weaning diets are primitive and consist largely of rice gruel.

4. Vulnerability of the Food Supply to War and Natural Disaster

Burma is a good example of the extent to which war damage can affect the economy of an agrarian country. According to Fisher, "three-quarters of its towns and villages were razed to the ground and its national income was reduced to half the pre-war level" as a result of military operations during World War II. Because of guerilla insurgency since the end of the war, Burma's agriculture has been slow to recover from the wartime devastation. Although a subsistence economy normally can survive more easily than an exchange economy, the scale and length of time involved in military operations has definitely retarded the Union's agricultural development.

Overdependence on rice is a major weak point in the Burmese economy. The country is subject to wide fluctuations in the price of rice as determined by varying demand. Drought constitutes the principal natural hazard affecting agriculture in Burma. The coastal areas and lower delta very rarely experience dry summers, but they are common in the interior. Irrigation projects are unnecessary in the coastal areas except to control flooding, but they are vital for reliable yields of wet-rice in the dry zone. Occasionally, violent cyclones (typhoons) come out of the Bay of Bengal and inflict heavy wind and flood damage on the coastal areas.

IX. Conclusions

The food resources of Southeast Asia are sufficient to provide reasonably adequate diets for most of the inhabitants of the region. In comparison to many Western countries, however, the food available to the typical Southeast Asian is deficient both quantitatively and qualitatively. Although nutrition is not the only factor determining general health, it is one of the most important; and it is indisputably true that the level of health in Southeast Asia is significantly lower than in the West, if measured by common indices such as mortality rates, life expectancy at birth, the prevalence of disease, physical development, and working capacity.

Judged by American standards, the typical diet in Southeast Asia is very monotonous. Overdependence on rice, fish, and hot spices is a basic characteristic of the dietary structure of every country in this region. Rice accounts for as much as eighty percent of the caloric intake in the daily food ration. To a large extent, this is a matter of food preference, but it also is due to economic necessity. Many foodstuffs which might otherwise be consumed in larger quantities simply are too expensive for the average family.

Two aspects of the food geography of Southeast Asia are particularly encouraging. First, the region as a whole is a surplus producer of food, indicating that the ratio between resources and population is unusually favorable compared to other parts of Asia. Second, most experts agree that food production could be increased considerably by the application of a more scientific agriculture. Such developments must, however, be adapted to the particular physical and cultural environments found in Southeast Asia. Many improvements would be relatively easy and inexpensive to implement; others would require a considerable amount of capital investment. Education is perhaps the key to sustained increases in food production; unless the individual farmer is able to understand new agricultural programs and willing to help implement them, the prospect for the success of most projects remains poor.

Although the food geography of all Southeast Asian countries is basically similar, some regional differences do exist. Thailand, Burma, and Cambodia produce food surpluses, whereas the two Vietnams and Laos are approximately self-sufficient. Malaya is unique in that it is the only country with a large food deficit; however, its rubber and tin exports allow it to meet this problem by importing foodstuffs. Food production in Thailand, Malaya, and Cambodia has been increasing rapidly, a situation made possible by stable governments and a lack of serious internal problems. On the other hand, agricultural growth has been very slow in the Vietnams, Laos, and Burma.

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13. ABSTRACT

This report describes the food resources of Mainland Southeast Asia in terms of their adequacy, geographical distribution, and potential military significance. The study reveals that food resources in this area are reasonably satisfactory in comparison to other parts of Asia. However, diets are monotonous and often deficient in the protective foods such as animal proteins, vitamins, and minerals.

Because of primitive agricultural techniques, small landholdings, and lack of capital, food production per unit area and per individual is low in Southeast Asia. Despite this, several countries within the area produce more food than their people consume, and are exporters of food. Rice is by far the leading foodstuff produced. Fish constitutes the leading source of animal proteins and ranks second to rice in terms of importance as a food.

The large cities and major ports are points of maximum food availability. The sawah (wet-rice) areas also have fairly abundant food, whereas the extensive zones of shifting cultivation have only very limited amounts available. Surplus food produced by Thailand, Burma, Cambodia, and South Vietnam contributes significantly to the importance of this region. However, because of problems of food acceptability, most foodstuffs produced in Mainland Southeast Asia have very limited usefulness for personnel of Western nations.

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