



This is to certify that the
thesis entitled

Agriculture, Population, and
Development in Guam: Some Options for the Future
presented by

BRUCE G. KAROLLE

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Geography


Major professor

Date 7/27/78

~~FEB 28 1985~~ 60

~~WV~~ JUL 31 1985

~~NCV~~ CT 385

~~2~~ #50

AGRICULTURE, POPULATION, AND
DEVELOPMENT IN GUAM: SOME
OPTIONS FOR THE FUTURE

By

Bruce George Karolle

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Geography

1978

9112981

ABSTRACT

AGRICULTURE, POPULATION, AND DEVELOPMENT IN GUAM SOME OPTIONS FOR THE FUTURE

By

Bruce George Karolle

The principal problem facing Guam, a small developing Western Pacific tropical island controlled by the United States for strategic military purposes, is the identification, control, and utilization of the food-producing base. Nearly all food, manufactures, and investment capital are imported. Can the artificial import economy of the present be decreased and directed toward self-reliance and local resource development? Guam's achievement of a balanced economy and a stabilized population depends on local land control, and a willingness on the part of its people to accept a less conspicuous mass consumption of many goods and services presently available, such as the private automobile. This study addresses these problems by utilizing the following methodology: 1) the regional approach or method, 2) field work techniques, 3) selected quantitative procedures, 4) cartographic techniques, and 5) documentation and source acquisition.

Spatial differentiation and homogeneity, synthesis, and association provide the conceptual basis of the descriptive analysis. The cartographic material illustrating Guam's site and situation locate the geographic data collected from the following sources: 1) field-work questionnaire, 2) results of the statistical compilations, and 3) spatial analysis of primary and secondary library and government

sources. The maps present the locational implications of insular land bases, the island's archipelagic position in the Marianas and Micronesia areas, and the overall proximity to East and Southeast Asia. Additionally, five qualitative maps offer views of the island mosaic.

Special attention is focused on the agricultural sector of the economy, which is inventoried. It is shown that a potential food supply exists, and that it is necessary to recognize the interaction of American political economy and traditional Guamanian land tenure and practices. Further, the field research utilized an agricultural questionnaire. One hundred interviews were conducted island-wide within a tri-regional distribution.

The study shows that land resources are dominated and controlled by non-local sources; that external powers historically prevented local resource utilization based on self-reliance through self-determination; and that twentieth-century development resulted from a massive United States military establishment which transformed the entrenched subsistence system into a federal welfare community. Additionally, the actual number of active farmers and the size and number of operative fields were found to be small. Less than 1 percent of Guam's civilian work force farmed; just over 1 percent of the island's dry land was agriculturally utilized. Half of the farmers lived on their ranches, a major locational change from past patterns; 80 percent were Guamanian by birth, owned their fields and had little indebtedness, received significant proportions of their annual income from non-farm sources, and consumed major portions of their crop production.



Future options and alternatives for economic development require major change. While it has been shown that for over thirty years modernization transformed the cultural and physical environment, this type of American military-political economy is completely imported. Without a military need for the island, redistribution of substantial amounts of American public funds logically would follow. Therefore, a balanced development paradigm is requisite; a model entailing internal supports and reliance on island resource utilization is recommended. With restoration of local land control, this model will augment the reliance upon the welfare imports in a positive way, and prepare the population for a future less dependent on artificial economic structures.



This dissertation is dedicated to my Chamorro friends, especially:
Salome S. Susuico, Alejandro B. Lizama, Lolita L.G. Huxel, P. Roland
Palomo, and Robert A. Rasalan. Si Yuus Maase.



TABLE OF CONTENTS

Chapter

I.	INTRODUCTION	1
	Objectives	
	Literature Review	
	Research Methodology	
	Assumptions	
	Hypotheses	
	Field Study	
II.	A REVIEW OF THE NATURAL ENVIRONMENT	11
	Climate	
	Land Forms	
	Soils	
	Water	
III.	THE HISTORICAL DEVELOPMENT OF GUAM	34
	Early Agricultural Foundations	
	The Early Impact of Spain	
	The American Period: 1898-1941	
	Japanese Occupation	
	Post-World War II Changes	
IV.	POPULATION, LAND USE, AND LAND TENURE	61
	Population Distribution	
	Government Lands	
	Private Holdings	
	Naturalizations	
	Land Taxes	
V.	THE ECONOMY OF GUAM	77
	Regional Outlook	
	American Military Development	
	The Government of Guam	



Agriculture	
Personal and Social Background	
Location of Farm by Field and Residence	
Farm Size	
Land Ownership	
Farm Land Value	
Physiography	
Farm Land Use	
Crops and Animals	
Agricultural Labor	
Investment	
Farm Expenditures	
Improvements	
Credit	
Role of Government	
Summary	
Tourism	
Manufacturing	

VI. FUTURE OPTIONS	127
Option 1: Guam Without the U.S. Military	
Option 2: Guam and the Status Quo	

VII. CONCLUSIONS AND RECOMMENDATIONS	137
.	

APPENDICES

Agricultural Questionnaire	A1
Bibliography	B1

LIST OF TABLES

1. Population and Study Sample of Farmers on Guam by Region, 1974	10
2. Rivers of Guam	27-32
3. Population Estimates - Early Period (1521-1668)	39-40
4. Major Ethnic Groups in Guam By Percentage of Total Population	46-47
5. Number of Guam Inhabitants: 1901 to 1977	52
6. Guam Population By Selected Group and Year	63
7. Guam Land Ownership: 1973	71
8. Naturalized Persons in Guam by Year	73
9. Military Population in Guam, 1977	82
10. Military Expenditures: 1964-1975 (In thousands of dollars)	85
11. Government of Guam Statement of Revenue: 1975	86-87
12. Guam Agricultural Production and Imports, 1974	93
13. Annual Farm Expenditures: Averages, 1972-1973	106
14. Tourists and Other Visitor To Guam (1967-1975)	113
15. Visitor Arrivals In Guam According To Purpose of Trip (1967-1975)	114
16. Visitor Arrivals In Guam According To Visitor Origin (1967-1975)	116
17. Guam's Share Of Total Japanese Travelers Going Abroad (1967-1973)	116
18. Hotel Occupancy Tax Collections By the Government of Guam (1970-1974), and Guam Visitors Bureau Budget (1970-1975)	118
19. Estimated Employment In Tourist-related Enterprises On Guam (March 1974)	122
20. Guam's International Trade, 1972 by Value (Categories of Commodities, Imports and Exports)	132

LIST OF FIGURES

1. Micronesia	12
2. Western Pacific and Micronesia	13
3. Guam Island Relief	16
4. Guam Island Federal Lands	20
5. Guam Island Population 1977	64
6. Guam Island Land Ownership 1977	69
7. Western Pacific Military	81
8. Guam Island Farms and Regions	96



Chapter I.

INTRODUCTION

The American-owned island of Guam is a classic example of the profound impact that a massive military presence can have on a small, relatively underdeveloped economy, particularly the impact on agriculture and food supply. Today, the role of agriculture in the Guam economy is limited by the number of farm operators and the size and number of operative farms. The leadership has repeatedly stated that with proper agricultural land utilization Guam could achieve self-sufficiency in fruit and vegetable production. Yet only about 30 percent of the fruit and vegetables required by the civilian population in 1971 was locally grown. Nearly all grain, meat, and fish are imported from the United States, Australia, New Zealand, Japan, and the Trust Territory of the Pacific Islands.

Upon casual observation there appear to be sizeable amounts of vacant and unused land throughout the island. However, government control of land excludes nearly one half of the entire island from any agricultural activity, since most of this is federal military property. Moreover, there is agreement among observers that the disadvantages for food production are significant. Inherent tropical limitations for farming include soil infertility, soil and plant pests, and fluctuations of rainfall from flood to drought. The typhoon discourages agricultural newcomers, and delays the expansion and progress of the existing farm operations. In addition, the institutional and political control of land and other economic factors of production exist to offer



competition to agricultural land use. Therefore, a regional analysis of the interrelationships of the spatial variables of agriculture, population, and developmental resources in Guam is needed.

The present crucial relationships of a rapid population increase, inflated land prices, and increasing food and energy importation requirements suggest an unbalanced economy. After World War II, development meant a shift away from the primarily self-sufficient agrarian economy to a service- and salary-based economy. In the pre-1941 period, 90 percent of the working population was engaged in farming and fishing activities, while the census of 1950 showed only about 6 percent of the civilian labor force employed in agriculture. By 1970, of all employees on civilian, private, and government payrolls, less than 1 percent were engaged in commercial agriculture.

While this rapid transformation occurred in the economic sector, the population of the island doubled twice in the thirty years between 1940 and 1970. No substantive agricultural inventory was made, and no cross-cultural provisions were developed and implemented to protect local land tenure.

The economic shift from primary to secondary and more properly a shift to tertiary activities positively correlates with the establishment of U.S. Government foreign policies for the Western Pacific and East Asian realm. The American military presence has dominated Guam's post-World War II economic growth. However, since the military immigration and tourist restrictions were lifted in 1962, and the political transfer of "shared" power was offered and accepted by a



civil government under the Organic Act, a commercial market sector has developed in Guam's economy. Therefore, the geopolitical factor has accounted for most of the recent changes on Guam.

Guam's location with respect to Asia is transforming the island landscape. At the present time, several airlines operate regularly scheduled flights between Guam and Asian airports. Five trans-Pacific communication cables connect to Guam. These transportation and communication links place the island relatively close to Asian rimlands; Tokyo and Manila can be reached in a little over three hours' flying time and Hong Kong in slightly over four hours. Consequently, additional commercial activity has developed within the last five years.

Tourism is a major new industry which taps the Asian markets. Over 200,000 Japanese visitors alone came to Guam in 1973; over a dozen modern high-rise hotels exist for this tertiary activity. In addition, as a free port Guam is attracting investments from Japan, Taiwan, and South Korea. Banking and construction, high-cost and low-weight manufactures, and oil refining industries are found here today. Some have suggested that Guam become a corporate center and entrepôt like Singapore.

Although the impact of Western contacts came early to the island, there is presently a grave danger of a newer form of "fatal impact" by the outsiders. The risks of economic disfranchisement are in evidence. A rapid displacement of land ownership from local control of private land to corporate ownership seems likely under present political and economic circumstances. Family estates of the

past are now commonly subdivided legally for inheritance processing, and large amounts of land are owned by non-residents from East Asia and the United States.

Objectives

To promote planning for the future, Guam needs input from a geographical investigation. An assessment of the island's agricultural resources is vital. What happens if the U.S. military leaves, or is forced to decrease its expenditures? Will a depressed Asian economy ruin recent advances toward light industry and tourism? How will the growing population provide for its food needs? The following are objectives of this dissertation:

- 1) to examine and explain Guam's existing economy;
- 2) to determine what might happen to Guam's economy in the event of a withdrawal or drastic reduction of the U.S. military presence, particularly the effects this would have on the island's agricultural self-sufficiency and future prospects;
- 3) to determine what might happen to Guam's economy if the status quo is maintained, particularly in regard to agriculture, food supply, and diet;
- 4) to recommend some policy changes that the Government of Guam could or should implement to ensure a sounder development of the island's economy and agriculture.

Literature Review

The Guam literature written by professional geographers is limited. Several sources on related research are found in



non-geographical works, and are available from the fields of anthropology, history, and geology.

Geographer Neal Bowers in 1951 described the Mariana archipelago as a whole. However, he pointed out (as did the anthropologist Laura Thompson in 1945) that farming and fishing were major economic activities prior to World War II, and that the military occupation disrupted the primary patterns of subsistence. Both pointed out the incongruence of the two systems.

David Lee, in cooperation with the Department of Agriculture of Guam, reviewed the agricultural situation in the late 1960s. His contribution never appeared locally, and was not published until 1971. Lee's article posed far more questions than it answered; the data were based on sketchy government sources, and his land use map showed about one half of the island as potential agricultural land. Unfortunately, his depiction of idle land was too generalized for research utility. Lee's contribution consisted of areal synthesis, a recommendation for agronomic research, and a reiteration of the disadvantages of tropical agriculture in general. No data or analysis existed showing the support capacity of Guam for agricultural production.

In addition to research contributions by Laura Thompson to Guam's anthropology and Fred Reinman in archaeology, Robert Solenberger's article provided documentation and data on rice cultivation in the Marianas. Ronald Haverlandt, a sociologist, provided insights into early Chamorro agriculture and economic patterns during the Spanish period. Jane Jennison-Nolan contributed a recent review of Guam's land tenure problems.



The historians Jane Underwood, Paul Carano, and Marjorie Driver, among others, were relied upon for the chronological records.

The natural scientists and other professionals in technical fields provided basic data on the physical environment. Geologist Joshua Tracey, hydrologist Charles Huxel, marine biologist Richard Randall and others have published research since the early 1960s. The Uniform Mapping System was established by the Bureau of Planning, and became available in late 1976, the year the research for this dissertation was completed. Current investigations abound in Guam in the late 1970s; these researchers are establishing a contemporary set of research literature.

Research Methodology

A review of the literature and field work experience reveals that land use and the control of land in Guam is a result of thirty years of intensive U.S. military occupation and development. As Guam's economic dependency on military spending grew following 1945, a corresponding decline in agricultural production occurred. Furthermore, an increased reliance on food imports by all segments of the population meant a radical shift in land use and worth. There existed a correlation between local land ownership decline and the change in labor force employment from agricultural activities to government salary and wage types of work. Little thought in public forum was given to the rapid population growth situation; an economic boom helped suppress alternative considerations. Population migration between Guam and the United



States was legal and unlimited in either direction, helping to disguise the negative results of vast economic investment, rapid population growth, and large transfers of population to and from Guam.

Assumptions: A balanced economy for Guam assumes that the military will continue to exist in some form as a permanent sector of the economy, but that future expansion and/or reduction of the military role is possible. A stable population is desirable; however out-migration of Guamanians to the United States mainland and the influx of other Americans to Guam contributes to the displacement of the existing local culture and population.

Hypotheses: If Guam is to achieve a balanced economy and a stabilized population the following factors are necessary:

- 1) a greater portion of the island's land base returned to local control;
- 2) a decreased dependency on United States federal spending;
- 3) the establishment of a population policy.

The results of these assertions depend upon Guamanian control and development of their resources, and their willingness to accept less outside investment in general and specifically a United States cutback in the armed forces budget. Provided that there is a reduction in the large amount of federal money flowing into the Guam economy through military expenditures for land, labor, and capital, it can be predicted that the following will result:

- 1) Guam's labor force will radically shift to primary tasks, tourism, and other commercial activities;
- 2) self-reliance and development will hinge on local land control and utilization, and development will focus on farming and fishing;
- 3) imported food per capita will decline, and local production and "native" food consumption will increase.

Based upon these hypotheses, an analysis was made of Guam's resources for all forms of economic development, especially agriculture, industry, and tourism, with particular emphasis on the agricultural potential of the island. This analysis will be accomplished by:

- 1) search of primary and secondary local data sources;
- 2) map and photograph use (maps include population and farm distribution; land tenure according to federal, territorial, and private categories);
- 3) field work in Guam, including a survey of farm operators and their existing farm resources and individual operations.

Field Study

Any individual regional analysis of agricultural development begins with a thorough knowledge of the actual farming community being studied. Since there was a dearth of agricultural literature and data for Guam, an assessment of the present agricultural resources was made by interview. The names and addresses of many of the farm operators were on file with the Department of Agriculture in Guam.

Beginning in January, 1973, during this author's field work research, an inventory of the agricultural resources of Guam was made by interview. The research tool, a field questionnaire administered to practicing farmers, contained 172 questions and 189 possible responses. The individual interviews were conducted by delineated survey regions, referred to as North, Central, and South. (See Figure 8, p. 96)



The questionnaire utilized in the interviews covered fifteen separate categories of farm resources. The following headings define those categories:

1. Personal and social background
2. Location of farms by fields and residence
3. Size of the landholding(s)
4. Tenure of farm operator
5. Value of the agricultural land
6. Physiography of the farm
7. Land use by individual farm
8. Crops and animals by farm
9. Diet of farm household
10. Agricultural labor
11. Investment of capital in equipment and facilities
12. Farm annual expenditures
13. Improvements to the agricultural land
14. Credit extension
15. Role of government

Initially, farm operators and their addresses were obtained from the Department of Agriculture (DA), Government of Guam, at the Mangilao station, and compiled by region. The farmers then were categorized by self-definition as full- and part-time farmers. In the case of those farmers found in the field by the author (i.e., not on the DA lists), the individual's assertion of farmer status and the presence of a farm provided the basis for inclusion in the study; if the person said he/she farmed, and showed the farm as such, then he or she was considered a farmer for the purposes of this study.

Table 1 shows the farm population and study sample. The procedure was to find the farmers listed by the DA, and interview as many as possible. Eighty-nine farmers, or 56 percent of the original DA list, were surveyed. During the field work, ninety-seven additional farmers were discovered and reported; eleven interviews were conducted from this group. Thus the survey compiled data from 39.1 percent of the known farmers during the fourteen months of field work ending in March, 1974.

Table 1. Population and Study Sample of Farmers
on Guam by Region, 1974

<u>Number of Farmers</u>	<u>Number of Farmers by Region</u>		
	<u>North</u>	<u>Central</u>	<u>South</u>
1) DA name list	80	38	41 = 159
2) New farmers (found in the field)	19	25	53 = <u>97</u> 256
3) Interviews by region	31	42	27 = 100

Source: B. Karolle, Guam agricultural fieldwork (Agana: University of Guam, 1977).

Chapter II.

A REVIEW OF THE NATURAL ENVIRONMENT

The purpose of this chapter is to provide an accurate description of the environment as observed in the 1970s. Elements of the natural environment discussed here focus on the geographer's view of Guam's climate, land forms, vegetation, soils, and drainage. These land resources, although limited because of the island's small size, are capable of providing the necessities of life if properly utilized. It is a question of the number of people to support, and at what level of "quality of life."

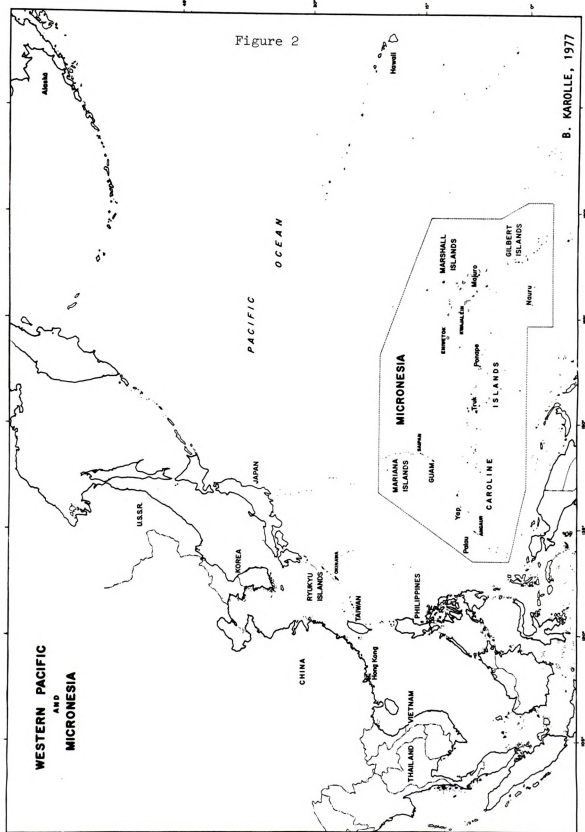
The resources found in the physical environment include fresh water, sunshine, seascapes, marine life, forests, air, arable land, and rock. Some might suggest that Guam's resource base is ruined already by overuse and extensive degradation. These resources are thought unique to tropical oceanic islands, and the environment is not easily adapted to technologies from the industrialized Western countries. By providing adequate information about the land and its basic resource base, the author hopes to clarify Guam's options for development.

Climate

Guam is a tropical island of the Western Pacific located 13 degrees north of the equator (See Figures 1 & 2), and has a daily average temperature of 80° Fahrenheit with an annual average range of only 2 to 3 degrees. Even though there are two seasons, a dry season (December through April) and a wet season (May through November), the

Figure 1. Micronesia

Figure 2. Western Pacific and Micronesia



temperature remains quite constant. Rarely does the temperature rise above 90° F. during the hottest part of the day or drop below 70° F. during the coolest part of the night.

To further differentiate between the two seasons, the northeast trade winds blow consistently during the dry season, and of the yearly average of approximately 90 to 100 inches of rainfall, 75 percent occurs during the wet season. On the whole, lower humidity and the persistent breezes of the trades make the dry season much more pleasant than its sultry, enervating, wet counterpart. Of the drier months, March and April are on the average actually subhumid months causing a dormant period for vegetation and resulting in less verdant landscapes. Overall Guam has a tropical wet-dry, or, in some geographical circles, a tropical savanna-type, climate.

Guam Island is located in the typhoon belt of the western central Pacific. Typhoons are reasonably common in the vicinity, and the chances are fifty-fifty in any year that one or more damaging typhoons will strike.¹ Guam has been hit by a major typhoon on the average of once every ten years. The last great storm was Typhoon Pamela of May, 1976, that killed one person and destroyed several million dollars worth of property. However, there is always sufficient advance warning, and enough of the buildings on the island today are of

¹Joshua I. Tracey, Jr., et. al., General Geology of Guam, U.S.G.S. Professional Paper 403-A (Washington: Government Printing Office, 1964) pp. 9-12. Also see Otis Freeman, "Geographic Setting of the Pacific," Geography of the Pacific (New York: Wiley, 1951) pp. 7-22; Sailing Directions for the Pacific Islands, Vol. 1, H.O. Pub. No. 82 (Washington: U.S. Naval Oceanographic Office, 1964) p. 396.

typhoon-resistant construction and reinforced concrete to provide shelter. Thus, actual bodily danger from typhoons is slight for the most part. Heavy winds and intense rainfalls are associated with typhoons and the lesser tropical disturbances. The summer period of July to mid-November is the wettest part of the year and is most likely to witness these damaging storms.

Land Forms

In contrast to the frequently monotonous tropical weather, except for typhoons, are the varied land form features of Guam. (See Figure 3) This topographic variety can be understood best by thinking of the insular oceanic setting of the island. One usually thinks of ocean landscapes as dominating the vision of island residents. On the contrary, the limited geographical area of Guam is in effect made larger by the uneven arrangement of the land surface. One can live and work for long periods on Guam Island and see very little of the ocean. Most important to this interpretation are the limited coastal plains which are discontinuous and narrow around the periphery of the island. Consequently, although most of the population resides near these restricted lowlands, the people are actually involved with occupying and traveling in high areas. For example, one large village, Tamuning, occupies an elevated peninsula along the central western coast several hundred feet above the sea. The peninsular terrain is so irregular that people of the area are seldom aware of the sea which exists on three sides of them. A good share of people's daily lives is spent without seeing the ocean and beach areas.

Figure 3. Guam Island Relief



Figure 3

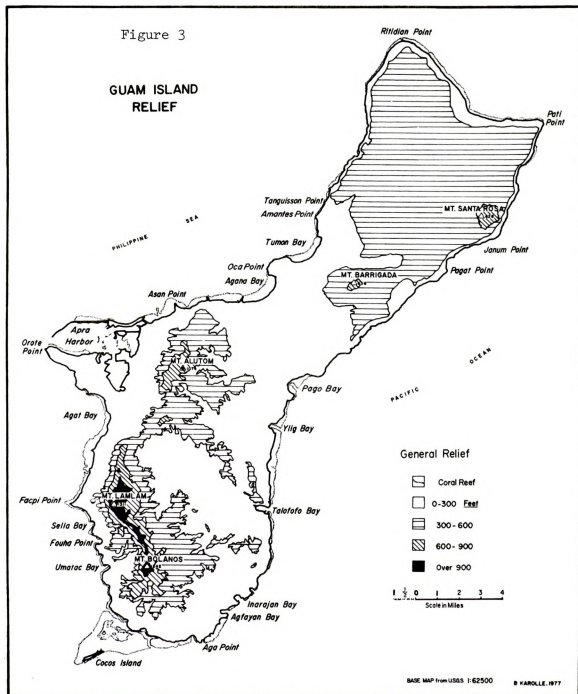
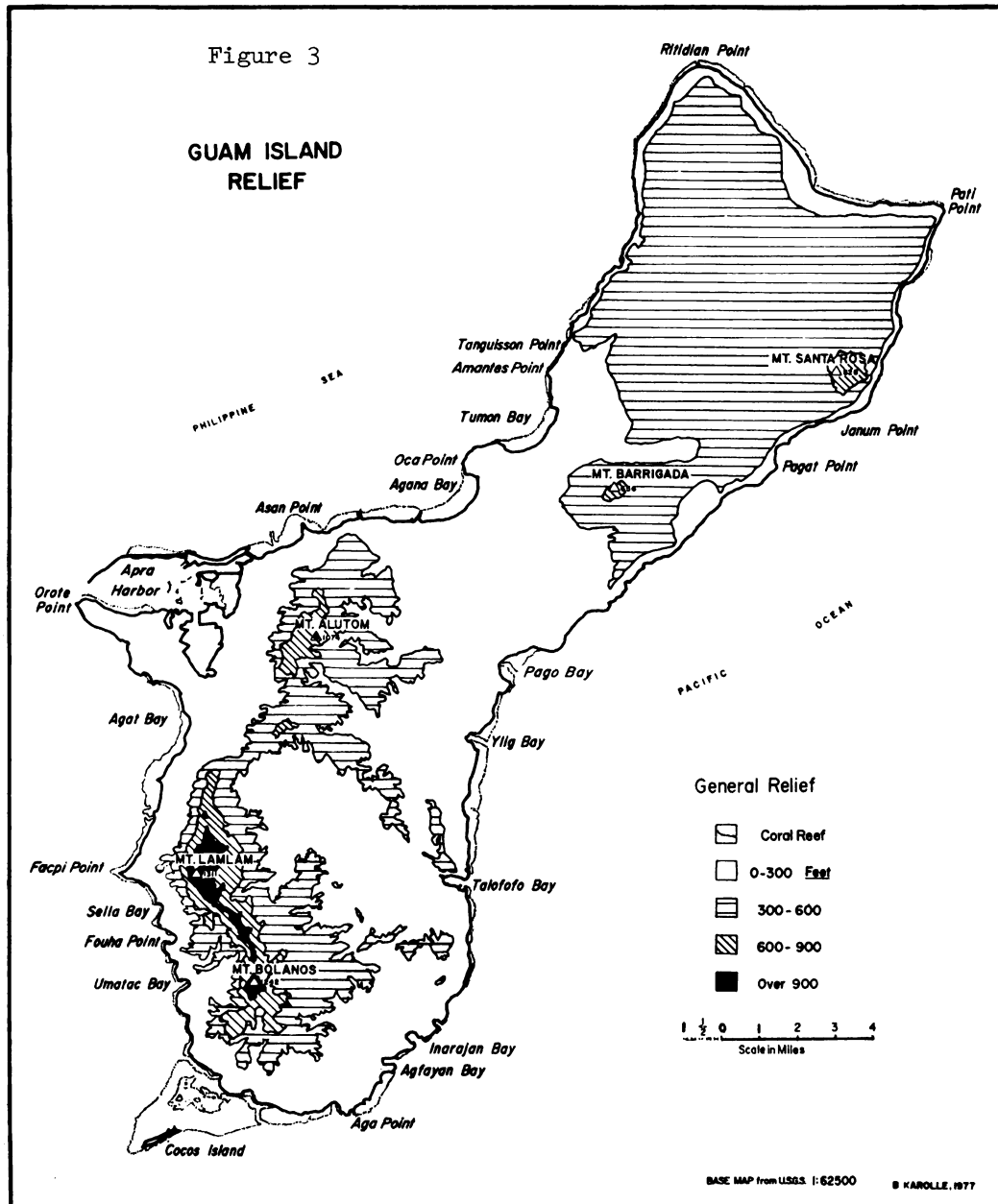
GUAM ISLAND
RELIEF

Figure 3

GUAM ISLAND RELIEF



Therefore, very few island residents are concerned enough about the enormous oceanic areas surrounding them to experience a closed-in feeling.

The island's land forms can best be understood if one keeps in mind that the island is relatively high in relation to the sea. Four distinctive physiographic divisions are recognized: the northern limestone plateau, the southern dissected volcanic plateau, the interior south central basin, and the coastal lowlands and associated fringing reefs.²

The northern third of the island is a broad limestone plateau with gentle undulation toward the interior. The peripheral areas are steep limestone cliffs with numerous solution features such as caves. Perhaps the best known solution cave is Marbo Cave located on the northeast coast. Also, because of the extreme permeability of the limestone, there are no surface rivers (only in southern Guam does surface fresh water exist on the land). The plateau slopes southward from high elevations of 600 feet in the Ritidian Point area in the northernmost part of the island to less than 180 feet near Mongmong Village in the central part of the island.

The limestone surfaces are frequently faulted.³ The most obvious occurrence is the block fault mountain wall which extends from the Mongmong vicinity at the edge of the Agana Swamp area of the coastal plain to Yigo Village in the north. Traveling at the base of the block mountain at the lower plateau level is Route 1, or Marine

²Tracey, 1964, pp. 61-71.

³Tracey, 1964, pp. 53-61.

Drive. The maximum local relief along the highway and the upper surfaces is between fifty and seventy-five feet with some faces of the mountain walls nearly vertical. The Tamuning-Yigo fault with nearly vertical raised surfaces is one of the island's outstanding limestone features. There are several well-developed wave-cut terraces along these seaward faces. Most of the smooth upper surfaces are naval reservation lands, with Guam's International Airport and Naval Air Station occupying the largest share of the upper limestone surfaces of this particular section.

Several small intermittent rivers cut through the low limestone land near the capital city of Agana and then empty into the swamp in the east Agana area. Another fault zone lies on the south side of the Agana Swamp, extending from Adelup Point on the west and crossing the island to a position south of Pago Bay in the Yona Village area. Lining Agana on the west side are faulted surfaces which extend from Nimitz Hill through the region known as Agana Heights. The civilian and naval residential areas here command some of the best scenic views on the island.

The uncleared areas of the northern plateau contain the rapidly vanishing tropical low forest of the island, usually associated with the limestone soils. A few of the extensive forest areas contain a mixture of breadfruit, pandanus, cycad, and papaya. This cover contrasts with both the coastal strand, dominated by the coconut palm tree, and the southern half of the island, underlain by volcanic materials and covered by coarse savanna grassland. There are some low forest areas confined to the limestone high peak areas which parallel the west side of the island. They begin south of the Adelup

Point-Cabras fault junction at Mt. Tenjo and extend to Mt. Alifan. There is also forest further south in the Mt. Lamlam vicinity.

The southern half of Guam Island is characterized topographically as irregular. The volcanic peaks, sometimes capped with coral rock, are all higher than the few hills on the northern plateau. These mountain summits extend southward along the west coast and can best be viewed from the top of Nimitz Hill at the light tower on Mt. Alutom. Looking south, one can see high peaks ranging from 850 to 1,311 feet.⁴ In order of appearance these are: Mts. Tenjo, Alifan, Almagosa, Lamlam (the island's highest peak), Jumujong-Manglo, Bolanos, and Sasalaguan. Coral rock caps the extreme summits and is also found scattered in the interior basin and coastal positions around the southern periphery of the island.

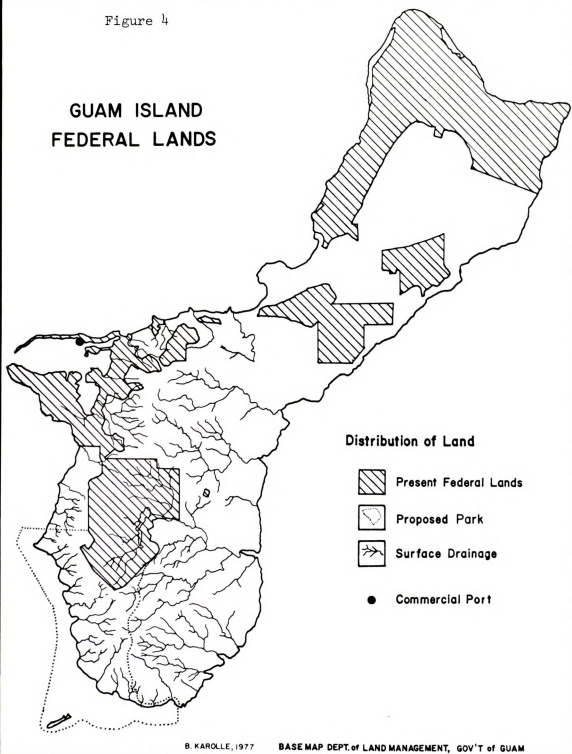
East of the high peaks in the northern portion of the southern volcanic region, including the Pago and Ylig River dendritic systems, is an area of dissection with surfaces (the high interfluvial and divide surfaces ranging from 480 to 640 feet) sloping eastward. The Talofofu River and Fena Lake include the major portion of the interior basin which also slopes generally eastward from the high peaks area. There is limestone karst terrain, many conical hills, small eroded valleys, and many gently sloping valley floors. Fena Lake, a reservoir, is another large area of U.S. military property which is entirely off limits to the civilian population. (See Figure 4)

⁴U.S. Geological Survey, Topographic Maps, Series 1:12,000 and 1:24,000 (Denver: 1968).

Figure 4. Guam Island Federal Lands

Figure 4

GUAM ISLAND FEDERAL LANDS



The east side of the southern half of the island is mixed plateau with many coral cliffs along the beaches behind relatively narrow fringing reefs. The west coast is higher, more irregular, and rugged, and has steep volcanic cliffs along its beaches, which are very narrow and restricted.

One fascinating area is the rugged and irregular coastal area south of Agat Village which includes several bays and remote coastline regions along the southwest side of the island. This coastal volcanic region, known by the place-names of the bays and promontories, is the Cetti-Sella Bay area. The mountainous land of this wild area includes long and steep slopes and some comparatively large V-shaped stream valleys, e.g., Geus River near Merizo Village and the Umatac-Madog Rivers at Umatac Village. The southern villages of this southwestern area were distant and cut off from the activities of the north until an adequate road was constructed after World War II. Today, the whole Cetti-Sella Bay and Merizo area is a potential U.S. national park. The adjacent Naval Magazine reservation, which includes several of the high peaks and the Fena Lake, is part of the proposed park. This "scenic and natural," or wild, area covering 13,000 acres and seventeen miles of shoreline may become the Guam National Seashore Park of the National Park Service.⁵ (See Figure 3) Other coastal areas are less difficult to reach; access to the beaches and reefs is quite easy

⁵Lawrence Johnsrud and Associate, Outdoor Recreation of Guam (Agana: Territorial Planning Commission, 1967) p. 61; Also see U.S. National Park Service, Proposed Guam National Seashore (Washington: U.S. Department of the Interior, 1967) 59 pp; Environmental Impact Statement Ammunition Pier, P-550 Sella Bay, Guam, Mariana Islands (Washington: Dept. of the Navy, June 1971) 30 pp.

because of wider coastal plains where roads presently exist. Much difficulty in use of coastal areas by the population has resulted from the competition for control and/or ownership between the military and civilian sectors of the population. Several of the most aesthetic beaches and fringing reefs are militarily controlled. For example, at the northern edge of the northern plateau is Tarague Beach; an access road that cuts through the limestone cliff to the beach, which is one of Guam's most spectacular sights, is inaccessible to the civilian population. Also there are privately owned coastal areas along the northwest and north sides of the island which include many lovely sandy beaches and reefs. As the Naval and Air Force reservations virtually surround these narrow coastal areas, development has been prevented.

The island is almost completely surrounded by fringing reefs or limestone benches. Reefs two to three thousand feet wide are located at Tumon and Agana Bays and in Merizo Village on each side of the Manell Channel at the southern tip of the island. Also offshore at Merizo is the Cocos Island barrier reef and associated atoll development. There is one other barrier reef which is located at Apra Harbor extending seaward from Cabras Island.⁶

Soils

The soils of Guam have been inadequately surveyed; therefore this brief description requires generalization. Most often the soils

⁶For further reading see Richard H. Randall and L.G. Eldredge, Atlas of the Reefs of Guam (Agana: Bureau of Planning, 1976) 190 pp.; and K.O. Emery, Marine Geology of Guam, U.S.G.S. Professional Paper 403-B (Washington: Government Printing Office, 1963) 76 pp.

are thin and stony, and on the whole the quality depends on the care taken by the farmer. The soils suffer from low organic matter and leaching. Soil depth varies considerably, and within a small area. At the Lalo plot (located at the Department of Agriculture) five soils have been recognized with horizons varying from a few inches to twenty-five inches in depth.⁷

In this paper, four soils are recognized, and are referred to in these non-technical terms:

- 1) heavy alluvial soil found in the low coastal areas and river valleys;
- 2) shallow limestone soil located on the northern plateau;
- 3) clay soils of volcanic origin found in south-central Guam;
- 4) red lateritic soils which are widespread and referred to as "Guam dirt."

For most soils the Department of Agriculture recommends adding organic materials in the form of animal manure, crop residues, and compost, not only to increase nutrient quantity but also to help retain soil moisture and structure. Chemical fertilizers are encouraged which have nitrogen, phosphorus, and potassium in approximately equal amounts.⁸

Water

Present estimates indicate a daily average of nearly one billion gallons of rainfall for Guam, assuming an average of ninety

⁷Walter E. Russell, "Soil Survey of Lalo Farm, Mangilao, Guam," Micronesica, Vol. 2 (Agana: University of Guam, 1965) pp. 77-85.

⁸Frank B. Aguon, J.V. Hurst, and W.G. Firestone, Vegetable Gardens, Bulletin No. 3 (Agana: Department of Agriculture, 1966) p. 17.

inches falling each year. In 1975 water consumption by the community amounted to just over four billion gallons for the year. This is exactly a four-fold increase over the 1963 yearly consumption level of 1.4 billion gallons.⁹ According to Huxel, Guam's water supply is produced from several sources. A majority, 56 percent, comes from wells, 36 percent from rivers and Fena Lake, and 8 percent from springs. Agency and organizational sources of produced water are: the Government of Guam, 43 percent; U.S. Navy, 41 percent (three million gallons daily is sold to the Government of Guam with the Navy taking 10 to 11 million gallons daily from the Fena Lake Reservoir); U.S. Air Force, 12 percent; and 4 percent is produced from private sources. With proper water conservation and careful development, Huxel believes the island has sufficient water resources.

As earlier stated, Guam has two distinct climatic seasons. The frequency of excessive rainfall usually occurs during the wet season from July through November. The dry season, and likelihood of drought, occurs regularly from January through April each year. Below are rainfall (R) and temperature (T) figures from three Guam weather stations; these climate data illustrate the seasonal patterns of rainfall distribution.

⁹Steven J. Winter, method of converting rainfall data to gallons, March, 1978, University of Guam; lecture by Charles J. Huxel, hydrologist, U.S. Geological Survey, University of Guam, April, 1974; and unpublished data, October, 1977.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

National Weather Service (Dededo)

R	6.3	4.4	4.8	5.0	7.8	6.2	11.2	14.7	14.6	13.1	8.9	6.3
T	77	77	78	79	80	80	79	79	79	79	79	79

Naval Air Station (Barrigada)

R	4.4	2.7	2.5	3.8	5.3	5.1	9.3	13.5	13.8	12.0	8.2	5.0
---	-----	-----	-----	-----	-----	-----	-----	------	------	------	-----	-----

Fleet Weather Central (Nimitz Hill)

R	7.6	4.0	6.9	3.5	13.0	9.4	11.6	18.3	15.0	13.6	13.1	4.6
---	-----	-----	-----	-----	------	-----	------	------	------	------	------	-----

Total rainfall:

National Weather Service	103.3	inches
Naval Air Station	85.6	"
Fleet Weather Central	120.6	"

Areal rainfall distribution for the island relates to regional oceanic patterns. The mean annual rainfall ranges from less than 90 inches on the lee (western) side of the island in the Apra Harbor area to nearly 120 inches on the higher plateau surfaces at Naval Magazine in the Fena Lake Reservoir area. According to Blumenstock, major amounts of rainfall for Guam occur during the passage of tropical lows and typhoons which track east to west in the inter-tropical convergence zone of the Pacific Ocean. Major storms are five times more likely to happen during the wet rather than the dry season. The rainfall from these low pressure systems brings periods of heavy precipitation, but the amount of rain is not uniform on the island during any given storm period. For example, Blumenstock's data show twenty-six inches of rain falling in twenty-four hours in October, 1953, on Umatac Village.

However, during this particular tropical depression only five inches fell on Inarajan Village six miles east, beyond the southern coastal hills.¹⁰

With respect to the tropical wet-dry nature of Guam's climate pattern and its effect on surface water supplies and crops, any month with less than four inches of rain is considered a subhumid condition. This increased variability factor coincides with Guam's dry season. Blumenstock calculated a probability of 60 percent that at least two consecutive months would receive less than four inches of rain during the dry season, and a probability of 40 percent that the three months of February through April would be drought months. In 1973 and 1976, Guam experienced less than the average precipitation for periods of more than five months. In 1976, approximately 65 percent of the January-June average rainfall was received, while in 1973 only 50 percent of the average fell island-wide during the same time period.¹¹

Table 2 shows water data of Guam's rivers, and Figure 4 locates the island's surface drainage. Nearly half of the island's potable water is acquired presently from surface sources.

Apart from precipitation and surface data it is evident that water plays a key role in the biological, chemical, and physical processes of plant growth. Agricultural plants obtain their water requirements via the soil. Much of the research in the literature on

¹⁰Blumenstock, in Tracey's, General Geology of Guam, 1964, pp. 9-11.

¹¹Fleet Weather Central Joint Typhoon Warning System, November, 1977, Guam, unpublished data.

Table 2. Rivers of Guam (Part 1)

Name	Point of Discharge	Total Drainage Area (Acres)	Length of Max. Travel (mi.)	Average Slope (%)	Period of Record (years)	Ultimate Usage % Open/% Developed
Fonte	Agana Bay	1,495	3.6	3.6	50	--
Asan	Philippine Sea	531	2.2	6.0	30	75/25
Matque	Philippine Sea	209	1.1	7.1	30	30/10
Taguag	Philippine Sea	139	1.0	7.8	30	50/50
Masso	Philippine Sea	480	1.9	6.9	30	70/30
Sasa	Apra Harbor	640	2.7	7.3	50	--
Laguas	Apra Harbor	174	1.4	4.5	30	70/30
Aguada	Apra Harbor	484	2.4	7.4	30	70/30
Atantano	Apra Harbor	2,910	3.0	5.8	50	--
Namo	Philippine Sea	1,246	3.0	5.3	50	--
Togcha	Philippine Sea	333	1.5	10.6	30	60/40
Salinas	Philippine Sea	138	1.1	11.9	30	50/50
Finile	Philippine Sea	197	1.5	12.2	30	70/30

Table 2. (Part 1) Continued

Name	Point of Discharge	Total Drainage Area (Acres)	Length of Max. Travel (mi.)	Average Slope (%)	Period of Record (years)	Ultimate Usage % Open/% Developed
Gaan	Philippine Sea	202	1.6	10.0	30	50/50
Auau	Philippine Sea	87	1.1	9.5	30	60/40
Chaligan	Philippine Sea	181	1.3	13.5	30	50/50
Taleyfac	Philippine Sea	1,229	3.4	7.2	50	--
Taelayag	Philippine Sea	217	1.7	6.2	30	80/20
Sagua	Philippine Sea	95	0.8	10.7	30	100/0
Madofan	Philippine Sea	249	1.5	14.8	30	100/0
Agaga	Philippine Sea	171	0.8	10.7	30	200/0
Asmafines	Sella Bay	220	1.2	20.0	30	100/0
Sella	Sella Bay	398	1.4	17.0	30	100/0
Cetti	Cetti Bay	509	1.5	16.6	30	100/0
La Sa Fua	Fouha Bay	800	3.3	6.8	50	--
Umatac	Umatac Bay	1,340	2.2	--	50	--
Toguan	Toguan Bay	398	1.6	11.7	30	100/0
Bile	Bile Bay	141	0.9	9.8	30	95/5
Pigua	Bile Bay	244	1.7	11.9	30	95/5



Table 2. (Part 1) Continued

	Point of Discharge	Total Drainage Area (Acres)	Length of Max. Travel (mi.)	Average Slope (%)	Period of Record (years)	Ultimate Usage % Open/% Developed
Gues	Pacific Ocean	640	2.7	7.1	50	--
Julog	Achang Bay	203	1.2	6.5	30	80/20
Manell	Achang Bay	600	2.3	8.1	30	80/20
Suyafe	Achang Bay	337	1.4	8.4	30	75/25
Sumay	Achang Bay	124	1.0	9.5	30	80/20
Liyog	Pacific Ocean	268	1.4	8.0	30	90/10
Ajayan	Ajayan Bay	872	3.0	7.8	50	--
Agfayan	Agfayan Bay	1,430	3.4	5.2	50	--
Inarajan	Inarajan Bay	3,220	4.6	-	50	--
Pauliluc	Pauliluc Bay	2,100	3.5	2.4	50	--
Asalonso	Paicpouc Cove	1,219	2.7	2.1	50	--
Ugum	Talofofo River	4,670	-	-	50	--
Talofofo	Talofofo Bay	13,300	-	-	50	--
Togcha	Togcha Bay	1,319	2.7	2.1	50	--
Ylig	Ylig Bay	7,420	-	-	50	--

Table 2. (Part 1) Continued

	Point of Discharge	Total Drainage Area (Acres)	Length of Max. Travel (mi.)	Average Slope (%)	Period of Record (years)	Ultimate Usage % Open/% Developed
Gues	Pacific Ocean	640	2.7	7.1	50	--
Julog	Achang Bay	203	1.2	6.5	30	80/20
Manell	Achang Bay	600	2.3	8.1	30	80/20
Suyafe	Achang Bay	337	1.4	8.4	30	75/25
Sumay	Achang Bay	124	1.0	9.5	30	80/20
Liyog	Pacific Ocean	268	1.4	8.0	30	90/10
Ajayan	Ajayan Bay	872	3.0	7.8	50	--
Agfayan	Agfayan Bay	1,430	3.4	5.2	50	--
Inarajan	Inarajan Bay	3,220	4.6	-	50	--
Pauliluc	Pauliluc Bay	2,100	3.5	2.4	50	--
Asalonso	Paicpouc Cove	1,219	2.7	2.1	50	--
Ugum	Talofoyo River	4,670	-	-	50	--
Talofoyo	Talofoyo Bay	13,300	-	-	50	--
Togcha	Togcha Bay	1,319	2.7	2.1	50	--
Ylig	Ylig Bay	7,420	-	-	50	--

Table 2. (Part 1) Continued

Name	Point of Discharge	Total Drainage Area (Acres)	Length of Max. Travel (mi.)	Average Slope (%)	Period of Record (years)	Ultimate Usage % Open/% Developed
Pago	Pago Bay	5,760	-	-	50	--
Tamuning	Agana Bay	561	3.7	2.1	30	30/70
Agana	Agana Bay	-	-	-	30	40/60

Source: Greenleaf/Telesca-Ahn Masterplan, Phase II: 1972, pp. 279-281.

Table 2. Rivers of Guam (Part 2)

Name	Wt. Runoff Coefficient	Time of Con- centration (min)	Rainfall Intensity (in/hr)	Design Discharge	Average discharge ¹	
					cfs	Inches Per Year
Fonte	-	-	-	7,500	-	-
Asan	0.64	42	6.0	2,000	-	-
Matque	0.56	22	7.7	930	-	-
Taguag	0.63	17	8.3	800	-	-
Masso	0.64	34	6.5	2,000	-	-
Sasa	-	-	-	3,200	-	-
Laguas	0.63	30	6.9	750	-	-
Aguada	0.66	37	6.4	2,000	-	-
Atantano	-	-	-	11,000	-	-
Namo	-	-	-	7,800	-	-
Togcha	0.67	25	7.3	1,600	-	-
Salinas	0.68	20	7.8	780	-	-
Finile	0.65	24	7.4	950	-	-
Gaan	0.69	24	7.4	1,040	-	-
Auau	0.70	17	8.3	530	-	-
Chaligan	0.73	17	8.3	1,100	-	-
Taleyfac	-	-	-	6,870	-	-
Taelayag	0.74	27	7.0	1,120	-	-
Sagua	0.77	15	8.5	620	-	-
Madofan	0.81	17	8.3	1,670	-	-
Agaga	0.84	15	8.5	1,220	-	-
Asmafines	0.81	15	8.7	1,550	-	-
Sella	0.79	16	8.5	2,670	-	-
Cetti	0.78	18	8.1	3,200	-	-
La Sa Fua	-	-	-	3,800	-	-
Umatac	-	-	-	7,500	7.99	53.2

Table 2. (Part 2) Continued

Name	Wt. Runoff Coefficient	Time of Con- centration (min)	Rainful Intensity (in/hr)	Design Discharge	Average discharge ¹	
					cfs	Inches Per Year
Toguan	0.61	22	7.7	1,680	-	-
Bile	0.61	15	8.7	750	-	-
Pigua	0.62	24	7.4	1,120	-	-
Gues	-	-	-	3,450	-	-
Julog	0.62	65	5.3	700	-	-
Manell	0.62	44	6.0	2,200	-	-
Suyafe	0.66	25	7.5	1,470	-	-
Sumay	0.67	20	7.8	650	-	-
Liyog	0.66	27	7.0	1,240	-	-
Ajayan	-	-	-	2,830	-	-
Agfayan	-	-	-	4,650	-	-
Inarajan	-	-	-	4,220	15.6	47.2
Pauliluc	-	-	-	6,800	-	-
Asalonso	-	-	-	3,900	-	-
Ugum	-	-	-	12,200	27.5	53.7
Talofoyo	-	-	-	16,600	-	-
Togcha	-	-	-	2,800	-	-
Ylig	-	-	-	14,300	23.5	48.5
Pago	-	-	-	18,600	22.7	49.9
Tamuning	0.58	32	6.7	2,170	-	-
Agana	-	-	-	7,000	-	-

Sources: Greenleaf/Telesca-Ahn Masterplan, Phase II: 1972, pp. 279-281; van der Leeden, Frits, Water Resources of the World (Port Washington, N.Y. Water Information Center, Inc., 1975) p. 289.



soil and water and their ecology involves middle latitude, or mesothermal, climatic regions. Soil water research for the tropical soils and particularly those of Guam requires attention.

The hindrances of Guam soils include intensive leaching, acidity, limited minerals of parent rock, and soil depth. However, one overall problem that regular irrigation may help solve involves soil water balance and moisture capacity. Since most Guam soils tend to drain easily in relationship to the intermittent rainfall patterns, the spatial fluctuation of precipitation, and high evaporation rates, dry weather conditions are common. Rapid drainage, high air temperatures, and wind all combine to cause upper soil to dry out rapidly. Preliminary observations suggest that though many soils here may not even possess moderate water-retaining capacities, practical farm techniques, i.e., raising humus content, and irrigation may offer the solutions necessary for intensification of crop production. The recent establishment of an agricultural experimental station offers potential scientific research to measure accurately the ecology of the island soils. Farmers may expect in the near future soil analyses which properly forecast their individual field capacity and soil moisture requirements.

Chapter III.

THE HISTORICAL DEVELOPMENT OF GUAM

The land of Guam has been occupied continuously by a people long enough to have established a distinct cultural identity. These people today examine and interpret that experience in new and different ways since the Americans came at the turn of the nineteenth century. Essential to our understanding that experience is knowledge gained by viewing that cultural development. To analyze the present day resources of the land and how these resources are defined, measured, and developed requires a review of past occupancy.

This chapter attempts to provide a perspective on the interrelations of the main themes found in historical geographies of place. Since Guam came to be dominated by the outsiders, this review provides insight on the processes of culture, nature, and economic development.

The Chamorros of Guam and the Mariana Islands were the native inhabitants at the time of discovery by Magellan in 1521. The present Guamanians continue to speak the Chamorro language. Culturally, the Chamorros at the time of Western contact were of Malayo-Polynesian stock, having migrated from Southeast Asia by sailing to Guam as early as 2000 B.C. They were isolated from metal use, employing neolithic tools of polished stone and shell, large house posts, or *latte* (usually made from quarried limestone), outrigger canoes, pottery, and agriculture, including rice cultivation.¹²

The pre-contact Chamorros are grouped with other Western Pacific islanders called Micronesians, but they are also linked by pottery and language with the Philippines.¹³ Chamorro written records are nonexistent; therefore, there is little knowledge of their development during the pre-Spanish periods. Archaeological evidence suggests a material culture of two periods, pre-*latte* and *latte*.¹⁴ Settlement was dispersed and some houses were built upon stone foundations, called *latte*, by the time the Europeans arrived.

Early Agricultural Foundations

Review of the accounts on early Chamorro gardening offers a reconstruction based on a wide range of professional interests previously mentioned in the section on the literature review. The farming of the Chamorros was based on food crops of rice, taro, yams, breadfruit, and coconut. Other crops were bananas, sugar cane, ginger, and cycad nuts, or *fadang* (*Cycas circinalis*). The seed-nuts are

¹²Conversations with Marvin Montvel-Cohen, Territorial Archaeologist, Guam; Laura Thompson, The Native Culture of the Mariana Islands, Bulletin 185 (Honolulu: Bishop Museum, 1945) p. 4; and Laura Thompson, Guam and Its People (Princeton, N.J.: Princeton University Press, 1947) p. 14.

¹³Alexander Spoehr, "Marianas Prehistory," Fieldiana: Anthropology, Vol. 48 (Chicago: National History Museum, 1957) pp. 174-175.

¹⁴Fred M. Reinman, "Guam Prehistory: A Preliminary Field Report," Prehistoric Culture in Oceania, pp. 41-50; and Laura Thompson, Archaeology of the Mariana Islands, No. 100 (Honolulu: Bishop Museum, 1932) pp. 54-55.

nutritious after de-poisoning and grinding. Fishing accounted for a major portion of their food-producing activities. Fishing was done mainly by hooks and nets; fishponds and traps were also utilized.¹⁵

It is rice cultivation that distinguishes the Chamorro culture from that of other Micronesians. Thompson stated that in the early 1930s rice was planted during the month of October in the southern river valleys of Guam. She reported that these "extensive deposits of alluvial soil make excellent rice lands." Yawata identified the Chamorro rice variety as "long-awned," the Javanese variety, called in Indonesian *boeloe*, and found today in Java, Bali, parts of Celebes, the Philippines, and Taiwan. He supported Safford's account of tracing migration to the Marianas from Southeast Asia. Both Safford and Yawata believe the Chamorros brought with them the rice technology of the Indonesian-Philippine Islands.¹⁶

Archaeological evidence found in Guam and elsewhere in the Marianas reveals that the actual technology for food cropping and rice cultivation existed. Solenberger suggested that forests were cleared by fire (slash-burn). Tools of stone and shell, such as *akoa* or

¹⁵Jacques Barrau, Subsistence Agriculture in Polynesia and Micronesia (Honolulu: Bishop Museum, 1961) p. 22; William E. Safford, The Useful Plants of Guam, U.S. National Herbarium, Vol. IX (Washington, D.C.: Smithsonian, 1905) pp. 97-98; Robert R. Solenberger, "The Changing Role of Rice in the Marianas Islands," Micronesica, Vol. 3, No. 2 (Agana, Guam: University of Guam, 1967) pp. 97-103; Ward J. Barrett, Mission in the Marianas: An Account of Fr. Diego Luis de Sanvitores and His Companions, 1669-1670 (Minneapolis: University of Minnesota Press, 1975) pp. 12-21.

¹⁶Ichiro Yawata, "Rice Cultivation of the Ancient Marianas Islanders," in J. Barrau's Plants and the Migrations of Pacific Peoples, A Symposium (Honolulu: Bishop Museum, 1963) pp. 91-92; Solenberger, 1967, pp. 97-98; Thompson, 1945, pp. 27-29; Safford, 1905, pp. 153-154.

fosinos, adzes, axes, and chisels, as well as wooden digging sticks (*dagau*) were utilized by Chamorros. A type of sickle (*faucille*) for rice cutting was reported in 1825, and is considered the prototype of the metal knives used in the post-contact period.¹⁷

While many of the physical aspects of the Chamorro farming techniques have been reconstructed, one aspect of rice cultivation remains a mystery. Wet rice was cultivated in Spanish times, but no evidence of a pre-contact irrigation system exists, nor evidence that the wet rice system required a plow and draft animals to pull it.

Solenberger suggests that the terms "irrigation and wet rice cultivation" are carelessly used; flooded lowland fields and water-holding capacities of the heavy river soils of Guam may have been enough for the early peoples of the Marianas to grow wet paddy. Safford and Yawata described the simple rice field systems in the Marianas in the late nineteenth century. Therefore, some authorities conclude that both wet and dry varieties were produced by the early Chamorros.¹⁸

Less is known specifically about early settlement patterns and population size. Sanvitores stated that the Chamorros lived in hamlets and villages of various sizes.¹⁹ Coastal settlements ranged

¹⁷Solenberger, 1967, pp. 98-99.

¹⁸Solenberger, 1967, pp. 99-101.

¹⁹Luis de Sanvitores wrote from 1669 until his death in 1672. The two English translations read by this author, exclusive of Laura Thompson's references, are by Margaret Higgins, Guam Recorder, 1936-1939, and Ward Barrett, Mission in the Marianas, 1975.

from 50 to 150 huts, and interior river valley hamlets from 6 to 20 huts. His estimate of the number of settlements for Guam were 160 to 180 such villages and hamlets. Barrett wrote that the "160 hamlets of 1668" were reduced to 7 villages in the 1680s.²⁰

It is estimated that the Guam population was 50,000 at the time of Western contact, with as many as 100,000 Chamorros in the entire Marianas archipelago. (See Table 3) The numerous settlement units (*songsong*) were scattered, but probably corresponded to the coastal plains with some harborage nearby, and to the interior valleys where an adequate water supply was located. Apparently the Chamorros divided Guam into districts which contained several settlements each. According to Thompson each district contained a socio-economic structure. The noble class (*matua*) ruled the best of the district lands and fishing grounds; therefore, power rested in inherited wealth. The upper class also controlled the manufacture of money, canoes, and trade. The middle class (*atchaot*) assisted the nobles, while the lower class (*mangatchang*) was restricted spatially, as well as socially, in each community. Within each village or hamlet were various numbers of houses situated by class and clans. The nobles generally built their houses on *latte* stones, which were parallel pairs of stone posts with a capstone upon which the floor was built. Yawata suggests the design of

²⁰Thompson, 1945, p. 12; Barrett, 1975, p. 55. The Spanish found it difficult to establish their administration based on a decentralized Chamorro pattern.

Table 3. Population Estimates - Early Period (1521-1668)

Estimate-Total Number	Source (Where Given)	Reference
<u>GUAM</u>		
30,000	Reconstructed from Jesuit Housecounts	Fritz, 1904
35,000	Reconstruction from Tobias Kotzebue, 1821	Thompson, 1947
40,000	Reconstruction, Kotzebue 1821 from Juan de la Conception	Thompson, 1947
40,000 potential		Thompson, 1947
44,000	Reconstruction, Kotzebue, 1821 from Murillo Velarde	Thompson, 1947
50,000	Reconstruction by Garcia, 1936-39, from Sanvitores	Thompson, 1947
60,000	Reconstruction, Kotzebue, 1821, based on Marion	Thompson, 1947
60,000	Crozet	Roth, 1891
<u>MARIANA ISLANDS</u>		
40,000	Kotzebue, 1821	Bowers, 1950
40,000-50,000		Spoehr, 1954
40,000-90,000		Bowers, 1951
50,000 minimum	Nurillo	Cox, 1917
50,000 minimum	Anson	Roth, 1891



Table 3. Continued

Estimate-Total Number	Source (Where Given)	Reference
(Guam, Rota & Tinian)		
50,000 minimum		Reed, 1952
60,000	Crozet	Roth, 1891
73,000	Freycinet, 1829	Thompson, 1947
70,000-100,000		Joseph & Murray, 1951
100,000	Jesuit estimates	Olive, 1887
100,000		Thompson, 1945; Corte, 1807a

Source: Jane H. Underwood, "The Native Origins of the Neo-Chamorros of the Mariana Islands," Micronesica, Vol. 12, No. 2 (Agana: University of Guam, 1976) pp. 203-204; 1973, p. 15.

the slanted capstone is traced to the Philippines where rice granaries are constructed. Such structures exist to prevent rats from climbing up and into the grain house.²¹

The Chamorro resource base has been found to support a reasonably high subsistence system. The people utilized stone, bone, shell, and clay for tools to plant and harvest field crops, catch fish, and grind nuts. Their sailing vessel, the flying proa, or an outrigger canoe rigged with a lateen sail, deserves recognition. In addition to fishing with hooks and nets they used spears and a nerve-numbing poison which stunned the fish until picked out of the water. Hunting was limited to large fruit bats (*fanihi*), a small variety of bat, fowl (domestic type of which was raised for food), and coconut crab (*ajuju*).²²

Preparation of food and medicine was accomplished by steaming in an earth oven, boiling in pottery, or roasting on fire. Stone mortars and wooden pestles were used daily for husking rice, grinding cycad nuts, and crushing herbs.²³

The Early Impact of Spain

While the historical period of Spain's domination lasted some 377 years from the time of discovery until American possession, the early period was crucial in terms of agriculture, population, and development. After discovery in 1521, it was not until 1565 that

²¹Thompson, 1945, pp. 12-14; Solenberger, 1967, pp. 97-98.

²²Thompson, 1945, pp. 29-30.

²³Thompson, 1945, pp. 33-34.

Spain took formal possession of Guam, and established trade and administrative hegemony. Thereafter, Guam served as a regular port of call for the Manila-Acapulco trade route for the Spanish galleons.

From Legazpi's visit in January, 1565, to the arrival of Sanvitores in 1668, the Chamorros were visited by and conducted trade with Spanish, Dutch, and English traders and explorers. Chamorro and European contact focused on the exchange of food and water for iron and new tools. The Spanish, in establishing the trans-Pacific trade, formalized the need for a Guam harborage that transformed Guam and the Marianas.²⁴

The following account is summarized mainly from the report Guam Historic Preservation Plan.

After the Philippines was secured for Spain, and another Spanish navigator, Urdaneta, discovered the route from Manila to the prevailing westerly winds of the North Pacific, a round trip in the Pacific was deemed feasible. A unique maritime institution was established: the Spanish galleon trade from Mexico to the Philippines. Each year, usually in April, one or more ships set forth from Acapulco, Mexico (15° N Lat.), laden with Mexican silver for Manila. The westward route followed the Central American coast from Acapulco to the tropical (Northeasterly) trade winds and the westward (North Equatorial) currents. The sailing galleons of that day needed at least eight weeks to reach Guam (13° N Lat.), nearly 8,000 miles away. Thus, the

²⁴ Marjorie M. Driver, Spanish Galleon, paper given at the Chamorro Studies Convention, Guam, January, 1977. Thompson, 1947, pp. 100-107; Paul Carano and Pedro C. Sanchez, A Complete History of Guam (Tokyo: Tuttle, 1964) pp. 44-47.

most favorable east-to-west ocean passage made Guam an indispensable rest stop for this part of the trans-Pacific voyage. By late spring the galleons would arrive in Manila across the Philippine Sea, passing through the San Bernadino Strait and around the southwest coast of Luzon Island to Manila. By midsummer the galleons would leave Manila with their Oriental treasure bound for the California coast. The "northern passage" was most difficult sailing because of the typhoon season occurring in the high sun months and the lack of local directional sailing winds. The eastward passage from the Philippines was far to the north, between 35 and 40 degrees latitude. The route passed between north Luzon and Formosa, passing the southern Japanese islands into the Westerlies, and extending to the northern California coast, thence another 3,000 miles south to Acapulco. This voyage lasted about five months, and the goal was to leave Manila in summer and arrive in Mexico by Christmas. This trade system lasted from 1565 to about 1815, terminating with Mexican independence. Guam's function in this annual movement was as a supply stop on the southern leg. Umatac Bay was the traditional port, and the galleons left provisions and personnel, including soldiers, laborers, and priests with royal dispatches.²⁵

The decision by the Jesuits to missionize the natives resulted in the occupation of Guam by Spanish civil personnel, an occupation that transformed the Chamorro system. The annual Spanish commercial stop and sporadic visitations by other Europeans altered the native

²⁵Guam Historic Preservation Plan (Agana: Government of Guam Department of Parks and Recreation, 1976) pp. 11-12.

development of Guam very little. But as a result of open warfare and epidemic diseases, within thirty years the population of Guam--variously estimated from 30,000 to 60,000--was reduced to about 5,000 by 1699.²⁶ (See Table 3)

According to Thompson, the missionaries were initially well received by the Chamorros, but Jesuit interference with traditional values was met with open resistance. An official Spanish census for 1710 recorded only 3,678 Chamorros in the entire Marianas (481 in Rota); 3,197 Chamorros and 417 mestizos comprised the total population of Guam in 1710.²⁷

Both Thompson and Carano speak of the decline in the Chamorro way of life during the period of the first seventy years of the eighteenth century. The Spanish relocated practically all the population of the Marianas to Guam; they resettled all Chamorros in a few villages. The Chamorro population continued to decrease to the point that the reports described the Chamorro era as over. Thompson admits that "only the Chamorro language persists as an integrated functioning link between the ancient and modern culture in Guam."²⁸ However, recent historical evidence may help to suggest an alternative viewpoint.

Underwood asserts that based upon original Spanish census records the Chamorro population constituted the largest single group

²⁶Jane H. Underwood, "Population History of Guam: Context of Microevolution," Micronesica, Vol. 9, No. 1 (Agana: University of Guam, 1973) pp. 11-13; Underwood, 1976, p. 203.

²⁷Thompson, 1945, p. 3; Underwood, 1976, p. 203.

²⁸Thompson, 1945, p. 3; Carano, 1964, pp. 89-120.

within the total population. (See Table 4) However large the initial decline of the Chamorros, they were never entirely annihilated as concluded by earlier records. Therefore, the data in Table 4 shows the population composition historically.

The Spanish-Chamorro confrontation ended in near disaster for the remaining few thousand survivors of the wars (1670-1695) and the epidemics of the early eighteenth century. Development of Guam following the Spanish conquest consisted of Jesuit construction and missionization of the remaining few villages. The Jesuits were primarily credited with the introduction of new varieties of food crops--corn, for example--and domesticated dogs, swine, cattle, horses, and carabao. They exposed the Chamorros to new methods in food production and processing, such as baking breadfruit in ovens. The Jesuit involvement ended in 1769 during the historical period of cultural disintegration, and was replaced by the Order of St. Augustine.²⁹

The Spanish government introduced a colonial system of economic development which depended entirely on outside material support for the non-Chamorros. The annual appropriation fostered a closed monetary system; at first the annual funding came from Mexico and lasted until 1808, and then the money came from the Philippines until the 1820s. This colonial money-wage economy was largely manipulated for and by the governor and the non-Chamorros, or outsiders. For the Chamorro population money came only indirectly from the governor's expenditures.

²⁹Guam Historic Preservation Plan, 1976, pp. 12-13.

Table 4. Major Ethnic Groups in Guam
By Percentage of Total Population

Date	Officials and Troops	Spanish ^a and Mestizo	Filipinos and De- scendants	Natives	Others ^b	Mixed	TOTAL NUMBERS
				PERCENTAGES			
1710	--	13.04	--	86.96	--	--	3,614
1786	--	--	--	41.59	--	--	3,169
1793	4.10	26.81	19.81	49.27	--	--	3,584
1795	4.20	15.34	25.66	54.11	0.69	--	3,500
1797	4.82	20.37	--	37.17	37.64	--	2,989
1799	3.55	14.77	29.09	51.84	0.75	--	4,001
1800	3.42	13.35	30.39	51.92	0.91	--	4,060
1801	3.30	15.48	30.02	50.47	0.73	--	4,244
1802	3.35	16.29	27.86	51.84	0.65	--	4,149
1816	2.73	20.58	27.54	47.49	1.67	--	5,389
1825	--	--	--	45.47	--	54.53	5,901
1828	1.21	0.03	38.24	43.30	2.17	15.04	6,448
1829	1.22	0.08	39.46	41.62	2.10	15.52	6,480



Table 4. Continued

Date	Officials and Troops	Spanish ^a and Mestizo	Filipinos and De- scendants	Natives	Others ^b	Mixed	TOTAL NUMBERS
PERCENTAGES							
1830	1.08	0.08	40.25	40.86	2.22	15.52	6,490
1901	--	--	--	99.52	0.48	--	9,676
1940	--	--	--	99.05	0.95	--	22,290
1946	--	--	--	98.11	1.89	--	23,136
1950	--	--	--	47.63	52.37	--	59,498
1970	--	--	--	60.28	39.72	--	84,996

a Mestizos excluded from this category in Spanish census reports for 1828-1830.

b Includes for 1828-1830 census reports: English and descendants; French and descendants; Mulattos; Malayans; and Pacific Islanders.

Sources: Underwood, 1976, p. 206; Carano, 1964, p. 199, pp. 323-324; Statistical Abstract: Guam 1975, Vol. 6 (Agana: Department of Commerce, 1976) p. 2.

Furthermore, the Chamorro population probably viewed development in terms of survival. While they remained small in numbers the overall portion remained significant, and large enough to suggest cultural continuation. A blend of tradition and innovation was crucial to their economic and cultural survival. While these people continued their subsistence ways they also adapted.³⁰

The original Chamorro order adapted to the new money system by forming a family-based reciprocal exchange system. According to Haverlandt, the Chamorro utilization of the introduced money economy basically is a response to the Spanish colonial system, and he describes it in terms of a survival mechanism. Money became useful for prestige ranking, or status, and for satisfying obligations of the family within the local community. The involuted economic-social system that developed in eighteenth- and nineteenth-century Guam under the Spanish suggests a Chamorro innovation. Thus, the historical accounts describing on the one hand the paucity of material accumulation by the Chamorros, or the newer-term Guamanians, and on the other hand the Guamanian ability to acquire money are better appreciated.³¹

Decline of Spanish power in the 1820s and 1830s meant Guam had to rely more on trade and commerce of the world economy. The mid-Pacific whaling era utilized Guam as a favored port of call. Also,

³⁰R.O. Haverlandt, "The Guamanian Economic Experience," Vol. III, Part VI, The Social-Economic Impact of Modern Technology Upon a Developing Insular Region: Guam (Agana: University of Guam Press, 1975) p. 105; Thompson, 1947, pp. 21-23.

³¹Haverlandt, 1975, pp. 105-107.

Guam experienced a favorable administrator, Governor Villalobos. He stimulated the economy by encouraging the production of exportable goods, mainly food supplies for the whalers and trading vessels.³²

The American Period: 1898-1941

The United States acquired Guam as a result of the Spanish-American War; by December, 1898, Guam officially was a U.S. possession. In that month, by executive order, the U.S. Navy provided governance and development for Guam until 1950 and 1962.³³

Initial reforms made by the Naval government were mandated: English language requirement, large estates expropriated, island-wide land tax reform, economic peonage and concubinage abolished, and needed health and sanitation reforms initiated. The most important cultural result of this transfer of power to the Americans was that the U.S. Navy, rather than the Spanish governor, became the leader of the political system. According to Walter Scott Wilson, the Naval administration did little to change the Guamanian way of life. Wilson writes that

. . . the Catholic Church continued in its important role as center of community life. . . . the center of life in the village was the church. When the men went to work in their fields, they sometimes had to journey for a day or more. The basic economy of Guam was subsistence agriculture. Copra was also produced by households as a cash crop. As in former

³²Guam Historical Preservation Plan, 1976, pp. 14-15.

³³On July 31, 1950, the U.S. Congress passed the Organic Act which established Guam as an unincorporated territory of the United States with a civilian government; in 1962 President Kennedy ordered suspension of Naval security clearance requirements which effectively ended any direct U.S. Navy rule for Guam.

days, the basic unit of production was the household. Households were augmented by members of the older generation and sometimes by women or men who came to the family by marriage.

Kinship ties extended well beyond the confines of the households and, although the household was nominally self-sufficient, there was extensive sharing and exchange of food between households related by kinship, including marriage and god-parental relationships. Relationships between persons and households formed complex interlocking networks.

Social ties were symbolized and cemented by annual fiestas given in each village for its patron saint. Other social occasions, including marriages, baptisms, and funerals, also called for feasts and brought people together from all parts of the island. Each household prepared and served the food at village fiestas and each household was assisted by related households. Fiestas and other special occasions served both to create and to discharge whole systems of obligations between households and individuals.

In addition to the subsistence economy and copra production, wage work became available with the military establishment. A few families continued to operate small businesses and others also established businesses during this period. Guamanians were given the opportunity to join the U.S. Navy, but opportunities for Guamanians and other minority groups were severely restricted by racial policies then in effect. To supplement the limited educational opportunities afforded by the Catholic Church, the Navy established the beginnings of a public school system.

The Navy Government of Guam placed very little authority in the hands of the people. Nevertheless, the Guamanian people began to acquire a political awareness and a desire to improve their status.

The American influence on the local culture was profound, but there were no traumatic changes to disturb the equilibrium of the society and culture. There developed on Guam in this period [pre-World War II] a dual community: the local Chamorro community and the U.S. military community. Although there was much interaction between members of both communities, they remained separated by language, culture, and standard of living.³⁴

³⁴Walter Scott Wilson, "Historical Summary of Cultural Influences on the People of Guam," Vol. III, Part VI, The Social-Economic Impact of Modern Technology Upon a Developing Insular Region: Guam (Agana: University of Guam Press, 1975) pp. 93-94.



During the first forty years of U.S. administration of Guam, the population growth of the Guamanians was significant. (See Table 5) From 1900 to 1940 the census figures show an increase of 12,614 which represents a 130 percent increase in population growth. The average annual growth rate of this period was 3.25 percent. Thus the Guamanian population doubled in slightly over thirty years. This trend continued at an increasing rate, and provides the main distinction of the American period.

Agricultural development during the pre-World War II period focused on limited help in the form of farm assistance. To increase local production the Naval administration established in 1905 an agricultural experiment station in Agana. The idea was to teach improved agricultural methods including the introduction of new plants, seeds, fertilizers, and implements. Emphasis was placed upon teaching of livestock breeding and care, and instructions for increasing the production of coconuts for cash, and food crops such as rice and corn.³⁵

However, the U.S. Department of Agriculture was called in and apparently intended to develop the original Navy farm station in Agana into a thriving extension prototype that is characteristic of USDA. In 1909 the new Department of Agriculture was granted 1,332 acres of land in two locations, Piti and Cotal.³⁶ While the 32 acres in Piti

³⁵Thompson, 1947, p. 130.

³⁶Annual Report of the Governor of Guam, (Agana, Guam 1910) pp. 37-38.



Table 5. Number of Guam Inhabitants
1901 to 1977

Census Date	Total Number	Increase over preceding period	
		Number	Percent
1977 ^a	123,637	21,578	21.1
1975 ^b	102,059	17,063	20.1
1970	84,996	17,952	26.8
1960	67,044	7,546	12.7
1950	59,498	37,208	166.9
1940	22,290	3,781	20.4
1930	18,509	5,234	39.4
1920	13,275	1,469	12.4
1910	11,806	2,130	22.0
1901	9,676	--	--

^a Estimate based on 1970 figure and a 3 percent average annual increase.

^b Guam Commissioners' Report, 1975.

Source: Statistical Abstract, 1976, p. 2.



were similar in physiography and accessibility to the Agana area, the additional 1,300 acres were remote and of poor agricultural quality. Besides being of low fertility, the soils of the volcanic plateau of the region are highly subject to erosion due to the severity of slope. The Cotal area is owned by the Government of Guam and remains unused even today except for recreation--hikers going to the Ylig river, and motorcyclists who use the slopes and flatter surfaces for their bike tracks.

Efforts by the USDA to stimulate agriculture for island-wide increases in planted acreages progressed slowly. In 1917 the governor passed a measure that required landowners to till more of their lands, or to lease their lands for tenant usage. A "back to the soil" program followed the typhoon of 1918, and a compulsory labor law was passed for men over sixteen and under sixty years of age. This law was later modified so that each family unit was required to cultivate a certain amount of agricultural land on the basis of family size.³⁷

The Department of Agriculture, in order to further stimulate crop and animal agriculture, developed the following program in 1918:

- 1) a public campaign of education to establish a model farm, and extension program, 4-H clubs, a yearly agricultural fair;
- 2) a farm credit system;
- 3) a tax-exempt animal program;
- 4) a rural highway construction program; and
- 5) a marketing system.

³⁷Annual Report of the Governor of Guam, 1919, pp. 12-14.

The central market was located in a regular Agana market place known as the Farmers' Market, and a government trade commission was given regulatory powers to oversee the marketing system.³⁸

Copra export success was achieved in the late 1920s and lasted until 1932. Then the USDA developed a program to cultivate commercial kapok (*Ceiba pentandra*) to increase exports. The government required kapok trees to be planted on all government lands leased to farmers, guaranteed purchases of all kapok, cleaned the seed, and exported the crop.³⁹

Rice production was also encouraged in the 1930s. The government provided materials for river dam construction with volunteer labor, made loans available for rice land purchase by private companies, and required government agencies to purchase Guam-grown rice rather than imported rice. Consequently, the planted rice acreage increased from 197 acres to 640 with yields also increasing. During the years 1930 and 1931, a yield of 20 bushels per acre existed, and by 1937 yields were averaging 41.5 bushels.⁴⁰

Juan S. Aflague reported in 1935 that the market demand for rice averaged about 2,335,000 pounds over the previous three years. The 1935 production of local rice from 260 acres was 416,000 pounds, which left a 1,919,000-pound import figure. Therefore, about 22

³⁸Annual Report of the Governor of Guam, 1918, p. 14.

³⁹Annual Report of the Governor of Guam, 1933, p. 1; Carano, 1964, p. 239.

⁴⁰Thompson, 1947, p. 13.

percent of the rice consumed was grown locally at a time when the average per capita consumption of rice for Guamanians was approximately 116 pounds per year.⁴¹

Thompson's map showing 1939 land utilization locates the major rice lands in Asan, Piti, Naval Station, Agat, Umatac, Merizo, and Inarajan with a total average rice acreage of 640 acres. Land planted in corn amounted to 752 acres harvested out of about 1,500 acres of known corn acreage (corn is usually a two-season crop in Guam).⁴²

By 1941 the Department of Agriculture station, in order to carry out its goals, had purchased 91 plows, 24 cultivators, 911 pounds of vegetable seeds, 300 pounds of improved rice seed, and various types of livestock for breeding purposes. All of these items were made available, at cost, to the local farmers. To reach the farmers by personal contact, extension agents were available. In 1940 the island was divided into four extension service districts. It was the responsibility of the agents to work with agricultural clerks and various farmers' cooperatives, to offer demonstration and field meetings, and to provide school training for students interested in agriculture.⁴³

Japanese Occupation

The period from December, 1941, to July, 1944, was a harsh and difficult one for the Guamanian community. The war between Japan and the United States shocked most Guamanians. Carano said, "That Japan

⁴¹Juan S. Aflague, "Agricultural Report," Vol. 12, Guam Recorder (Agana: Government of Guam, 1935) p. 205.

⁴²Thompson, 1947, pp. 136-139.

⁴³Carano, 1964, pp. 255-257.



would ever capture Guam was something no Guamanian ever thought possible." Confusion and terror was real among the people. The Japanese Army of approximately 5,000 men made its brutal points of war occupation quickly; after three months the Japanese Navy, of a smaller force size, replaced the Army and ruled until the American invasion and recapture in July, 1944.⁴⁴

During the first half of the Japanese naval rule, the majority of the Guamanians worked on their ranches and stayed away from Agana. Some elected to work for the Japanese, and while payment was low they were paid a wage. For the most part, until January, 1944, the subsistence economy met most of the local needs. Food production was sufficiently high to meet the Guamanian needs and a small portion of the Japanese needs.⁴⁵

The Japanese administration established a school system for teaching the Japanese language and culture. Saipanese Chamorros were brought in to help in this educational effort, since the Japanese had ruled the Marianas since 1914 as a result of the League of Nations mandate. There was some resentment toward the Saipanese after the war by Guamanians as a result of this program.

The last period of the Japanese occupation (January, 1944, until the recapture by the American military) resulted in extreme measures of treatment for the Guamanians. People were drafted into the work force and put into concentration camps. Historian Carano describes the situation:

⁴⁴Carano, 1964, pp. 273-277.

⁴⁵Carano, 1964, pp. 177-178.

The *kaikontai*, an agricultural group, came to Guam early in 1944. Its purpose was to provide food for thousands of returning [Japanese] army troops sent to defend the island [Guam] against American forces whose island-hopping campaign was bringing them ever nearer to Guam. Because the prosecution of the war was more important than civil administration, almost every Japanese civilian employed by the *minseibu* [Japanese Navy Civilian Authority] was drafted into agricultural projects. Guamanian men, women, and children were forced to work in the fields. Schools were closed, and children under twelve years of age were sent home. If they were over twelve, they were made to work with the adults. All available hands were drafted into the fields. Only invalids and those gravely ill were spared.⁴⁶

Post-World War II Changes

The re-occupation of Guam by the United States meant a radical change for all segments of the Guam community. The subsistence agrarian system practically vanished as the Guamanians signed up for government jobs. Most of the new wage-earning jobs were with the U.S. military--the Navy initially, and later the Air Force.

The number of military personnel and the size of military land requirements remained high in the period of the middle and late 1940s. There was no returning to the previous World War II period of a small-scale defense posture.

In 1948 about 42 percent of the total land area of the island was controlled by the U.S. Federal Government.⁴⁷ After World War II, it was estimated that 15,000 arable acres of the island's 30,000 acres of total cropland were diverted from agricultural use to military reserves. The U.S. Navy in 1951 estimated that approximately 75 percent of the land regularly cultivated before World War II was still

⁴⁶Carano, 1964, p. 287.

⁴⁷Carano, 1964, p. 336.

open to non-military land use. Most of the 25 percent of former cultivated land seems to be in the Naval Station reservation in the Orote Peninsula area.⁴⁸ Although much of the richer alluvial coastal plain lands remain privately owned, the U.S. and the Government of Guam land holdings remain extremely large (U.S. Government, 35 percent of total area; Government of Guam, 20 percent; private holdings, 45 percent).⁴⁹

Besides the re-occupation of the Apra Harbor-Orote Peninsula area (Naval Station), the number of military facilities increased to include a naval air station (NAS), several communications installations (NCS), a naval magazine (Apra Heights), a central headquarters (Nimitz Hill), and an air force base (Andersen).

In addition to the U.S. military population, another large American group appeared on Guam. An influx of white-collar workers and professionals from the U.S. mainland, called "statesiders," came to work for the federal agencies and for the various departments of the Government of Guam. As a civilian government was established in 1946, and in 1950 Guam's political status changed from a U.S. possession to an unincorporated territory of the United States, a rapid population growth occurred. The Organic Act made all people U.S. citizens who were of Chamorro heritage. Therefore, for most of the population, migration to and from Guam by citizens was feasible and became an

⁴⁸William R. Tansill, "Guam and Its Administration," Public Affairs Bulletin No. 95 (Washington: Legislative Reference Service, 1951) pp. 43-45.

⁴⁹Department of Land Management, General Land Use Data and Trends (Agana: Department of Land Management, 1973) p. 2.

important factor in the overall development of the island. However, the Navy continued to exercise entry control for even U.S. citizens until 1962, and remained in economic control. For all practical purposes Guam was a U.S. military bastion until 1962. Some of the statesiders who migrated to Guam in the 1945-1950 period became business leaders in the private economy which emerged in the 1960s and 1970s.

The recently defined view of the modern period, beginning in 1962, represents another transition on Guam. The civilian economic takeoff commenced when the naval security clearance was rescinded.⁵⁰ Previously, all visitors, ships, and aircraft entering Guam, including those of U.S. origin, were screened by U.S. Naval Intelligence and processed according to their legal and bureaucratic procedures. The lifting of security clearance by President Kennedy, through executive order, allowed foreign investment to enter the Guam private sector and made possible development not directly dependent upon federal spending.

Another event, perhaps even more important and yet interrelated, was the destructive typhoon of November 11, 1962. Seven persons were killed by the storm, called "Karen," and millions of dollars worth of property were damaged or destroyed. The civilian economy was stimulated by the federal funds which poured in to reconstruct the outdated infrastructure of the island. Large amounts of capital improvement rehabilitation funds went towards the construction of typhoon-proof structures such as schools and power and water

⁵⁰ Executive Order 11045, The White House, August 21, 1962; University of Guam, Micronesian Area Research Center, Vertical File.

facilities and repairs to the hospital. The infusion of \$45 million was approved by the U.S. Congress in 1963 to rebuild the island. An additional \$30 million was appropriated in 1968 to continue this effort.⁵¹

Subsequent economic development of the civilian sector was rapid and at times uncontrolled. By the end of the 1960s a major tourist industry existed with the Japanese market serving as the origin of both investment in and visitors to Guam.

However, the Guam economy (See Chapter V) continued to be supported by a limited-base, import-oriented economy which makes Guam extremely dependent upon the U.S. and Japanese economies. Therefore, external conditions such as inflation and energy scarcity resulted in a major recession in Guam in 1974 and 1975. The rapid growth, or "boom" condition, of the economy of the late 1960s and early 1970s ended in the near collapse of the private construction and tourist industries. The global recession in the mid-1970s left Guam short of capital and funds. Foreclosures occurred in the housing market, business receipts fell, Government of Guam revenues leveled off, and several federal funding programs stopped.⁵²

⁵¹James B. McDonald, Guam Annual Economic Review 1975 (Agana: Department of Commerce, 1976) p. 9.

⁵²Guam Annual Economic Review, 1976, pp. 9-10; Haverlandt, 1975, pp. 116-117.



Chapter IV.

POPULATION, LAND USE, AND LAND TENURE

This chapter provides a regional analysis of three important interrelated factors of Guam. The population is heterogeneous, providing diversity of land utilization and conditions of land ownership. Modern Guam demonstrates a continuation of the interplay of these factors as the island's development changes.

The local Guamanians remain the largest identifiable group. They constitute more than half of the population today. During the historic period, as noted earlier, their proportions, even during their historic demise, constituted nearly 50 percent of the population under the Spanish. However, the American element, called "statesider," or *hoale*, which replaced the Spanish at the turn of the nineteenth century, now comprises about 25 percent of the population. The Filipino component of the population (about 20 percent) is as large as it was during the long tenure of the Spanish period. The remaining Asian element, while very diverse, is small today, and includes Japanese, Chinese, Koreans, and Vietnamese. Also, the recent influx of Micronesians provides additional cultural variety to Guam's apparent international makeup.

Owing to this diversity of the population, many problems exist. As the population expands, as it is doing, the need for control over the island's resource base increases. Measurement and analysis of land tenure and use follows the areal study of Guam's population.



Population Distribution

Based on the 1977 data in Table 6, the density of the island is relatively high. (See Figure 5) The ratio of 578 people per square mile is comparable to many densely settled island countries of Europe and Asia. The population density of Guam is about the same as that of the United Kingdom (598) and Sri Lanka (516) and more than that of the Philippines (351), but less than that of Japan (758) and Taiwan (1,179).⁵³ The population density of the northern half of the island is nearly 800 people per square mile. These density figures are well above the average density of the U.S., which is about 60 persons per square mile, while in the megalopolis of the northeastern U.S. there are overall urban-rural population densities approximating those of central-northern Guam Island.

Guam's population is regional, being heavily concentrated in the central and northern parts of the island. Using the central dividing line of the Adelup Fault, which extends from Asan Village on the west coast through Agana Heights, crosses the narrow "waist" of the island, and ends on the east side at Yona Village, 75 percent of the population lives in the northern half of Guam. The only densely settled area in the southern half of the island is the Naval Station and the adjacent villages of Agat and Santa Rita, all south of Apra Harbor.

⁵³Goode's World Atlas, 14th edition (Chicago: Ran McNally, 1974), p. 229.



Table 6. Guam Population By Selected Group and Year

Ethnic Group	Population				Percent Change	
	1977 ^a	1971 ^a	1970	1966 ^b	1960	1966-1970
Military Based	15,970	28,181	19,037	38,000	23,329	-18.4
Guamanians	--	53,972	52,400	44,922	34,762	50.7
Statesiders	--	6,776	6,248	5,334	4,538	37.7
Filipinos	--	6,086	5,740	4,550	3,043	88.6
Others	--	2,755	3,504	2,619	1,372	155.4
Total	123,637	97,770	86,929	95,425	67,044	29.7
						-8.9

a 1977 and 1971 data are personally extrapolated from a variety of sources. The main discrepancy lies in the past military figures, and the lack of regular census statistical procedures.

b 1966 data are included to show the population fluctuation on Guam.

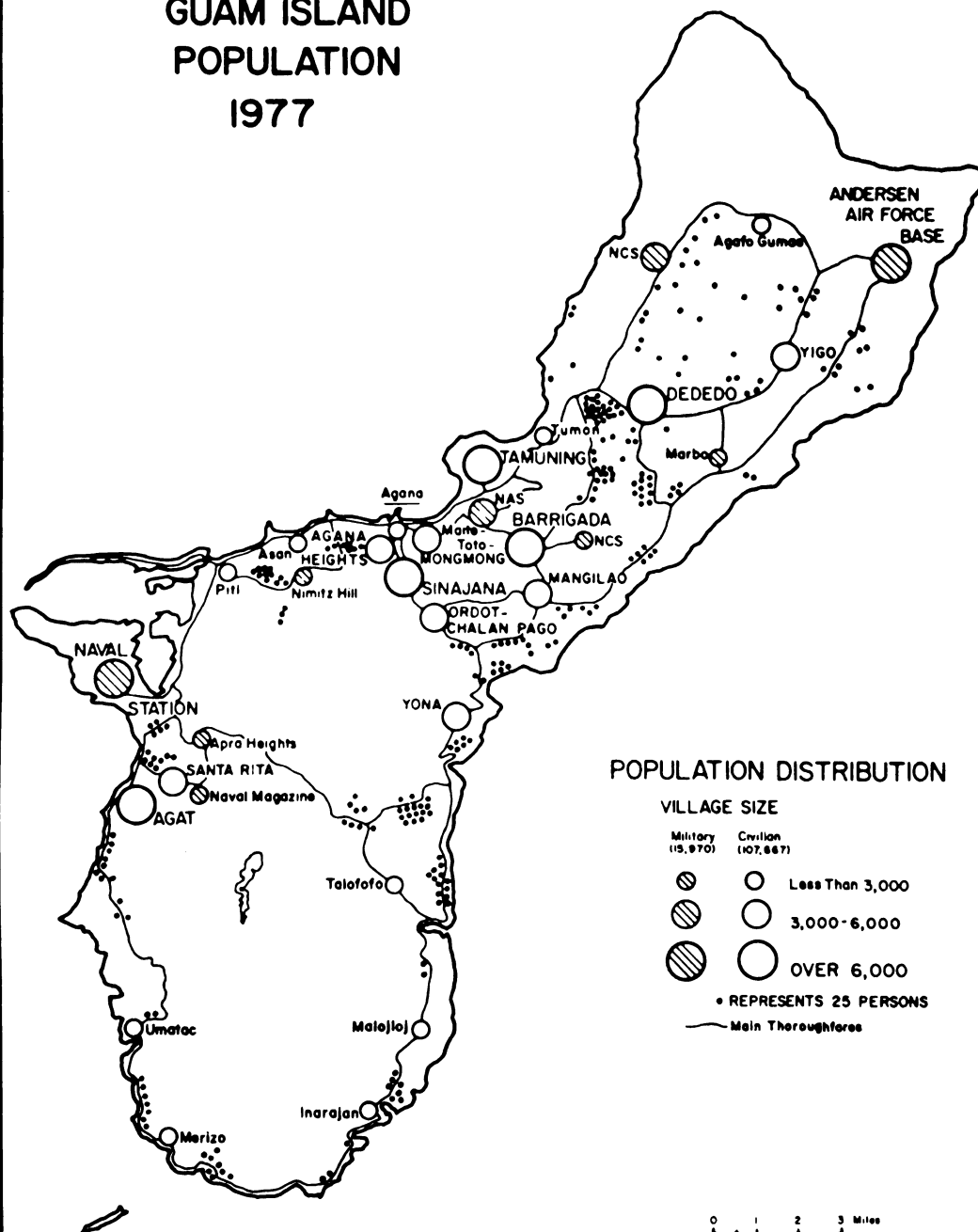
Source: Edwin L. Carey, editor, Guam 1970: An Economy in Transition (Agana: Department of Commerce, Government of Guam, February, 1971) p. 36.

Figure 5. Guam Island Population 1977



Figure 5

GUAM ISLAND POPULATION 1977





For this area study, Guam is divided on a tri-regional basis: North, Central, and South Guam. These divisions delineate well-established territorial zones reflecting physiographic and population designations. The North region is the limestone plateau, and represents an area of recent settlement. It was once dominated by low tropical forests. The villages and other built-up areas of Dededo, Yigo, Santa Rosa, and Mataguac are post-World War II settlements, while Tamuning and Tumon are older settlements and were accessible from the Agana and the Central region.

The Central region generally is an irregular area, topographically. Rocks are mixed; surfaces in the Barrigada, Mangilao, and Naval Air Station areas contrast with the steep dissection of the Agana, Chaot, and Pago River areas of the Central region. The smoother limestone surfaces of Barrigada and Mangilao extend into the argillaceous limestone found in this transition zone between the North's flat reef-limestone plateau and the conglomerate and andesitic surfaces which extend into the South region. The main urban places of the Central region are: Barrigada, Agana Heights, Sinajana, Mongmong-Toto-Maite, Chalan Pago-Ordot, and Yona.

The South is largely a dissected volcanic upland with a low remnant edge of mountains paralleling the southwest coast. Narrow limestone deposits exist on the borders of the southeast coast. Most of the villages of the South are found along the coasts with the exceptions of Santa Rita and Talofofo. From the west around the periphery of the South region are the villages of Agat, Umatac, Merizo, and Inarajan.



Villages, districts, and selected place names are categorized by regional designation as follows:

NORTH	CENTRAL	SOUTH
Agafa Gumas	Agana	Agat
Andersen Air Force Base (including Marbo)	Agana Heights	Apra Heights
Dededo	Asan	Inarajan
Naval Communication Station (Finegayan)	Barrigada	Malojloj
Santa Rosa	Chalan Pago-Ordot	Merizo
Tamuning	Maina	Santa Rita
Tumon	Mangilao	Talofofo
Yigo	Mongmong-Toto-Maite	Umatac
	Naval Air Station	
	Naval Communication Station (Barrigada)	
	Naval Station (Sumay)	
	Piti	
	Sinajana	
	Ylig	
	Yona	

Government Lands

In terms of land tenure and use, we know that in pre-contact times the Chamorro population lived in coastal settlements and interior river locations. Apparently the Chamorros divided Guam into districts with several settlements to a district. The noble class ruled the best of the district lands and fishing areas; this group also controlled other important resources of their culture, including money, canoes, and trade of food and other materials. The occupancy patterns of this integrated system of farming, fishing, and trade lasted over 150 years, from the time of first contact with the Europeans in 1521 until the 1680s. The Spanish brought an end to this system; they forced the Chamorros to leave their villages and farms to concentrate in a few villages ranging from Agana to Agat and Umatac on the



southwest coast of Guam; thus the population at that time was mainly distributed in the southern half of the island. However, by the 1870s nearly 85 percent of the population was located in the Agana area.

The economy remained at a subsistence level for the Guamanians and each family had its *rancho* (farm). Most of the land was privately owned. The Spanish government owned about 25 percent of the island and these lands were considered less desirable owing to their inaccessible location. These so-called crown lands were located in the northern forested areas and in the grazing areas of the southern interior.

When America took possession of Guam in 1898 the Spanish crown lands became the property of the federal government. By the end of World War II the proportion of land under federal and U.S. Navy control had grown to 42 percent of the island, and land held by Guamanians approximated one third, or seventy square miles. It was estimated that by 1941 approximately 15,000-17,000 acres were under tree and crop cultivation, 1,500 head of cattle were pastured, and 2,450 families derived their living directly from agricultural activities. Most of the population lived in Central Guam near Apra Harbor and Agana. The remainder lived in scattered villages in South Guam, with a few families in the northern plateau area; however, no permanent villages existed in North Guam at this time. Carano reported that in general land use terms 24.5 percent was cropland, 22.5 percent was forest-woodland, 40 percent was pasture and meadow, and 13 percent was devoted to all other uses combined.⁵⁴

⁵⁴Carano, 1964, pp. 335-338.



By the time of the passage of the Guam Organic Act in 1950, the major economic transformation of the modern era had begun. The war and the bombardment of the July, 1944, invasion of Guam by U.S. military forces resulted in tremendous denudation and depletion of the physical environment. Farming showed a rapid decline by 1949. In that year about 1,700 acres were tilled for field crops, rice and copra were no longer produced, and the food supply was dependent on imports. Military jobs were plentiful, wages were high, and there was an atmosphere of materialism that existed among Guamanians that resulted in a reluctance to return to farming.

When the Government of Guam came into existence, large amounts of land previously controlled by the U.S. Navy became public lands. Various official estimates considered between 18 and 30 percent of the island as in the public domain. (See Figure 6) These lands are distributed in an uneven way with obvious concentrations in the North and South regions of Guam. Numerous scattered public lands are found in the Central region of the island. However, private land is most concentrated in the Central and South regions with numerous sections of private parcels in the North. In the last ten years the proportion of private holdings has grown through various means, including the purchase of excess government lands, land grants, and litigation.⁵⁵

While the federal and local government agencies have measured the island over the years, there is no definitive source for the exact figures on land ownership among the three major ownership categories,

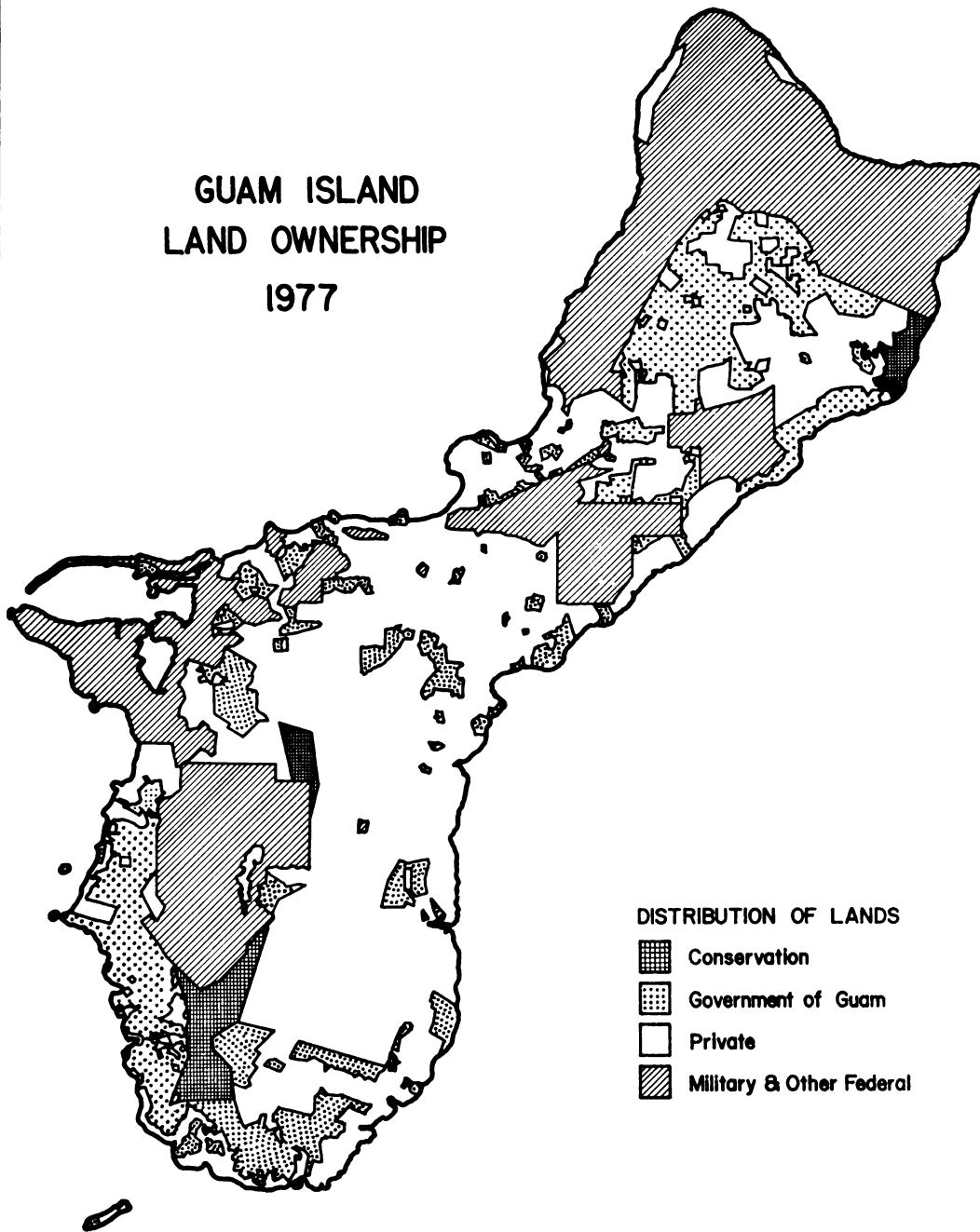
⁵⁵Jane Jennison-Nolan, "Land Use on Guam," Chapter I., Social Baseline Study for the Island of Guam, University of Guam (Agana: Micronesia Area Research Center, 1976) pp. 14-16.



Figure 6. Guam Island Land Ownership 1977

Figure 6

GUAM ISLAND
LAND OWNERSHIP
1977



DISTRIBUTION OF LANDS

-  Conservation
-  Government of Guam
-  Private
-  Military & Other Federal

i.e., private, Government of Guam, and the U.S. Federal Government. (See Table 7) The data sources vary considerably; however, the estimates in Table 7 are the Department of Land Management figures on the number of acres for each ownership category and represent the best breakdown available. According to Jennison-Nolan there are reasons for the discrepancies. "Land records are obsolete, inaccurate, and incomplete. Outdated base maps compound the problem. Moreover, 17 percent of the public domain lands have neither been surveyed nor registered as of April, 1976, and half of the public domain lands that have been surveyed as of the same date have not been registered."⁵⁶

Private Holdings

In 1974, the Stanford Research Institute reported that 26.4 percent of all private land was owned by off-island residents including foreign investors. Thus at least 25.22 square miles of the island's privately-owned land is presently alienated from local residents of Guam. However, the Stanford study did not distinguish who the local residents were by ethnic grouping. Therefore, its definition of "Guamanian" included any person born on Guam, and any resident who possessed U.S. citizenship and had resided on Guam at least five years. Since 55 percent of the entire island is government controlled land, and at least 26.4 percent of the private land sector or about 12 percent of the total is off-island controlled (according to the Stanford study), over two thirds of the entire island is outside the control of local Guamanians.

⁵⁶Jennison-Nolan, 1976, p. 17.



Table 7. Guam Land Ownership: 1973

<u>Ownership Category</u>	<u>% of Total</u>	<u>Acres</u>	<u>Square Miles</u>
Military holdings	33.59	46,000	71.875
Interior, NASA, FAA	1.72	2,357	3.683
<u>Total U.S. Federal Lands</u>	35.31	48,357	75.558
Conservation areas	4.31	5,900	9.219
Future development and use	9.49	13,000	20.313
Other	5.91	8,100	12.656
<u>Total Government of Guam</u>	19.71	27,000	42.187
<u>Total Private Land</u>	<u>44.98</u>	<u>61,603</u>	<u>96.255</u>
<u>Totals</u>	100.0	136,960	214

Source: Department of Land Management, "General Land Use Data and Trends" (Agana: Government of Guam, November, 1973) pp. 1-2.

Table 7. Guam Land Ownership: 1973

<u>Ownership Category</u>	<u>% of Total</u>	<u>Acres</u>	<u>Square Miles</u>
Military holdings Interior, NASA, FAA	33.59 1.72	46,000 2,357	71.875 3.683
<u>Total U.S. Federal Lands</u>	35.31	48,357	75.558
Conservation areas	4.31	5,900	9.219
Future development and use	9.49	13,000	20.313
Other	5.91	8,100	12.656
<u>Total Government of Guam</u>	19.71	27,000	42.187
<u>Total Private Land</u>	<u>44.98</u>	<u>61,603</u>	<u>96.255</u>
<u>Totals</u>	100.0	136,960	214

Source: Department of Land Management, "General Land Use Data and Trends" (Agana: Government of Guam, November, 1973) pp. 1-2.



Off-island private land control is relatively high in the South region, especially in its northern and Central portion, and in the districts of Inarajan and Talofofo; in the Central region along its southern boundary, especially in the Yona, Mangilao, and Santa Rita districts; and in areas of North Guam such as Dededo (especially Machanao) and Yigo.⁵⁷

Further, the Stanford study reports that in the early 1970s local residents owned 90 percent or more of the private property in Sinajana and Agana, 84 percent in Barrigada, 80 percent in Piti, and 74 percent in Asan, all in the Central region. In the South region they own 82 percent in Merizo, 81 percent in Yona, 78 percent in Umatac, 70 percent in Agat, 69 percent in Talofofo, and 51 percent in Inarajan.⁵⁸

Owing to the political relationship of Guam and the United States, one important aspect of population and land ownership involves immigration and naturalization. Guam, as a U.S. territory, qualifies as a port of entry for foreign immigration into the United States. According to Table 8, a significant number of naturalized citizens enter the U.S. by way of Guam. Since 1952 the U.S. Office of Immigration and Naturalization has operated in Guam with more than 9,267 naturalized persons receiving U.S. citizenship.

⁵⁷ A Study and Review of Laws Pertaining to Alien Investment on Guam, Volume I (Menlo Park: Stanford Research Institute, 1974) pp. IV-19-26, and Exhibit A.

⁵⁸ Stanford Research Institute, 1974, pp. IV-20.



Table 8. Naturalized Persons in Guam by Year

Year	Number of Guam Naturalizations	Number of All Naturalizations in U.S.
1975	1,130	141,537
1974	1,040	131,655
1973	999	120,740
1972	789	116,215
1971	567	108,407
1970	556	110,399
1969	392	98,709
1968	431	102,726
1967	33	104,902
1966	272	103,059
1965	297	104,299
1964	443	112,234
1963	413	124,178
1962	742	127,307
1961	181	132,450
1960	185	119,442
1959	193	103,931
1958	2	119,866
1957	161	138,043
1956	186	145,885
1955	155	209,526
1954	18	117,831
1953	80	92,051
1952	2	88,655
1951	--	54,716

Source: Immigration and Naturalization Service, Annual Report, in Table 42 and since 1961 Table 42A, (Washington: Department of Justice, 1951 through 1975).

Most of these persons originate from the Philippines; from 1961 through 1975, 70.8 percent of the naturalizations were of Filipino origin. In recent years, Taiwan Chinese are the second largest category after the Philippines for place of origin, with Korean and Japanese close behind in absolute numbers.

Apart from the actual number of persons naturalized in Guam, the social and economic impacts of those choosing local residency for any length of time is difficult to determine. Little data exists, and therefore extensive measurement and analysis remains to be completed on those naturalized who stay.

However, the author's fieldwork conducted in 1974 revealed that seven of the 100 farmers interviewed were oriental in origin; three owned their own land, and four leased their farms. The seven controlled a combined total of approximately thirty-two acres. While the Asian agricultural impact is small, land ownership in general is significant as pointed out by the Stanford study. Most of the Asian development so far has focused on tourism and other commercial land use.

Land Taxes

Land taxation in its present structure, was first introduced in the early 1950s, shortly after the establishment of the Guam Legislature, following the Organic Act. The present general property tax system is based on the ad valorem concept with a yearly charge of the assessed property value. Under this system, each individual property has two assessments; the first measures the actual land, and the second if applicable, evaluates the buildings, homes, and other



real estate appendages as a separate property evaluation for assessment purposes. Therefore, the individual tax bill computation on land is $\frac{1}{2}$ of 1 percent of the taxable portion of the assessed land value plus a full 1 percent on the taxable portion of the assessed worth of the structures. For the most part, the farmer operating a given amount of agricultural land without permanent buildings pays one-half of one percent on 35 percent of the assessed land value.

The Guam property tax assessment structure operates with two major criterion, land use and location. Land assessed for tax purposes regarding usage is classified in the following rank order (highest to lowest in value):

<u>Zones</u>	<u>Type</u>
Commercial	C
Industrial	M2
Light Industrial	MI
Multiple Dwelling	R2
Single Family Dwelling	RI
Rural	A

In theory, all properties in Guam are by statute assessed at a portion of their full market value, and all properties should be reassessed at frequent intervals. These rules in practice are legislatively adjusted and changed from time to time. For example, in 1977, an island-wide reevaluation of property market values was conducted. As the 1977 tax bills began reaching the 1500 some odd taxpayers who owned approximately 23,000 parcels of land (including about 17,000 buildings), taxpayer objections apparently forced the Guam Legislature to pass immediate legislation delaying the enforcement of the new assessments. Therefore, the 1972 bench mark land values, a six-year old property tax evaluation remained in effect for the 1977 tax year. According to officials in the Department of Revenue and



Taxation, the new 1977 evaluation reported a total property value for Guam of \$2 billion. The aggregate tax bill due under the new evaluation was \$4 million; potentially this constitutes a substantial increase over the 1976 island property tax bill (over \$2 million). However, land taxes provide a relatively small share of the Government of Guam's revenue base fluctuating between one and two percent during the early 1970s.

Presently, the lowest assessed land includes all property zoned as rural; in Guam for property taxation purposes this amounts to \$1.42 per acre per year for some agricultural areas in the South. However, farmland in close proximity to urban areas in the Central and North regions of the island are taxed at a minimum of \$3.54 per acre annually, and in other instances they amount to \$5.30.

Comparative data on farm real estate taxation reveals that Guam's taxes on agricultural land is relatively high. The average tax state-wide in Hawaii for 1976 according to the U.S. Department of Agriculture, shows a levy of \$2.67 per acre. Assuming that the Guam average for agricultural land per acre in 1975 to be \$3.00, twenty-nine states in the same year taxed their agricultural real estate at a lessor per acre rate. To insure a progressive agricultural development, Guam needs a restructuring of the present tax system.

Chapter V.

THE ECONOMY OF GUAM

The relationship between the general economy of Guam and the U.S. military posture in the Pacific Far East is of profound importance. Following the major foreign policy changes in Indochina during 1973 and 1974, serious repercussions were felt. Declines occurred in land values, job opportunity, and available capital for investment. The lucrative real estate market collapsed. Military construction nearly terminated, military personnel halved, military spending off the bases decreased, etc., all this helped slow the civilian economy. In addition to the American-Vietnamese war ending, which resulted in a significant downturn for Guam, the Middle East oil price increases had their own impact. While the federal government absorbed the initial rise of oil per barrel to Guam, the Japanese-Guam economic connection deteriorated. The large Japanese investments in land in general, and specifically in tourism, fell off. Japanese visitors to Guam decreased; thus construction projects related to the visitor industry ceased.

Moreover, during the months after those events, unemployment compensation and food stamp distribution existed in significant amounts. This type of federal involvement in welfare programs was new for Guam. In addition to the economic recession of 1975, and infusion of additional federally funded programs, in May, 1976, a major typhoon struck Guam. Ironically, the large-scale disaster relief monies provided the turnaround stimulus to Guam's economy. A stabilized world economy, and



the continuation of large federal expenditures has produced a cautious optimism. However, the widespread reliance on federal spending in Guam as a long range growth view is limited at best. What is needed now is a development plan that fully utilizes the island's resources and position in the Western Pacific.

Regional Outlook

Of all Guam Island's geographical particulars, it is the relative location that gives it considerable international and national importance. (See Figures 1 & 2) How far away Hawaii and Japan are in units of actual distance is less important than how close they are in relative distance. The interrelationships of political, economic, and military factors, viz. the position of Guam with respect to the Far East, explains the island's recent development and rise to importance as America's "westernmost" territorial possession. Guam's global place is of significance today because it is American territory located in the central-western Pacific. The island is located some 3,644 miles west of Honolulu, Hawaii, and 1,500 miles south-southeast of Tokyo, Japan. Its land size is approximately 214 square miles, or about one half the size of Hong Kong. This makes it the largest land area in Micronesia.

There are several island groups and individual islands in Micronesia, or "tiny islands," whose proposed name was submitted by Domeny de Rienzi to the Societe de Geographie de Paris in 1931. The island groups include: Caroline Islands, numbering 957 islands, islets, and reefs, totaling 461.441 sq. miles; Mariana Islands, numbering 21 islands, islets, and reefs, totaling 184.508 sq. miles,



excluding 214 sq. miles of Guam Island which is not part of the Trust Territory of the Pacific Islands; Marshall Islands, numbering 1,225 islands, islets, and reefs, totaling 69.84 sq. miles; Gilbert Islands (a British Crown Colony), numbering 16 main islands, totaling 114.12 sq. miles, and Ocean Island (a United Kingdom dependency), totaling 2.3 sq. miles; Nauru Island (an independent republic formerly Australian), totaling 8.2 sq. miles. With Guam's 214 sq. miles, this is a total of 1,054.409 sq. miles. Guam and the Trust Territory account for 929.789 sq. miles or about 88 percent of the total land area of Micronesia.⁵⁹

Guam's advantage of location with respect to Micronesia and East Asia provides the backdrop for development. As the Japan-American economies continue to be intertwined, Guam may well take the initiative for competitive advantages. According to recent trade data, U.S. trade with Guam's neighbors, including Japan, Korea, Taiwan, Hong Kong, the Philippines, Indonesia, and Singapore, is rising. The Pacific-Asian countries represent a major trade block for the United States. While political stability, abundant labor supply, and vast resources are available to the U.S. economy from these countries, a significant shift from being a supply source of raw materials to a manufacturing region has taken place in the Pacific-Asian countries since the 1960s. There is little doubt that Guam can strengthen these opportunities of

⁵⁹ Edwin H. Bryan, Jr., Guide to Place Names in the Trust Territory of the Pacific Islands, Pacific Scientific Information Center (Honolulu: Bernice P. Bishop Museum, 1971); Otis Freeman, editor, The Geography of the Pacific (New York: Wiley, 1951) pp. 208, 237-238, and 273-274; and Gina Douglas, "Draft Check List of the Pacific Oceanic Islands," Micronesica, Vol. 5, No. 2 (Agana: University of Guam, 1969) pp. 387-414.



neighborhood location. That Guam is a tourist destination for Asians is only one part of development. In a limited way, Guam is serving as a U.S. center for international services in education, transportation, communications, corporate finance, and other related businesses.

American Military Development

The dominant American presence in the Pacific explains Guam's overall economic growth since the 1940s. American interest in the Pacific as a significant geopolitical area dates back to the mid-nineteenth century, but World War II precipitated the large-scale U.S. involvement in the Far East and Pacific regions. Much of the U.S. military administration and strike forces for the Central Pacific are centered in Guam. (See Figures 1 & 2, especially 7) In fact, it was from the Strategic Air Command airbase in Guam in mid-1965 that sustained air bombing of North Vietnam first began. The presence of the armed forces is easily discernible on the island; the military reservations cover over one third of the total land area, and military personnel and their dependents numbered 28,181 in 1971 and 15,970 in 1977. (See Tables 5 & 9) Although this figure is reduced from a previous high of 42,000 in 1968⁶⁰, in 1975 the military payroll amounted to about \$97 million, with over 6,000 civilian jobs providing another payroll of \$60 million. The Government of Guam realized about \$18 million in income tax revenues from these payrolls.

⁶⁰ Edwin L. Carey, editor, Guam 1970: An Economy in Transition (Agana: Department of Commerce, 1969) p. 6.



Figure 7. Western Pacific Military



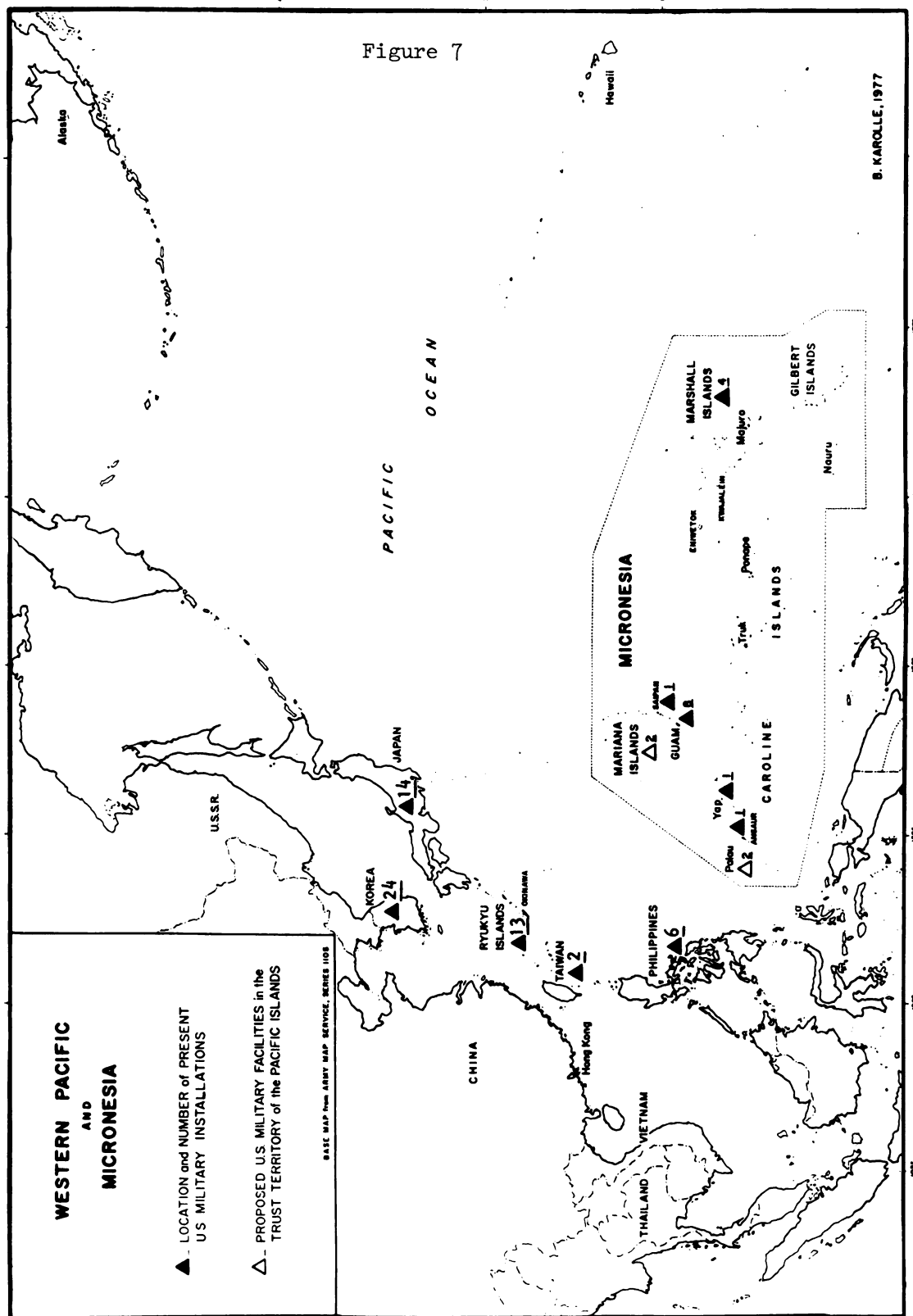


Table 9. Military Population in Guam, 1977

	Duty Personnel	Dependents	Civilian Employees
U.S. Navy	5,886	NA	4,602
Air Force	4,874	NA	1,500
Total:	10,760	5,210	6,102

Source: U.S. Navy and Air Force, Offices of Personnel, Guam, 1977.



The notion that national security requires a large outlay of men, arms, and land areas in the Pacific region for military operations rests on the U.S. foreign policy of "containment" of the late 1940s and 1950s. This policy holds that the United States should and will counter and contain the activities of certain nations because of ideological and economic differences.

Consider America's "containment" military policy by looking at the location of "selected military installations" published by the Department of Defense in July, 1973. (See Figure 7) There existed in the Asian rimlands seventy U.S. military facilities of which there were thirty in South Korea, seventeen in Japan, fourteen in the Ryukyu Islands, six in the Philippines, and three in Taiwan.⁶¹

In Micronesia the number and size of U.S. military lands and facilities is also known. The Trust Territory of the Pacific Islands has a total of seven installations. The Kwajalein Missile Range, with headquarters on Kwajalein Island, is in the Marshall Islands. There is a Coast Guard installation on Ebeye Island in the Kwajalein Atoll. Enewetok Atoll, in the Marshalls, is part of the Western Test Range facility. In addition, there are Coast Guard installations on Saipan in the Mariana Islands, Yap Island, Angaur in the Palau Islands, and Enewetok Atoll in the Marshalls.⁶²

⁶¹ Department of Defense, "U.S. Military Installations Outside the 50 States," (Washington, D.C.: International Security Affairs, July, 1973).

⁶² Recent negotiations between the Trust Territory and U.S. officials revealed further military lands in the T.T. are necessary. The new installations will be in Tinian and Saipan located in the Mariana Islands, and Babelthaup and Malakal Harbor located in Palau.



While the civilian economy has grown rapidly in the 1970s, by far the single largest industry is the military. The total military expenditure ending June, 1975, amounted to almost \$217 million. (See Table 10) This constituted an increase of 18 percent during the economic recession (from \$183.5 million total expenditures in 1974 to \$216.9 in 1975). Payroll payments to military personnel and civilian employees over a five-year period increased by 50 percent. On the basis of real estate values and replacement costs the total military assets on Guam are estimated to be worth \$2.6 billion.⁶³

The Government of Guam

On July 21, 1950, the Guam Organic Act established a local government for the island's civilian population. Citizenship rights were granted to the Guamanians, and the new unincorporated territory became subject to certain U.S. laws and congressional acts.

The Organic Act provides that federal income taxes belong to the Government of Guam. Income taxes collected directly in Guam from businesses and individuals are referred to as Guam income taxes. They follow federal internal revenue regulations and are based on federal IRS guidelines. The federal agencies in Guam deduct federal income taxes from their employees' wages, and while that employee may file his income tax return elsewhere, the federal government returns that income tax to the Government of Guam. (See Table 11)

⁶³Guam Annual Economic Review, 1976, p. 18.



Table 10. Military Expenditures: 1964-1975
(In thousands of dollars)

Fiscal Year	Military Pay	Civilian Pay	Military Construction	Other	Total
1964	32,228	21,711	15,347	--	69,286
1965	33,385	24,770	6,545	22,764	87,464
1966	37,249	32,158	6,885	25,174	101,466
1967	38,814	34,275	691	49,025	122,805
1968	51,008	35,299	11,679	39,118	137,104
1969	55,812	38,304	12,656	36,857	143,629
1970	56,045	40,394	20,265	46,903	163,607
1971	57,570	34,573	12,986	37,261	142,390
1972	54,104	36,572	22,670	30,489	143,835
1973	65,245	43,314	15,197	48,097	171,853
1974	74,316	48,000	22,682	38,500	183,498
1975	97,372	59,869	29,295	30,397	216,933

Sources: Statistical Abstract, 1976, p. 65; Commander Naval Forces Marianas, Guam.



Table 11. GOVERNMENT OF GUAM STATEMENT OF REVENUE: 1975

Class of Revenue	1975
I. General Fund	
Taxes:	
Income Taxes	\$ 51,183,228
Gross Receipts	21,963,212
Alcohol Beverage	1,033,884
Tobacco	654,611
Excise and Admission	334,629
Vehicle Transfer	281,545
Use Tax	664,548
Real Property	762,490
Others, Documentary Tax	<u>195,309</u>
Sub-Total	\$ 77,073,456
Licensing and Permits	511,639
Fines and Forfeitures	380,489
Use of Money and Property	1,026,925
Revenue from Other Agencies	
Income Tax from U.S. Agencies	16,844,339
Immigration fees	120,964
Revenue from Current Services	
General Government	119,014
Public Safety	56,000
Public Works	29,056
Hospital	4,426,949
Public Health and Social Services	34,738
University of Guam	456,158
Public Library	2,888
Agriculture	74,678
Commerce	5,205
Others	
Other Local Revenue	1,305,396
Federal Grants-in-Aid	<u>14,822,662</u>
Sub-Total	\$ 40,217,100
TOTAL	<u>\$117,290,556</u>
II. Special Funds	
Territorial Highway Fund	\$ 8,456,213
Tourist Attraction Fund	693,789
Economic Development Fund	1,918,418
Housing Revolving Fund	<u>936,609</u>
TOTAL	<u>\$ 12,005,029</u>

Table 11. Continued

Class of Revenue	1975
III. Semiautonomous and Autonomous Agencies	
Guam Airport Authority	\$ 1,005,768
Public Utility Agency	3,096,060
Guam Telephone Authority	4,729,315
Commercial Port	5,878,249
Guam Power Authority	25,809,024
Guam Housing and Urban Renewal	3,817,500
Guam Economic Development Authority	176,926
Guam Housing Corporation	<u>467,018</u>
TOTAL	<u>\$ 44,979,860</u>
IV. Capital Projects	
Federal Grants	\$ 4,202,329
Other Funds	<u>2,606,900</u>
TOTAL	<u>\$ 6,809,229</u>
GRAND-TOTAL	<u>\$181,084,674</u>

Source: Statistical Abstract, 1976, pp. 62 & 63.

The Government of Guam is a large bureaucracy consisting of some 9,016 employees in 1975; therefore, its economic importance as an employer, especially for Guamanians, is significant. Out of a total of 34,938 persons employed on the island in 1975, 45 percent (15,697) were employed by government. The Government of Guam in that year employed 25.8 percent (9,016) of the work force, and the federal government employed 6,681 civilians, or 19.1 percent.⁶⁴

While the Government of Guam in 1975 showed approximately \$181 million in revenue, it spent \$187,351,167 that year. The largest class of expenditure was education at \$51,132,951. The 1975-1976 school year found public school enrollment at 28,209, with the University of Guam's total academic enrollment at 3,862. Some of the government educational funding supports the private school sector (K-12 grades); there were 4,592 students who attended private schools on the island. This means that the island's population of 103,010 supported some 36,663 students during the 1975-1976 school year. Approximately 35.6 percent of the Guam population is supported by public funding of education at an overall average of \$1,395 per student.

Other Government of Guam expenditures include the Department of Public Health and Social Services, \$15.8 million; Public Safety (Police Force), \$10.6 million; and transportation and economic development, \$6.2 and \$4.5 million, respectively. Community services, environmental protection, recreation, and general government-wide support totaled

⁶⁴Statistical Abstract, 1976, pp. 43-46.



another \$18 million for a general fund total of about \$105 million. Other Government of Guam agencies which are autonomous and self-supporting for the most part provide the balance of the money flow set out in Table 11.

With respect to agricultural interests, several Government of Guam programs affect the island's farm operators. One of the most important is the gross receipts business tax; from its incipience in the early 1960s, agriculturalists were exempted. Therefore, the individual farm producer who markets local produce is excused from this government business tax. However, certain horticultural establishments, i.e., plant nurseries, and agricultural services, i.e., farm machinery, are not excluded. Altogether these agri-businesses provided slightly over \$1 million of the 1975 gross receipts revenues, while the producers themselves paid none.

Another significant governmental subsidy for farmers involves the Government of Guam's Department of Agriculture. This agency during the 1970s expended annually about \$1 million for plant and animal development, forestry and soil conservation programs, and fish and wildlife research and extension projects. According to Department of Agriculture officials during fiscal 1977 the Department of Agriculture received a legislative budget of \$1,094,627, and employed seventy-eight technical and professional personnel.

Agriculture

Agricultural development in any society is a response to many cultural and technological factors. Guam's particular agricultural situation is the product of several political-historical influences.

Generally, the clash has centered on the concerns of the American commercial approach to land ownership (tenure) and exploitation, and the deeply entrenched subsistence practices of Guamanian culture.

Prior to World War II subsistence horticulture was an entrenched feature in the landscape. Many Guamanian families owned two units of land: a village house where most of the family resided most of the time, and a simple dwelling on an agricultural parcel. A dualistic pattern of urban and rural living was characteristic, with some people commuting over long distances between the ranch, or *lanchon* and the village home, often on a daily basis. Often a division of time occurred, with some family members (generally adult males) living on the farm during the week and residing in the village during the weekend. According to Bowers, in 1940, out of a total population of 22,290, though 2,812 persons were listed as farmers, it is clear that most people were growing most of their own food. In 1939, some 4,000 acres were cropped, and in the same year approximately 12,000 acres of coconut palm forest existed with 2,500 tons of copra harvested. However, since 1946, no copra has been harvested for commercial purposes.⁶⁵ By 1950 the number of Guam farmers had declined to 1,189.⁶⁶

⁶⁵Bowers, Neal, M., "The Mariana, Volcano, and Bonin Islands," Otis W. Freeman (ed.), Geography of the Pacific (New York: Wiley, 1951) pp. 223-224.

⁶⁶Johnson, Walter D. and Carey, Edwin L., Guam 1969: A Developing Pacific Economy (Agana: Guam Technical Services, 1970) p. 30.

In addition to subsistence gardening for the family food supply and supplementing their incomes with copra production, the Guamanians also fished for the family's food. However, the economy changed so drastically after World War II (coincident with the military buildup of the island) that even with the large agricultural extension service, a form of direct subsidy to the local farmers, the agricultural segment of the economy continued to decline in the 1950s and 1960s. In fact, the turnabout from subsistence farming to wage-earning became so pronounced that it was said in the mid-1960s that there were more full-time technical and professional employees working for the Government of Guam's Department of Agriculture than there were actual island farmers.

In 1973-74, an intensive field investigation was conducted among the farm-rural community of Guam. The purpose was to empirically assess the agricultural picture of modern Guam. This fieldwork revealed several impressions reported at length in this analysis. These people interviewed demonstrated a tremendous determination to maintain their agricultural activities, to expand their individual operations when feasible, to teach any younger people who were willing to stay on the farms, and to learn new agricultural methods and techniques. While farmers frequently criticized the Department of Agriculture and the Public Utility Agency of Guam leadership in general, they perceptively faulted an unfair allocation of the island's resource distribution as the basic reason for the magnitude of the historical decline of Guam agriculture.

The survey also revealed the production capabilities of the island. For example, it was found that:

- 1) the 100 farmers surveyed (or 39.1 percent of the population of 256 practicing farmers) operated 664.5 acres of land which included field and tree crops and pasture;
- 2) the 156 farmers not covered in this survey, or 60.9 percent, operated another 1,035 acres for a total projected acreage of 1,699.5;
- 3) similar potentially arable land exists; two independent studies show, for the South region alone, acreages of 5,197 and 9,791 are suitable for (but presently unused) agricultural lands;⁶⁷
- 4) local agricultural production in 1974 accounted for approximately 26 percent of the food requirements of the island's population. (See Table 12. Note: food data in this table excluded certain foods consumed in Guam, e.g., milk and rice.)

The sections that follow describe the basic findings of that agricultural survey. Each question is evaluated by analyzing the aggregate responses.

Personal and Social Background

Most of the farmers surveyed were between 40 and 60 years of age. There were 6 farmers over 65 years old, and 6 under 35. There were 80 who are Guamanian by birth; half were born in Agana and half in the South region; 9 farmers interviewed were born in the United States, 7 were oriental in origin, and 2 were Micronesians. In two cases no

⁶⁷Gillham, Koebig, and Koebig, Inc., Irrigation Feasibility Study (Agana: Department of Agriculture, 1973); Bureau of Planning, Master Plan unpublished (Agana: 1977).

Table 12. Guam Agricultural Production and Imports, 1974

<u>Commodity</u>	<u>A</u>		<u>B</u>		<u>C</u>	
	<u>Local Production</u>		<u>Imports (Estimate)</u>		<u>Total Consumption (A+B)</u>	
	Dollars	%	Dollars	%	Dollars	%
Eggs	1,982,904	86	327,926	14	2,310,830	100
Fruits & Vegetables	798,065	26	2,304,490	74	3,102,555	100
Pork	563,200	22	1,962,684	78	2,525,884	100
Poultry	104,300	8	1,156,552	92	1,260,852	100
Fresh Fish	131,000	11	1,104,010	89	1,235,010	100
Beef	94,068	2	3,740,990	98	3,835,058	100
	<u>\$3,673,537</u>	<u>26</u>	<u>\$10,596,652</u>	<u>74</u>	<u>\$14,270,189</u>	<u>100</u>

Source: W.P. Leon Guerrero, R. Muniappan, J.T. Ishida, V.T. Artero, Trends in Agricultural Development in Guam and Micronesia (University of Guam, 1976, unpublished) pp. 23-24.

answer was given.⁶⁸ Of the 100 farmers interviewed, 92 were married, 83 lived in households with more than 2 people, and over half had children still attending school.

Location of Farm by Field and Residence

Exactly 50 percent of the farmers lived on their ranches or farms. This is a new development in Guam. Historically, Guamanians lived in the village and traveled to their farms. With a rapid population growth, and village/residential sprawl and the post-World War II advent of paved roads, some farmers moved to their fields and subsequently built permanent homes there. However, the data in response to questions regarding house (residence) location and field (farm) location also reveals the close correspondence in proximity of residence and farm. In short, the following data on residence and farm site location by region reveals not only a new adaptation (farm and residence the same) but also the traditional tendency for house and field to be located away from each other. Largely because of the improved transportation system, the overall distance between the farmers' residence and farm is relatively short. Yet it is incorrect to suggest that farm people in the South region farmed land in the North, or vice versa. Of the farmers whose 42 residences are located in the Central region, most of them have Central farms. As seen in the data below, there is a marked degree of coincidence between farm and residence; in the North region, for example, 31 of the 33 farms located

⁶⁸In this description, NA represents a No Answer response. For the question, "Where were you born?", there is no apparent reason for a NA. For the most part, a NA means a zero, or that the question did not apply, and therefore the farmer gave no response.



there include the residence. Even in the Central and South regions, less than 30 percent of the farms by region are separated from the farm residence. (See Figure 8)

<u>Region</u>	<u>Residence location</u>	<u>Farm location</u>
North	31	33
Central	42	30
South	<u>27</u>	<u>37</u>
	100	100

Those farmers who said they had more than one farm or ranch totaled 28, and 64 said they operated only one plot or parcel of land. Over half said they had operated these farms for at least 9 years, and 35 said they had operated the farm for more than 9 years.

Farm Size

Verifying the size of the farm property was done on the farm site when possible. In setting down the response to the question "How much total land do you work or operate?", conversions were made during the interview from the various areal units given by the farmer to acres. Farms in Guam are small: 45 of the farmers answered that their farms were 0-2.99 acres in size; 17 farms were 3-4 acres; 24 were 5-10 acres; 6 were 11-20 acres; and 8 were 21 acres and more. The largest was 50 acres in operational size. Therefore, the average size of the Guam farm was 6.645 acres. Moreover, the median farm size measured between three and four acres. This is less than the 20 acres that Lee found in his study, although he was probably describing land owned, not

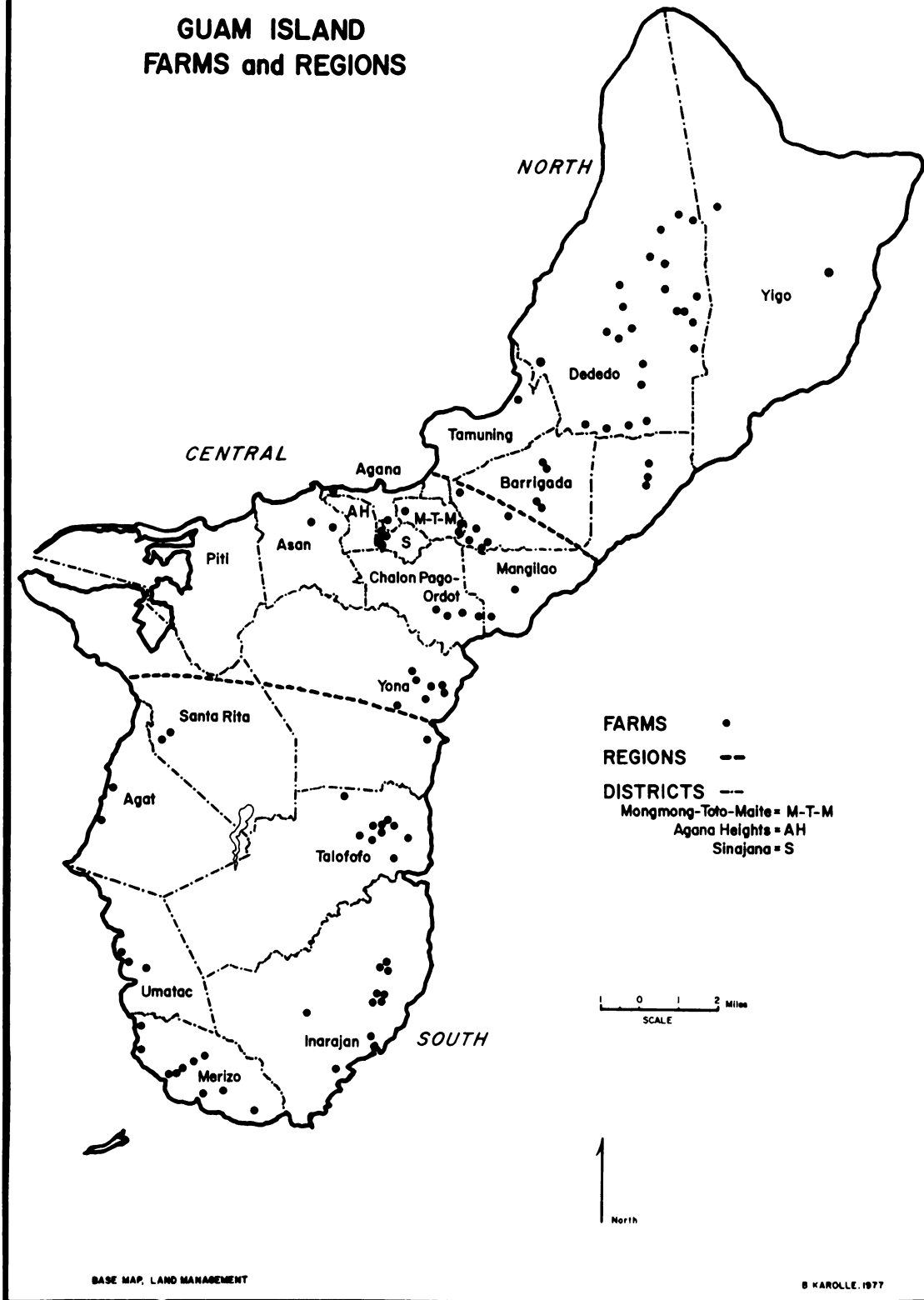


Figure 8. Guam Island Farms and Regions



Figure 8

GUAM ISLAND FARMS and REGIONS



necessarily how much land the farmer actually worked.⁶⁹ Also, since that time, much agricultural land has been rezoned, and ownership patterns have changed.

Land Ownership

There were 66 farmers who said they or their family owned the land they were farming. Only 4 farms were being rented or leased from private individuals, and 24 farmers said they were using land under the Government of Guam's Agricultural Land Lease Program. The single corporate farm, Sunshine Gardens, was a commercial hydroponic operation primarily growing tomatoes under glass and plastic. There were 5 NAs.

In answer to the follow-up question "How did you acquire the land?", 36 said they inherited it; 20 had bought theirs; 12 rented (which was a rate three times higher than their response to the previous question on ownership), but several of these said that they were renting the land from relatives, which probably explains this particular discrepancy; 25 said "other"; 24 were under the Land Lease Program; and 2 farmers told me they were actually squatting on government land. One squatter said the village commissioner approved of what he was doing, and his hope was that someday the government would recognize his use-claim and hence his eventual right to the land. He had built a house and was cropping about 3 acres. There were 7 NAs for this question.

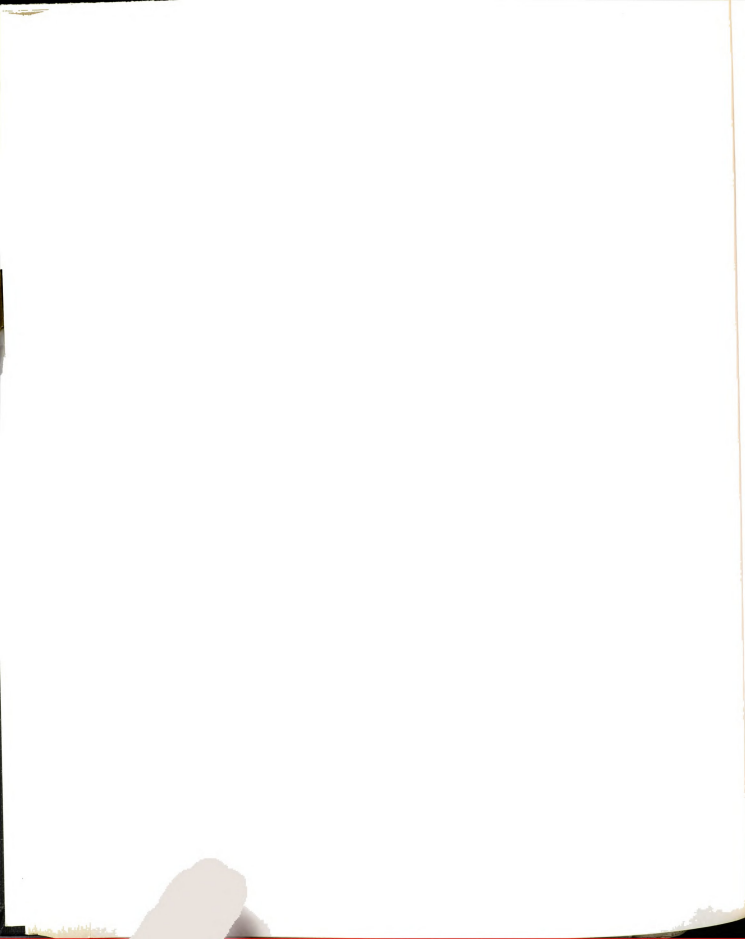
⁶⁹David Lee, "Problems in Tropical Agriculture: A Case Study from Guam," Yearbook Vol. 33 (Corvallis, Oregon: Association of Pacific Coast Geographers, 1971) p. 48.

Farm Land Value

Most of the farmers interviewed had difficulty answering questions that involved money. More than 50 percent did not respond to the two questions pertaining to the market value of their land and what they considered the land was worth to them. (This reflects a desire on their part to avoid discussion of money matters generally.) Slightly more than half of those who responded regarding the market value of their farmland said their farms were worth \$0-5 per square meter; 10 responded with \$6-20 per square meter; and 11 said their lands were worth more than \$21 per square meter. Of the 41 who answered the question "If you wanted to sell your land, how much do you think it is worth?", 29 said it was worth more than \$25 per square meter.

Physiography

Of the 100 farmers interviewed, 15 had coastal plain locations, and only 6 indicated that 90 to 100 percent of their farms were coastal lowland. Another 16 said their farmland was located in "valleys and low areas." There were 53 who identified their lands as being in the North and Central regions on limestone plateau, and 31 said their farms were located in the South region on volcanic plateau and near mountains. While there were farms that overlapped from one physiographic category to another, nevertheless for the most part, the farmers knew the topography of their lands, and were consistent in the identification of them. According to a Government of Guam study



written in 1972, about 24 percent of Guam is 36 degrees of slope or more; another 19 percent is classified as having 16-35 degrees of slope; and about 57 percent is 0-15 degrees of slope.⁷⁰

Regarding the farmers' assessment of their soils, 11 said they had clay, 30 indicated theirs were alluvial, 37 specified their soil as red (lateritic), and 11 indicated other (mainly identified as different types of clay and limestone soils). There were 11 NAs. Most farmers had a personal opinion of their soil fertility: 36 said their soil was of superior fertility, 48 thought their soil was of average fertility, and 11 indicated that their soil was poor, or of low fertility. There were 5 NAs.

Concerning rainfall requirements and field water supplies, 75 farmers said there was inadequate rainfall throughout the year for proper crop production, 22 said there was enough precipitation, and there were 3 NAs. In answer to whether they irrigated, 74 said that they had to take water to their fields, 19 said they did not irrigate, and there were 7 NAs. The follow-up question regarding the number of months in the year they irrigated elicited a wide distribution of responses: 57 farmers irrigated from 1 to 7 months out of the year, and 4 said they irrigated in every month (there were 39 NAs). The public water system supplied 69 farmers, and 25 said they used surface or ground water sources from their own land. Of those 69 who used the public water system, 42 said they did not receive the agriculture cost rate for public water. At that time the agriculture rate was 50

⁷⁰Greenleaf and Telesca-Ahn, Guam Master Plan, Phase I: Problems, Opportunities, and Alternatives (Agana: Government of Guam, 1972).

percent less (\$.25 per 1,000 gallons) than the regular domestic water rate. There were 77 farmers who indicated that they would use public water for irrigation if it were made available. The majority (53) responded that the cost for such water services should stay at the present agriculture rate. Many said that they would pay more for this service if the service was improved.

Farm Land Use

A total of 53 farmers indicated that up to 50 percent of their farm was utilized for cropland, or that it was regularly under cultivation; 35 said between 50 and 100 percent was utilized for cropland. There were 12 NAs. Half stated that a substantial amount of their farm (up to 20 percent) was utilized for buildings (which included their residence), and 49 said that up to 20 percent of their farm was utilized for roads and trails. Of the 100 farmers interviewed, 34 identified various amounts of land used for pasture, and 38 for forest. In answer to another land use question, 50 indicated that portions of their operations involved unused land.

Crops and Animals

In response to the series of questions on field crops generally, the small size of the Guam farm is shown. Most farmers grow small portions of an acre of tomatoes, eggplant, beans, melons, cucumbers, cabbages, peppers, and corn (the only grain grown). In response to the question "How many acres are planted in all the above [field] crops?", 24 said less than 1 acre, 16 indicated 1 to 2 acres, 12 said 3 to 5, 3 said 6 to 10, 5 said 11 to 20, and only 1 farmer had more than 21 acres in field crops but less than 50 acres. There were

39 NAs. Thus, the grouped data here reveal that the average field cropped portion of Guam farms is 3.623 acres in size, with the median farm 1 to 2 acres.

Larger acreages were planted in tree crops on the average farm, i.e., banana, citrus, mango, papaya, coconut palm, and betelnuts. In response to the question "How many acres are planted in all tree crops?", 26 said less than 1 acre, 14 indicated 1 to 2, 1 said 3 to 5, 4 said 6 to 10, 3 said 21 to 50, and 3 said over 50 acres. Therefore, 51 farmers raised tree crops on an average of 6.402 acres per farm, making the average tree farming size twice that of vegetable farming. The median tree portion of all 100 Guam farms was found to be approximately 1 acre.

There were 18 farmers who double-cropped up to 20 percent of their cropland yearly, and 26 said they double-cropped over 20 percent; 27 indicated they triple-cropped up to 20 percent of their tilled land, and 10 said they triple-cropped more than 20 percent.

Of those that practiced interculture, mainly trees and vegetables in the same field, 54 percent of the farmers who answered the question used up to 20 percent of their land for interculture, and the other 46 percent of the farmers who responded said they inter-cropped more than 20 percent of their farm.

In response to the question "Are your crops planted by season?", 53 said yes, 35 no, and there were 12 NAs. For their individual farm operations, 15 said there existed a one-crop season; 16 indicated there were 2 seasons; 22 said 3 seasons; and 13 said there were more than 3 seasons for their yearly operations. There were 34 NAs.

In response to the question "How much land is used for animal purposes [pens, barnyards, fields, etc.]?", 48 farmers said that up to 20 percent of their farm was utilized for stock purposes, and 21 indicated they used more than 20 percent (31 NAs). Chickens constituted the most numerous food animal commonly raised by the Guam farmers. However, the range of the chicken population on Guam farms went from zero to several thousand. The average farm supported both loose scavengers and laying hens with an average of 59 and 74, respectively. The greatest portion of poultry are chickens for egg production. In 1975 the total number of laying chickens on Guam was 142,537 with an egg production figure of 2,498,620, and most of this was done by a half dozen large-scale commercial type poultry farms. Hogs were the next most important food producing animal on Guam farms. The average number of hogs per farm was 16. Beef cattle ranked as the third most numerous animal on farms, the average number being 9.48 per farm. Outside of a few remaining categories of animals, i.e., fighting roosters, ducks, goats, horses, and carabaos, there were few other animals found on the average farm. And far fewer were being raised for commercial food production purposes.

Several questions pertaining to the farm family's diet and homegrown food consumption habits revealed that the farmers do indeed eat at least a portion of the food they grow. While they spoke of the regular buying of certain imported foods in supermarkets, Guam farmers indicated a preference for foods which they themselves are able to grow. In answer to the question "What part or percent of your crop production [of all fruits and vegetables] is eaten by you and your family?", 33 said up to 20 percent, 10 indicated between 21 and 40



percent, 9 said they consumed between 41 and 60 percent, and 31 responded that they consumed more than 60 percent of all the vegetables and fruits they grew on their farm (17 NAs). In response to the parallel question "What part of your livestock production is eaten by you and your family?", 22 said up to 20 percent, 9 said 21 to 40 percent, 8 said 41 to 60 percent, and 30 said 61 percent or more (31 NAs). When asked about the frequency of eating vegetables, 21 said their family is served vegetables at least once a day, 42 said they served vegetables 2 to 3 times a week, and 26 said they served vegetables once a week or less frequently (11 NAs). The same question was asked regarding fruit consumption, and 12 indicated fruit was served at least once a day, 29 said 2 to 3 times a week, and 43 said once a week or less (16 NAs).

Agricultural Labor

As indicated earlier, of the 100 farmers interviewed, 37 were full-time, and 59 were part time, with 4 NAs; 60 said they operated their farm alone, 33 said they had help, and there were 7 NAs; 52 said they held other jobs, and 40 said they did not work other than on their farm (8 NAs). In answer to the question "What is the average number of hours you work per week on your farm?", 64 worked up to 40 hours per week, 29 said more than 40, and there were 7 NAs.

When asked what portion of their total income is derived from employment outside the farm, 15 said that up to 20 percent of their present income comes from outside jobs, 2 said 21 to 40 percent, 2 indicated 41 to 60 percent, 7 said from 61 to 80 percent, and 34 said more than 80 percent of their income came from outside employment



(40 NAs). Responding to the question about the average number of hours worked per week on the outside job, 18 said they worked up to 30 hours, 27 said between 31 and 40 hours, 10 indicated they worked between 41 and 60 hours, and 3 worked more than 60 hours a week on the average at jobs outside the farm (42 NAs).

In response to the question "Do you hire or receive work from others in your farm operation?", 34 said yes, and 56 said no (10 NAs). This data closely approximates the earlier responses regarding the question about operating the farm alone, although on another question 69 out of 100 indicated that family members did contribute time to their farm operations. However, when asked about number of full- and part-time employees working on their farm, 22 of the 100 farmers said they employed agricultural labor. Only 6 farmers out of the 100 interviewed hired alien laborers: 3 farmers said that 3 to 4 aliens were hired on their operation, 1 said 5 to 6, and 2 farmers indicated hiring more than 6.

Investment

The survey also asked the farmer about investment in farm equipment. When asked if they had a truck for their farm operation, 52 said yes (5 had 2 or 3, and 2 said they had 4 or more), and 37 indicated they possessed an automobile for the farm; 11 farmers did not own a motor vehicle. There were 32 farmers who possessed a tractor (3 said they had 2 or 3), 33 possessed planting machinery (plows), and 22 said they owned harvesting equipment (3 said they had between 2 and 3

harvestors, and 7 had 4 or more). Rototillers were possessed by 41 farmers, with 4 having 2 or 3, and 2 farmers said they owned 4 or more rototillers. Hand tools were possessed by 64 farmers and 42 owned wheelbarrows.

When asked how much money they had invested in equipment the previous year 60 farmers responded, and the average amounted invested was \$944.47 per farmer. Of the farmers who responded to this question of annual expenditure, the distribution of answers bunched at the lower expenditure categories; 55 percent said they spend an average of \$163.86. Of the 100 farmers interviewed 41 stated how much they spent on electricity the previous year: the average expenditure was \$247.74 (23 had no public electric service on their farm, and there were 36 NAs). When asked if they had a telephone, 39 said they had a telephone in their residence or on their farm, 42 said they did not have a telephone, and there were 19 NAs.

Farm Expenditures

Table 13 shows the results of this portion of the comprehensive inventory made during the field work process. On this particular section of the questionnaire, the farmers were reluctant to divulge their financial operations. However, it was also obvious that many farmers simply did not know their accrued expenses; it seemed many did not actually keep an accurate weekly or monthly accounting of their farm expenses.

As measured in this survey, the leading farm expenditure was labor costs. However, it must be noted that few farmers operated on a large scale, commercial basis (only 18 percent of the farms expended



Table 13. Annual Farm Expenditures: Averages, 1972-1973

Expenditure Item	No. of Farmers	Total Annual Expenditure (in Dollars)	Per Capita (in Dollars)
Labor	18	39,003.00	2,166.83
Feed	60	19,468.00	324.47
Electricity	41	10,157.50	247.74
Animal Breeding	33	7,216.50	218.68
Gasoline	47	9,798.50	208.48
Water	60	12,280.00	204.67
Fertilizers	54	10,851.50	200.95
All Others	17	3,032.00	178.35
Insecticides	56	9,247.50	165.13
Other Fuel	28	4,360.00	155.71
Repairs & Maintenance	49	7,609.00	155.29
Seed	58	8,124.00	140.07
Herbicides	23	2,479.00	107.78
Hand Tools	46	3,234.50	70.32
Medicine	31	2,157.00	69.58

Source: B. Karolle, Guam agriculture field work (Agana: University of Guam, 1977).



money, an average of \$2,167, for hired workers). The next highest item of farm expenses was feed, especially feed for hogs and chickens. The average farm, with 60 of 100 farmers reporting, annually expended \$324.47 for feed. Though 23 farms were not electrified, electric costs were the third highest expense at \$247.74 per farm. Animal breeding was the fourth highest expenditure with an average annual expenditure of \$218.68. Several Guam farmers stated that they would not pay for these services; they indicated that they have established some sort of an exchange system for livestock stud service among a small group of farmers who share their breeding stock.

Improvements

Water works consistently showed its importance in Guam's agriculture with 52 percent of the farmers adding various forms of water works to their farms. In answer to the question "Do you have any tanks, ponds, barrels, or water reservoirs on your farm?", 25 said yes, with 15 farmers indicating more than 2 of the above facilities. Drainage facilities were installed on 12 percent of the farms; 9 farmers said they terraced on sloped land; 69 percent of the farmers said they rotate their crops seasonally and/or yearly.

Regarding the question concerning regular fertilization of their farm fields, 72 percent of the farmers said they did add fertilizers with 8 individual farmers fertilizing weekly, 29 monthly, and 9 yearly. In response to the query, do you fertilize by using: only manures, 18 said yes; only chemicals, 25 indicated yes; and both manures and chemical fertilizers, 36 replied yes. In response to the question on the annual quantity of fertilizer added to their soil, 45

farmers responded; the average amount these farmers put into their operations was 784 pounds of both chemical and organic fertilizers each year.

Credit

There is little indebtedness involved in Guam agriculture. There were only 12 mortgages, 16 long term farm loans, 10 short-term (yearly) operational loans; 13 farmers said they received financial aid from government agencies, mainly the Guam Economic Development Authority. In answer to the question "How much is your overall farm debt at this time?", 33 said up to \$1,000, 9 indicated their debt was in the \$1,001 to \$5,000 category, and only 4 said they were in debt between \$5,001 to \$20,000 (54 NAs).

Role of Government

Of the 100 farmers interviewed, 36 were members of one of the four or five agricultural organizations on the island. Twenty-seven were members of the Guam Farmer's Association which is partly subsidized by the Government of Guam. The GFA is primarily a marketing cooperative, and serves the farmers by guaranteeing a market outlet for their produce. The organization also maintains a delivery truck, and provides farm-to-market produce delivery for the farmer-members. Fifty-five responded affirmatively to the question "Does the Department of Agriculture offer any assistance to you and your operation?" They were then asked to respond yes or no to the following list of types of assistance offered (the affirmative responses are indicated):



Financial aid	6
Technical knowledge	28
Equipment loans	25
Seed and plant aid	28
Training and education	16
Crop and animal subsidies	11
Other assistance	9

Summary

The ground level farm survey revealed a surprisingly larger number of operators than expected and previously reported. However, the number of active farmers (256) was small, with 37 percent of those defined as full-time operators. In addition, this number accounted for no more than 1 percent of the island's civilian work force. Half of the operators lived on their farms; the majority were middle-aged and received significant proportions of their individual income from non-farm sources. The income dollar value of the farmers' combined crop production was found to be three to four times more than the earned income reported owing to the farmers' family consumption. The operator and family members simply consume their own produce before it enters the market place.

The size and amounts of land utilized by the operators revealed that individual farms were relatively small. The group data average of the total individual farm sizes was just over 6.5 acres; however, the median farm size fell between 3 and 4 acres. Moreover, the average tilled or field cropped portion of the average farm was 3.6 acres with a median of 1-2 acres. In other words, the aggregate averages were found to be higher than the medians for the typical total land size of the farms as well as for specific farm land uses. For example, on the average farm tree crops occupied exactly twice the space devoted to



field crops, but again the data was grouped revealing that on the median Guam farm both field and tree crops occupied about the same proportion of the whole farm.

The site locations of all individual agricultural operations showed that 80 percent of the farmers were Guamanian, and that two thirds of the farmers owned their own land, or that it was part of the family holdings; the majority of operators acquired their lands through inheritance and individual purchases. Thus, the identification of farms and farmers regarding land tenure aspects shows that alienation of land so far is less among the agricultural community than for other land use sectors, i.e. commercial holdings.

Coastal lowlands and other accessible shoreline areas were found to possess few farm locations. Military, commercial, residential, and recreational land uses prevailed in the coastal regions.

The farm survey distribution found on Figure 8 locates 100 individual agricultural operations (farms). A majority of the island's farms are located in the North and Central regions on limestone plateau surfaces. Unlike most of the South farms, the agricultural operations in the North and Central regions exist near relatively densely populated areas. Another distributional feature shows a dispersed pattern of farms in the North, quite well defined in the less populated areas of the Dededo district. However, the South region was found to include the largest number of farms in the survey by region, but containing a sharp distinction regarding site physiography. In the South region from Agat to Merizo farms were primarily located on coastal plains and



in coastal river valleys. However, in contrast, in the southeast from Inarajan to Yona, 85 percent of the South region farms were found clustered on volcanic plateau surfaces.

Further, it was revealed that the majority of Guam farmers operate on seasonal cycles; they irrigate their fields at least half the year; and nearly 75 percent regularly fertilize their fields. Most farm labor derives from the owner/operator and his family members. However, when additional labor is required, labor expenditures rank first on the average Guam farm. Indebtedness exists for only a minority of farmers; farm organizations are reasonably active among the agriculturists, and Government involvement is high.

It was found that water availability for increased agricultural development poses a serious problem to the island. Present allocation of water provides domestic and urban users first priority. The correspondence of the distribution of population and consumption leaves the rural areas lacking a water supply necessary for annual multi-crop field production. The effect of not having increased water pressure and adequate quantities of water daily and hourly flowing from water lines in the agricultural areas is tantamount to a no-growth agricultural policy.

The farmers surveyed, and those attending public meetings dealing with water problems, indicated that field irrigation is essential to their operations. They consistently pointed out the failure of public utility agencies to provide necessary rural coverage for their individual farm needs. During severe drought conditions many parts of the island experience public water supplies being terminated



for daily periods. Water pressure is non-existent for many rural areas. For the southern region as a whole and specifically the two villages of Umatac and Merizo, insufficient water infrastructure means perennial lack of potable water. The situation is indefensible and irrational not only in economic terms but for quality health standards. The water problem is responsible for a continual lag in agricultural development.

Tourism

Guam as a tourist destination had its start with the opening of the airline route between Japan and Guam in May, 1967. Tourist arrivals increased from that time at an annual rate of over 100 percent until 1973. Since then the tourist industry in Guam has leveled off with 237,000 visitors being accommodated in 1975. (See Tables 14 & 15)

The location of tourism in Guam rests on several influencing factors. The most important are the physical features of the landscape. The combination of sun, seascapes, and the marine ecology of the island provides an attractive environment. Moreover, the development of tourism in Guam and Micronesia derives from the existence of an urbanized-industrial Japan on the north, and of the relatively underdeveloped islands possessing a warm, sunny climate to the south. Another factor involves the establishment of cheap air transportation from Japanese destinations to Guam and Saipan. To some extent the more social and cultural interests on the part of the Japanese for opportunities to come in contact with a foreign American-Guamanian frontier provides other influencing reasons. Certainly the availability of a Pacific island culture, a chance to purchase U.S. goods, and

Table 14. Tourists and Other Visitors To Guam
(1967-1975)

Year	Tourist Arrivals	Returning Intended Residents and Other Visitors ¹	Total
1967	3,500	1,324	4,824
1968	15,082	2,918	18,000
1969	30,810	27,455	58,265
1970	50,500	24,500	75,000
1971	84,885	34,289	119,174
1972	139,883	45,516	185,399
1973	184,824	55,520	240,344
1974 ²	233,099	27,469	260,568
1975 ²	208,982	28,018	237,000

¹Government statistics include returning residents and intended residents among visitor totals; other types of visitors are not defined. Tourist arrivals have been considered the most significant data and these are used throughout the study.

²Data based on first 6 months of 1975.

Source: Statistical Abstract, 1976, p. 86.



Table 15. Visitor Arrivals In Guam According
To Purpose Of Trip (1967-1975)

Year	Business	Pleasure	Other	Total
1967	99	4,284	117	4,500
1968	725	15,082	2,193	18,000
1969	14,264	30,810	13,191	58,265
1970	10,530	44,580	16,611	73,721
1971	13,325	84,885	20,964	119,174
1972	21,514	139,823	24,052	185,399
1973	25,622	187,471	28,053	241,146
1974	12,460	233,891	14,217	260,568
1975	--	--	(estimate)	237,000

Source: Statistical Abstract, 1976 p. 85.



a host of "less desirable" features such as prostitution, gambling, and drinking all combine to offer a variety of supplemental activities for the tourists.

About two thirds of all tourists coming to Guam are Japanese. (See Table 16) The popular opinion held by the community is that the main category of Japanese visitors is honeymoon couples. However, a study in July, 1974, showed that 68 percent of all visitors were single, and well over half were male. Tourists tend to be young (50 percent were between twenty and thirty years of age).⁷¹ Even so, it is shown that of those newly married Japanese couples, each year about 4 percent travel abroad and about half of this travel is to Guam compared to a third to Hawaii.⁷² (See Table 17) This is owing to the relatively low cost of the excursion round-trip air fare between Guam and Osaka or Tokyo (\$288 or ¥79,900 for Tokyo/Guam/Tokyo as of late 1977). The excursion fare restriction requires the traveler to return within twenty-eight days. By comparison the regular non-restricted, round-trip economy class ticket is \$320 from Guam to Tokyo. The round-trip regular fare Tokyo/Manila is \$590 (¥163,600), from Tokyo to Hawaii the fare is currently \$770 (¥213,400) for a twenty-one-day excursion with a fourteen-day minimum, and the Guam/Tokyo twenty-three-day excursion fare is \$236.

⁷¹Peter C. Mayer, "The Visitor Industry on Guam", Vol. II, The Social-Economic Impact of Modern Technology Upon a Developing Insular Region: Guam (Agana: University of Guam Press, 1975) pp. III-37-38.

⁷²Stanford Research Institute, 1974, p. B-14.



Table 16. Visitor Arrivals In Guam According
To Visitor Origin (1967-1975)

Year	Japan	United States	Pacific Trust Territory	Philippines	Other	Total
1967	20.5%	40.7%	18.3%	--	20.5%	100.0%
1968	35.0	38.0	12.5	--	14.5	100.0
1969	50.0	32.0	9.0	--	9.0	100.0
1970	59.8	24.4	7.7	--	8.1	100.0
1971	70.5	16.6	6.2	2.4	6.7	100.0
1972	74.9	15.6	4.0	1.4	5.5	100.0
1973	68.3	15.5	7.0	.6	8.6	100.0
1974 ¹	66.1	10.5	7.7	10.6	5.1	100.0
1975 ¹	70.9	10.2	8.0	7.3	3.6	100.0

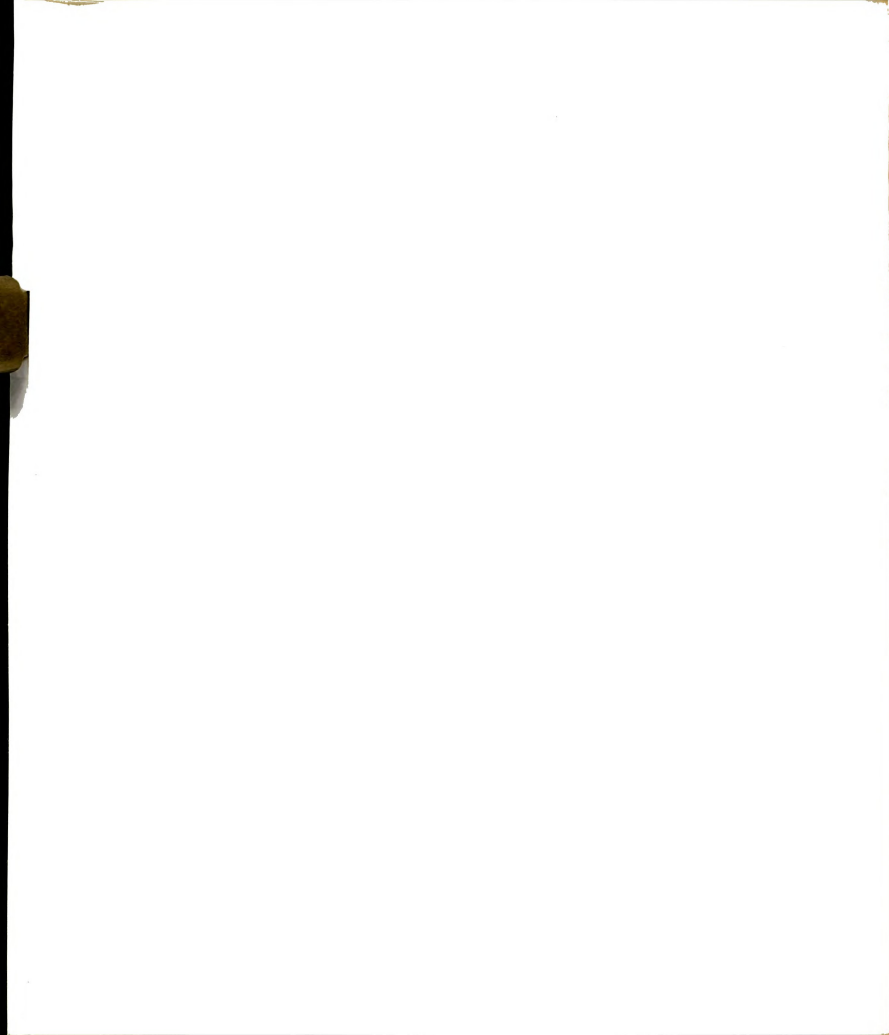
¹Estimates

Source: Statistical Abstract, 1976, p. 84.

Table 17. Guam's Share Of Total Japanese
Travelers Going Abroad (1967-1973)

Year	Guam's Share of Total
1967	1%
1968	2
1969	3
1970	5
1971	8
1972	7
1973	6

Source: Stanford Research Institute, 1974, p. B-16.



A study conducted in 1974 projected 160,000 Japanese tourists, each purchasing a \$400.00 average tour from Japan to Guam which provided about \$64 million to the Japanese travel industry. This type of tour includes air fares, hotel and some sightseeing costs paid to the tour operator in Japan before leaving for Guam. The benefits to the Guam economy in this 1974 study were calculated by the number of tourists times the length of their stay times their average expenditure per day. The dominance of the tourist industry by the tour operators (agents in Japan) with pre-purchase package tours provided an estimation of tourist expenditure once they were in Guam. The average expenditure by the Japanese tourist during a four-day, three-night stay was found to be \$130 per day. About 60 percent of the daily Guam expenditure was for the purchase of personal items and gifts, and about 40 percent for hotel accommodations, meals, sightseeing, and entertainment. This money apparently stays on Guam since it's spent here.⁷³

If the 160,000 Japanese tourists projected for 1974 spent \$130 a day, and stayed three days, they contributed at least \$62 million to the Guam economy in that year. In addition, economic benefits directly accrued in tax revenues for the Government of Guam. (See Table 18) Since the hotel occupancy tax was imposed in 1970, a total of more than \$2.4 million had been collected by the end of 1974. Originally established at 5 percent of room charges, the tax increased to 20 percent in 1975. Preliminary data show that 1975 and 1976 were slower years for Guam's tourist industry; but assuming no increase in room rates, a

⁷³Martin Pray, "Growth and Effect of Air Charters on Guam's Tourist Industry," PASA, Vol. 1, No. 2 (Agana: Pacific Asian Studies Association, 1976) pp. 9-10.



Table 18. Hotel Occupancy Tax Collection By the
Government of Guam (1970-1974), and
Guam Visitors Bureau Budget (1970-1975)

Year	Amount Collected (in dollars)	Guam Visitors Bureau Budget (in dollars)
1970	\$ 60,200.00	\$ 124,911.00
1971	225,300.00	123,441.15
1972	443,000.00	117,700.00
1973	777,500.00	174,992.40
1974	<u>932,000.00</u>	<u>174,992.40</u>
Total	\$2,438,000.00	\$ 716,036.95
1975 estimate	1,000,000.00	750,000.00

Sources: Stanford Research Institute, 1974, p. B-23; Guam
Visitors Bureau, 1976.



steady tourist occupancy, and no other major changes occurring in the industry, the hotel occupancy tax collections most likely will provide about \$1 million annually to the Government of Guam for the next few years.

Tourist expenditures can be a significant factor in the economy of Guam. If tourists make direct expenditures for a variety of goods and services, then the local industry re-spends this income for purchases of materials and services, wages and salaries of employees, advertising and promotion, taxes, replacement of capital assets, and new construction. This impact exists for the island. By the time the tourists' spending is exchanged a second time, the new revenue is disbursed throughout the economy. However, much of the present tourist development is controlled by foreign investment, predominantly the Japanese. A major share of recent investments in hotels, tour agencies, and tourist specialty shops are Japanese owned and operated. The major concentration of tourist hotels is located in Tumon along the Tumon Bay beaches. There are presently eight modern tourist hotels (the Japanese Tokyu is now closed), and two smaller off-the-beach hotels (Suehiro and Joinus) representing a capitalization for construction and equipment estimated at \$60 million. Situated southwest to northwest along the crescent-shaped beach are the Hilton, Tokyu, Continental, Dai-Ichi, Tropicana (formerly the Kakuei), Fujita, Reef, and Okura. A total of 1,864 rooms is currently available. Five of these hotels are Japanese owned, and they control 65 percent of

those rooms, or 1,215 of the available tourist rooms. Island wide, the total number of hotel rooms is presently 2,555, compared to the 267 available back in 1967.

However, while the predominance of the Japanese hotel interests is known, as of this date no scientific study has been conducted based on economic cost-benefits of Guam's tourism. Other disadvantages center on the relationship of environmental quality, public expenditure for infrastructure, and profit orientation of the investors. If there is a carrying capacity for tourists and if it is too high for the island's ecosystems, then a cursory examination already shows environmental degradation. Tumon Bay water quality, having declined in quality since 1970, but reported as "adequate" for recreational uses, is artificially maintained. The sewage outfall for the Tumon area currently empties on the reef just to the south of the hotel district. Agana Bay water is tested regularly by the local water control agency, and is consistently reported in the newspapers as being too "polluted" for safe swimming.

The joint aims of conserving the environmental aesthetics of Guam and of advancing economic development through tourism are interdependent. The more local participation in and associated economic benefits from tourism, the more the local populace will benefit from a commitment to preserve the attractive physical features which attract the tourists. If ecological considerations are ignored through poor private and governmental planning, then Guam can expect considerable undesirable consequences. One of Guam's most beautiful seascapes is now a built-up tourist area, and may offer an example of unplanned or spontaneous development.



Since 1967, most hotels that were built to cater to the tourists, which includes all of the major hotels on Tumon Bay, were given subsidies. The Government of Guam allowed reduced taxes for a designated time period to firms that would build hotels. These subsidies received by the off-island and foreign investors included a rebate of corporate income taxes and of income taxes on dividends paid to shareholders; real estate taxes were also reduced.⁷⁴

Tourism is an important employer directly employing more than 3,000 persons in 1974. (See Table 19) Another source placed the employment number at 4,485 people working in the tourist industry in 1974.⁷⁵ By comparison, the Government of Guam in 1974 employed 8,566; the federal agencies' total civilian employment was 7,382; and in the private sector's general contracting and building trades, employment was 7,458. Although the tourist industry employment is dispersed, collectively its impact on the economy is significant, representing between 11 and 20 percent of the work force. In addition, other employment resulting from tourism developments and expenditures probably brings about additional employment and business in general, and is affected by the economic activity of the visitor industry. For example, one South region village, Inarajan, has organized a community project designed to attract---so far successfully---the around-the-island sightseeing tours organized for the Japanese hotel tourists. Earnings from the all-volunteer Lanchon Antigo, or old Chamorro village, stay in

⁷⁴Mayer, 1975, p. III-34.

⁷⁵Carl J. Vail, Jr., "The Economy," The Social-Economic Impact of Modern Technology Upon a Developing Insular Region: Guam, Vol. II (Agana: University of Guam Press, 1975) pp. III-1.

Table 19. Estimated Employment In
Tourist-related Enterprises
On Guam (March 1974)

Type of Enterprise	Number of Employees
Airlines	482
Entertainers	100
Government	30
Hotels	1,560
Laundries	35
Rental car agencies	95
Security companies	40
Tourist shops	422
Sightseeing companies	139
Taxis and boats	100
Tour operators	50
Travel agencies	30
Total	3,083

Source: Stanford Research Institute, 1974,
p. B-27.



the community for local services and benefits. This type of community project supports the social welfare of the village by its direct participation in the tourist industry. In addition, this type of local control of tourism combats the tendency of the profit-maximizing orientation that results from tourist development through overbuilding and excessive densities of visitors in the so-called hotel districts. Also, a decentralized tourism which allows less "leakage" of earnings to outside investors may achieve the results of more self-sufficiency for residents as in the case of the Chamorro village in Inarajan.

It is reported that a large portion of the wages and salaries of the tourist industry is paid to employees residing in Guam. Preliminary reports show that about 66 percent of the income paid to employees in the tourist industry of Guam goes to local citizens. If a portion of the non-citizens' wages and salaries is spent locally, the overall impact may be equivalent to about 75 percent of the paid salaries and wages.⁷⁶ Purchases of goods, i.e., repairs and materials, cleaning and maintenance services, and public utilities including water, sewer, and electrical power, are all local expenditures.

Manufacturing

Guam's commercial activity is centered in Apra Harbor, which is located on the western or lee side of the island. (See Figure 4) The island's deep-water port is on the north side of Apra Harbor. The attractive natural harbor is protected on the south by Orote Peninsula and on the north by Cabras Island and the breakwater built in the

⁷⁶Stanford Research Institute, 1974, p. B-25.



mid-1940s. The whole of Apra Harbor is controlled by the U.S. Navy (Naval Station) except for the Commercial Port,⁷⁷ the island's port of entry. It is located about five miles southwest of Agana, the capital city, along the island's most extensive coastal plain. This low sandy coastal region extends for about twelve miles, from southern Tamuning to Piti, the former port of entry which is adjacent to the new Commercial Port.

An important commercial advantage for the island is that the Commercial Port is a "free port" so that entering goods are exempt from U.S. government tariffs. Additionally, finished commodities from Guam may enter U.S. mainland ports as normal state goods. They are not considered foreign commodities or products as long as certain trade policies governing U.S. territories are met. Products such as clothing or watches are required to receive between 30 and 50 percent of their value on Guam before entering the United States. The export value added on Guam allows these products duty-free entry, subject to certain limitations of U.S. Customs law, into the mainland markets.

Although raw materials are lacking on Guam, manufacturing activities are increasing rapidly. Besides the tax-free status of Guam's port, tax incentive programs established by the Guam Economic Development Authority (GEDA) are attracting new industries to the island. Such manufacturing firms that presently operate on Guam are a direct result of the island's relative location and its strategic

⁷⁷The fifteen acres of Commercial Port, Government of Guam, are used by the port for wharfage and associated facilities, and by various private firms and groups such as Mobil Oil Co. and the Marianas Yacht Club.



significance to present United States interests. The Guam Oil and Refining Company produces high-test airplane fuel and fuel oils for the military installations on Guam. Two watch factories, one aluminum window assembly plant, several rock product plants producing ready-mix concrete and concrete blocks, bakeries, a dairy, a soft drinks plant, and local handicrafts are other industries that now exist for the mainland and local markets.

Summary

For most of the twentieth century, the economy and development of Guam was dominated by the American military. A strong armed forces posture in the Pacific was maintained after 1945, and Guam remained a Western Pacific military bastion. That federal dominance by the Department of Defense may conceivably continue, or decline at some future time, and the economic reliance on military spending remains open to question. However, several political directions and relatively recent economic programs are recognized since the 1950s and 1960s.

The development of Guam as a commercial and free port and as a tourist destination offers economic alternatives to federal spending, inclusive of the military sector. Today, both the cultural and physical features of the land demonstrate the influences of international economic involvement from trade exchanges and visitor arrivals. However, these tertiary activities are maintained artificially by U.S. government spending and the alliances between the American and Japanese. Further evaluation of that economic and political connection requires attention.



The development of visitor resorts and other related amenities in Guam affects the spatial patterns of several features of the landscape, not the least of which are agriculture and settlement patterns. For Guam the impact of tourism on such a small place has serious social and ecological implications. The advantages and disadvantages require scientific appraisal. Already competition for labor and land for tourist activities presents problems.

Diversion of lands for tourist uses often means agricultural uses are lost. Additionally, agricultural land uses in Guam correspond to open space generally, and specifically, they coincide with several important water lens; they become easily contaminated by overpopulation. Future development of these primary areas as population and tourism expand places farm, water lens, and open space lands in jeopardy. Another important aspect of tourist expansion involves the question of labor force productivity. As the proportion of the labor force increases for tourism, it may adversely affect regional development by lowering production levels throughout the economic system. Employment in tourism activities is often seasonal, with low-paid and low-skilled workers, and promotes use of alien labor. Foreign labor continues to have major effects on this economy both in the private and military sectors.



Chapter VI.

FUTURE OPTIONS

The premise that the earth and its resources are finite
challenges this author's perception. Another premise such as that there
is no economic demand" for food in a population too poor to pay for it
can lead to the conclusion that there is a greater demand for food
from a different population (those who can pay for it); ten rich
Americans have a greater demand for food than ten hungry Bengalis. An
economics that divorces the concept of "demand" from the reality of
human need is not relevant. Likewise, the idea that physical
resources are essentially unlimited and inexhaustible assumes that
economic theories suggesting that resources can be infinite continue to
influence our thinking. A supply that is assumed to be infinite can by
definition satisfy infinite demand. Therefore the exhaustion of
natural resources must accordingly be assumed to be impossible--people
cannot exhaust the inexhaustible.

In Guam this latter type of thinking appears to predominate.
The political economy dependent on U.S. public tax support provides for
the present involuted and imbalanced system. The experience of Hawaii,
specifically Oahu, provides a parallel. Less than fifty years ago,
Hawaii was in about the same stage of development as Guam was in the
1970s. Many Hawaiian families were in control of their space,
land and resources. Outside capital and the concomitant power that
came with the money soon claimed control of the island(s). According



cent investigations not only are the Polynesian Hawaiians few in number, but they control little land and few power positions in that capacity.

Annex 1: Guam Without the U.S. Military

To suggest that the federal government and the U.S. military levels of spending and development in Guam would decline to the level of the pre-World War II is unrealistic, of course. At the time of the Japanese attack in December, 1941, there existed transportation and communication facilities supported by a military and para-military population of 670.⁷⁸ These naval facilities and associated commercial structure, the port and airfield, were restricted in size and located in the Apra Harbor areas of Piti and Orote Peninsula.

However, it would be unwise to project indefinitely the historic commitment of military funding that has characterized the many years following the re-occupation of Guam in 1944. Since 1974, with the American-Vietnamese War ending and the normalization policies with China occurring, a downward trend in armed forces personnel has developed. The activities of the Ship Repair Facility at Naval Station decreased to a low level causing a layoff of 361 civilians in

However remote at this time world arms limitations agreements become, reduced military budgets may occur in some form in the future. Consequently, the U.S. military posture in the Western Pacific may abruptly change and decline.

⁷⁸Carano, 1964, pp. 268-269; there were approximately 22,000 personnel, 375 U.S. Navy and Marine enlisted men, 49 Naval and Marine officers and nurses, and 246 Guamanian Insular Force and Militia personnel.



Developmental policies and programs (including population policies) focus on several factors. The interrelated factors of people, their culture, environment (nature and territory), and economic development all may work toward balance. Balanced growth based on stability, i.e., homeostasis, and resources deriving their meaning from a regional sense reflect this type of model. Resources result from interaction between man and the land filtered through a cultural pattern. The concept of development here must include the right of indigenous people to survive with some degree of prosperity and security. Thus, development is not just another word for modernization.

Regional development means the degree to which people within a region manage to utilize their available resources. As their achievements and knowledge accrue and changes, their right of access to alternative approaches for development should remain open.

Fundamental for stable development is land control and mechanisms for access to it. In Hawaii, as in Guam, the outsiders want to purchase land; with the control of land, the investors--individual or corporate--can closely monitor their investments. Land alienation affected considerable numbers of Guamanians in the 1960s and early 1970s, as shown from land holdings as documented. For example, modernization has concentrated on coastal areas. These prime lowlands have undergone a rapid transformation. Practically no farming or traditional ranching exists in coastal locations, where other forms of development, both private and public, have changed the landscape patterns. Land values and subsequent land use have placed a priority on commercial and residential development surrounding a modern highway system pressured by increasing numbers of private automobiles.



Guam imports most of its food and nearly all consumer goods outside sources. Haverlandt's household survey conducted in 1974 found that less than 41 percent of Guamanian families grew about 21 percent of their food. Only 31 percent fished for 17 percent of that important food commodity. Still the potential farmland exists; the prior areas, especially in the Central and South regions, lie idle. Half of the Government of Guam land remains unsurveyed; large portions of naval and air force lands are unused and empty of military

This situation of under-utilization of arable land⁷⁹ for food production is also reflected in the increasing balance of trade deficit. In 1965 the international trade of commodities for Guam was \$50 million; in 1974 it had reached \$280 million. The deficits for those two years was \$32.1 million and \$239.1 million, respectively. This means imports over exports rose from a 5.5 to 1 ratio to a 13 to 1 ratio of imports of goods over exports of goods during those ten years.

Food imports reflect the trend indicated by the above ratios. Trade of commodity figures for 1972 show that 15.7 percent of all categories of import commodities by value consisted of food. The categories reported by the Department of Commerce--food and live animals, beverages and tobacco, and animal and vegetable oils and fats represent \$26,118,010 of the \$166,767,662 import bill for Guam in 1972. Moreover, the United States provided 59.9 percent of the total

⁷⁹Carano reported in 1948 that 24.5 percent of Guam was classified arable; Oxford Economic Atlas of the World, 3rd edition, reported a figure for cropland of 22.6 percent in 1965.



supply in that year, followed by Australia (11.7 percent), New Zealand (9.7 percent), Japan (7.3 percent), Philippines (3.4 percent), Hong Kong (3.3 percent), United Kingdom (2.0 percent), United Kingdom (1.3 percent), and the Trust Territory of the Pacific Islands (1.2 percent). The United States provided about 60 percent of Guam's food and other necessities, it also is Guam's leading trade partner, providing nearly 38 percent of all imports during 1972 by value. Since all crude oil to Guam comes from Saudi Arabia, the second leading importing country according to the Commerce Department is "Other Countries (27.8 percent)," and Japan ranks third with 15.2 percent. The Philippines, ranked as the fourth overall importing nation, provides 4 percent, slightly behind the first three. Hong Kong, Australia, Taiwan, and New Zealand provide between one and three percent of Guam's imports, respectively.

If military spending were to decline drastically, closer to a World War II level, one of the major changes would occur in the balance of trade; a severe reduction of imports would take place since the present large amounts of revenues to the island are supported largely by federal taxes and/or Department of Defense expenditures for military construction and income from payrolls. Presently these federal funds pay for the deficits in trade of commodities. Table 20 shows that the largest category of imports in 1972 representing over 20 percent of Guam's imports, was mineral fuels, lubricants, and related products. The next two largest categories of imports directly depend on the first: importation of machinery, transport equipment, and



Table 20. Guam's International Trade, 1972 by Value
(Categories of Commodities, Imports and Exports)

	Imports	Exports	Net Imports
	(In thousands of dollars)		
Food and live animals	\$20,696	\$ 3	\$20,693
Beverages and Tobacco	5,171	42	5,129
Crude materials, inedible, except fuels	1,672	118	1,554
Mineral fuels, lubricants, and related products	46,115	7,415	38,700
Animal and vegetable oils and fats	251	0	251
Chemicals	5,089	3	5,089
Manufactured goods	27,545	75	27,470
Machinery and transport equipment	34,940	214	34,726
Miscellaneous manufactured articles	19,512	3,925	15,587
Commodities and transactions classified according to kind	5,776	4,609	1,167
Totals	<u>166,768</u>	<u>16,403</u>	

Source: Statistical Abstract, Guam, 1973, (Agana: Department of
Commerce, Government of Guam, 1974) pp. 40-41.



manufactures. All are high energy consuming items largely consisting of consumer goods, e.g., private automobiles, air conditioners, and other household electrical equipment.

Electrical power sales over the fiscal ten-year period 1966-1975 increased from less than \$3 million to over \$26 million. Island-wide consumption in the same period rose from 100.5 million kilowatt hours to 451.8, which represents over a four-fold increase for residential and commercial/government usage. The Guam Power Authority completed a new power generating facility at Cabras Island in Piti bringing the generating capacity of their service to 182 megawatts with current demand estimated at 60 megawatts. This semi-autonomous government utility is financed now by public bonds, and depends on crude oil imported from Saudi Arabia. A total of 4,161,000 barrels of oil was purchased at an average of \$13.00 a barrel in 1975 for a crude oil bill of \$54,093,000. This cost rises drastically when value added for conversion to electricity and gasoline is passed on to the consumer.

While it is difficult to precisely measure the relationship of increasing technology and the use of fossil fuels because of lack of data, several facts are apparent. There is no public transportation system of Guam, and there were approximately 50,000 private motor vehicles registered in 1975. A review of the increase in number of motor vehicles on Guam will offer an estimate of the volume of fossil fuel consumption. The number of private cars has increased in the ten-year period 1966-1975 from 16,875 to 48,203. Government of Guam estimates of vehicles increased eleven-fold during that time. Gasoline consumption estimates for private automobiles reveals a 37 percent



increase from 1962 to 1973. The total number of motor vehicles on the island in 1975 was 63,009. This means the island's population of 102,059 that year maintained a 1.6 per capita motor vehicle equivalency.⁸⁰

Without large military and other federal appropriations and spending in Guam, the imbalanced economy would abruptly decline. Money going off-island for large amounts of energy (fossil fuels) and consumer items would be reduced drastically. The expensive personal comfort and convenience items would decline from the present high levels.

Another major imbalance in the economy is the spending of money on things which can be produced locally. Local food including fish could largely replace the existing imported diet of a majority of the present population. Tourism, regional communication and transportation activities, and certain federal projects could bring revenues in for basic levels of imported energy and manufactures, while the economy could shift to self-sufficiency and reliance on local resources. This approach means a shift towards autarky and independence.

During the general election held in November, 1976, the residents of Guam had the opportunity to express their preference on a future political status for Guam. The result of the referendum on the island's political relationship with the United States was decisively in favor of a continuation of the status quo. A large majority of the voters supported "the continuation of the unincorporated status of Guam

⁸⁰ Statistical Abstract, 1976, p. 81.



with the U.S."; "more of the same" sums up this position. Statehood or independence, two other possible choices listed on the ballot, received relatively small percentages of the votes in that election.

Improvement of this apparent favorable position in the American system will lie in the island's willingness and ability to achieve relative growth toward a balanced and integrated economy. With respect to the food base and diet, it has been shown that the agriculturalists themselves consume adequate quantities of fruit and vegetables. Generally, the record is less than satisfactory for other Guam residents.⁸¹ A recent study of public school children shows a high intake of rice, bread, cereal, and other starchy foods. This is confirmed by import data; in 1972 imported rice amounted to 14,190,570 pounds, which means a consumption rate of 140 pounds of rice per person. This compares to 116 pounds per capita in 1935. In that year local production of rice was 22 percent of consumption; today, all rice is imported.

Today, the nutritional level of Guam school children shows several disturbing characteristics. This same report by Sterling in 1976 indicates that the consumption of imported soft drinks, tea and coffee with sugar, and other sweetened beverages was high, along with fried foods, chips, and fat intake. Milk intake, on the other hand,

⁸¹Jeanne B. Sterling, "Report on Eating Habits of Junior High School Students" (Agana: Department of Public Health and Social Services, 1976) unpublished; also see Jean Hankin et. al., "Dietary and Disease Patterns among Micronesians," The American Journal of Clinical Nutrition, Vol. 23, No. 3, March, 1970, pp. 346-357.



was found to be low. However, both studies found intake of protein-rich foods was high. Using a dietary recall method these studies found overall daily meal patterns to be poor to fair for Guamanians.



Chapter VII.

CONCLUSIONS AND RECOMMENDATIONS

What impressed me the most about the farm survey-fieldwork was the very positive response of the Guam agriculturalists. They were generally cooperative in answering accurately most of the questions. The farmers pointed out the need for government support for such fundamental assistance as water supply and irrigation works. Further, they recognized how depressed the farm industry was, and believed that they themselves must continually struggle for their minority way of life in order to retain the viability of local ranching.

Despite the difficult environmental limitations, competition for job opportunity and land use competition remain the basic problems for increased agricultural development in Guam.

Presently, Guam property taxes are comparatively low for all uses. But more often than not, this assessed value (determined by the Department of Revenue and Taxation), is inflated for the agricultural land in Guam. Thus the farmer's property taxes may rise to the point where it is impossible for the farmer to carry on agricultural activities. In other words, due to shifts in land rent, he may reach the no-rent margin for farming purposes. Often, Guam farmers sell their land to a developer, and the community loses: more food-producing acreage covered by asphalt, concrete, and fenced-in home lawns. In Guam, it is the speculation factor which causes the farm operator to give up the struggle of ranching. He finds willing



International buyers prepared to offer small fortunes for relatively small parcels of land. In early 1974, land prices were as high as \$10 to \$15 a square meter for accessible agriculturally zoned land.

Currently, proposals call for thwarting the problem of hindling agricultural production activities not only near urban areas, but island-wide. Plans would call for use value assessment of qualified agricultural and/or horticultural lands. In essence, a farmer would be paying taxes on the value of the land in its present use, rather than paying taxes on the value of land if it were converted to urban or commercial uses. For example, a farmer is near or surrounded by developing land. If he abandons farming, or perhaps stops farming temporarily, and/or subdivides the property, under the present system his land would be evaluated and assessed at a higher level than if assessed as agricultural land.

To curb the sale of croplands, under these proposals the farmer would get a substantial tax break, thus encouraging him to retain ownership of the land while working the land agriculturally. If the farmer sells his land within a certain time period, he would be called upon to pay a penalty for taking the land out of agricultural production, as specified in law (if such legislation is passed and implemented). Additionally, some have called for all zoned cropland to be sold only to the Government of Guam, which then would redistribute the land to others for agricultural use.

A development policy based on higher levels of agricultural production creating food self-sufficiency will improve diets. Likewise, less reliance on imports will strengthen the balance of payments.

process of improving the Guam food base will also increase the connection with land ownership by the Guamanians. Their control of land is fundamental to the preservation of their culture.

Presently, all urban land use (residential, commercial, and industrial) accounts for approximately 10 percent of the civilian population's land area. Agriculture, conservation, and open space uses comprise about 50 percent of public and private land on all non-federal land. Given proper planning with emphasis toward internal development, Guam residents have the basic resources of water, air, and land to offer a reasonably secure future for limited lifestyles. The work for balance does not rest on conspicuous consumption of outside resources. The outside resources that exist owing to this historical connection with the American community should be carefully managed and controlled.

The following are this author's recommendations based on this research. This first section sets out general ideas which must be considered by the whole community for eventual adoption. The second section of recommendations might help shape specifics within a master plan for legislative and executive action on the part of the Government of Guam. The following are the author's recommendations:

- 1) Establish a Guam population commission to design and develop a comprehensive population policy which defines the relationships of optimum numbers of people and their quality of space; establish a family planning program which



would be coordinated with existing public health facilities and programs; restrict immigration to Guam by the establishment of a coordinated federal and local government program.

- 2) Assign priority to development programs for agriculture and fisheries, with the Government of Guam providing initial programs utilizing public lands and expertise; establish educational and public relations programs for the recognition of the importance of self-reliance and self-sufficiency in values and activities.
- 3) Enact a moratorium on off-island and alien land acquisition, and provide regulations for short-term lease arrangements for alien investors who desire land.
- 4) Implement immediately stringent enforcement of land use and development laws related to land zoning and building codes.

Specific recommendations:

- 1) Establish economic support for part-time gardening and near space horticulture and aquaculture which follow traditional values and patterns for food production; maintain a long-term focus on intensive farming of relatively small parcels of land, as presently in existence, for production of vegetables and fruits solely for local consumption as a significant and viable alternative to the present imbalances.



- 2) Encourage the development of a larger scale, commercial type of intensive horticulture and aquaculture industry owned and operated by residents for the Guam market and located within the designated agricultural district lands; allow limited alien labor, GEDA loans, and abatement on taxes in the initial phases, along with government water and electrical power subsidies.
- 3) Obtain U.S. military release of idle lands for long-term (more than 5 years) agricultural development; promote cooperation between the Government of Guam and the Department of Defense to establish more programs such as the eighty acres of agricultural land at Naval Communications Station in Barrigada, with development rights for building permanent, agriculturally sound facilities.
- 4) Construct a sewer-irrigation water recycling system, available to both part- and full-time farmers.
- 5) Establish a revolving fund for recovery subsidies following typhoons and all damaging tropical storms, with emphasis on providing farmers with seed money for immediate recovery from storm damages and replanting expenses.
- 6) Continue development and support of the University of Guam extension and research services and Department of Agriculture programs, with emphasis on public financial support for the Guam Farmers' Cooperative Association and other farmer organizations.



- 7) Foster public recognition of and more volunteer support for community action and educational programs such as the Green Revolution Committee and 4-H clubs; establish an executive and legislative commission on agriculture and nutrition.



APPENDIX



GUAM AGRICULTURAL SURVEY QUESTIONNAIRE

Personal and Social Background:

1 What is your age?

1. 1-15 yrs. 2. 16-24 3. 25-34 4. 35-44
5. 45-54 7. over 65 years

2 Where were you born?

1. Agana 2. Agana Heights 3. Agat 4. Asan
5. Barrigada 6. Chalan Pago 7. Dededo 8. Inarajan

3 1. Maina 2. Maite 3. Malojloj 4. Merizo
5. Mongmong 6. Piti 7. Santa Rita 8. Sinajana

4 1. Sumay 2. Talofofo 3. Tamuning 4. Toto
5. Tumon 6. Umatac 7. Yigo 8. Yona

5 1. Guam 2. U.S.A. 3. Korea 4. Japan
5. Philippines 6. T.T.

6 What is your marital status?

1. Married 2. Single 3. Separated from family
4. Divorced

7 How many children do you have?

1. 0 2. 1-4 3. 5-8 4. 9-12 5. 13-17
6. 18-22 7. over 23

8 How many attend school?

1. 1-3 2. 4-7 3. 8-11 4. 12-15 5. over 15

9 Number of people in your household:

1. 0-2 2. 3-10 3. 11-20 4. over 20

Location: Residence and Farm (s):

10 In what village or district do you live? (Your house location)

1. Agana 2. Agana Heights 3. Agat 4. Asan
5. Barrigada 6. Chalan Pago 7. Dededo 8. Inarajan

11 1. Maina 2. Maite 3. Malojloj 4. Merizo
5. Mongmong 6. Piti 7. Santa Rita 8. Sinajana

12 1. Talofofo 2. Tamuning 3. Toto 4. Tumon
5. Umatac 6. Yigo 7. Yona 8. Mangilao
9. Marbo

13 1. North

14 2. South

15 3. Central

16 Do you live on your ranch or farm?

1. Yes 2. No

17 Do you have more than one (1) ranch?

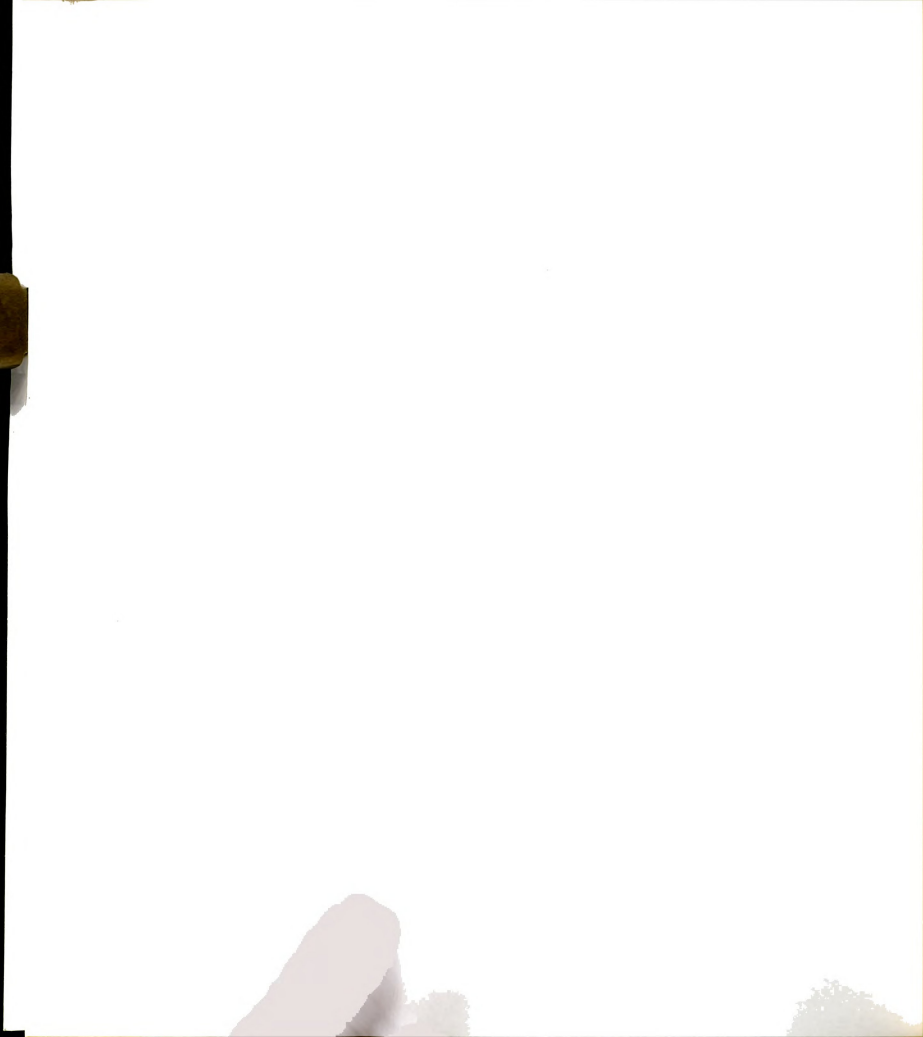
1. Yes 2. No

18 How many ranch areas or plots do you operate?

1. 1 2. 2-3 3. 4-5 4. 6-7 5. 8 or more

19 Where are they located?

1. Agana 2. Agana Heights 3. Agat 4. Asan
5. Barrigada 6. Chalan Pago 7. Dededo 8. Inarajan



Location: Residence and Farm (s):

- 10 In what village or district do you live? (Your house location)
1. Agana 2. Agana Heights 3. Agat 4. Asan
5. Barrigada 6. Chalan Pago 7. Dededo 8. Inarajan
- 11 1. Maina 2. Maite 3. Malojloj 4. Merizo
5. Mongmong 6. Piti 7. Santa Rita 8. Sinajana
- 12 1. Talofofo 2. Tamuning 3. Toto 4. Tumon
5. Umatac 6. Yigo 7. Yona 8. Mangilao
9. Marbo
- 13 1. North
- 14 2. South
- 15 3. Central
- 16 Do you live on your ranch or farm?
1. Yes 2. No
- 17 Do you have more than one (1) ranch?
1. Yes 2. No
- 18 How many ranch areas or plots do you operate?
1. 1 2. 2-3 3. 4-5 4. 6-7 5. 8 or more
- 19 Where are they located?
1. Agana 2. Agana Heights 3. Agat 4. Asan
5. Barrigada 6. Chalan Pago 7. Dededo 8. Inarajan



_____ 1. Maina 2. Maite 3. Malojloj 4. Merizo
20 5. Mongmong 6. Piti 7. Santa Rita 8. Sinajana

_____ 1. Talofoyo 2. Tamuning 3. Toto 4. Tumon
21 5. Umatac 6. Yigo 7. Yona 8. Mangilao
9. Marbo

_____ 1. North
22

_____ 2. South
23

_____ 3. Central
24

_____ How long have you worked or operated your ranch or farm?
25

1. 0-2 yrs. 2. 3-9 yrs. 3. more than 9 years

Farm Size: Farm holdings by (areal units) hectares, acres, square meters, square feet.

_____ How do you measure the area of your land?
26

1. hectares 2. acres 3. square meters 4. square feet
5. other units

_____ How much total land do you work or operate? (acres)
27

1. 0-2 2. 3-4 3. 5-7 4. 8-10 5. 11-20
6. 21-over

Land Ownership and Tenure: Tenure of the farm operator, full owner or individual, part owner or family, tenant, manager.

Who owns the land you farm?

_____ 1. Do you
28

2. Your family
 29
3. Do you rent or lease; friend or relative
 30
4. A company or Corporation
 31
5. The Government of Guam; the Department of Agriculture
 Land Lease Program
 32

How did you acquire the land?

1. Inheritance
 33
2. Buy
 34
3. Rent
 35
4. Other, (specify)
 36

Farm Land Value (including all real estate of the farm):

- What is the dollar value of your land by the unit, square
 meter?
 37
1. 0-5 2. 6-10 3. 11-15 4. 16-20 5. 21-25
 6. more than 25
- If you wanted to sell the land, how much do you think it
 is worth? (dollars/sq. meter)
 38
1. 0-5 2. 6-10 3. 11-15 4. 16-20 5. 21-25
 6. more than 25



Physiography: Terrain, land form regions, soils, climate and vegetation.

- 39/40 What portion of your farm land lies along the beach (coastal plains)? (%)
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
 6. 51-60 7. 61-70 8. 71-80 9. 81-90
 10. 91-100
- 41/42 What portion of your farm land lies in the south near the mountains (southern volcanic uplands)? (%)
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
 6. 51-60 7. 61-70 8. 71-80 9. 81-90
 10. 91-100
- 43/44 What portion of your farm land lies in the north and near the center of the island (northern limestone plateau)? (%)
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
 6. 51-60 7. 61-70 8. 71-80 9. 81-90
 10. 91-100
- 45/46 What percent of your farm land lies in valleys and low areas?
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
 6. 51-60 7. 61-70 8. 71-80 9. 81-90
 10. 91-100
- 47/48 Is your land sloped or hilly?
1. Yes 2. No
- 49/50 What percent is very hilly (or excessively sloped)?
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
 6. 51-60 7. 61-70 8. 71-80 9. 81-90
 10. 91-100
- 51/52 What percent is a little hilly (or moderately sloped)?
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
 6. 51-60 7. 61-70 8. 71-80 9. 81-90
 10. 91-100



53 Is your land dry (well drained) all year?

1. Yes 2. No

54 Is your land dry for only part of the year?

1. Yes 2. No

What kind of dirt or soil do you have?

55 1. clay

56 2. alluvial (valley)

57 3. red (lateritic)

58 4. other, specify

59 Is your dirt or soil

1. very good (superior fertility) 2. alright (average fertility) 3. poor (low fertility)

60 Is there enough rain all year around for crops to grow?

1. Yes 2. No

61 Do you add (by hose, pipes or building water ditches) water to your fields by irrigation?

1. Yes 2. No

62 If yes how many months do you add water to your fields? (months/year)

1. one 2. two 3. three 4. four 5. five
6. six



_____ 1. seven 2. eight 3. nine 4. ten 5. eleven
63 6. twelve

Other than crops and pasture, what other type of plants (vegetation) are found on your farmlands?

_____ 1. grass
64

_____ 2. tangentangen
65

_____ 3. mixed forest
66

_____ 4. coconut trees
67

_____ 5. others (specify)
68

Farm Land Use:

_____ What percentage of your farmland is used for cropland (all
69/70 lands tilled or cultivated)?

1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. 51-60 7. 61-70 8. 71-80 9. 81-90
10. 91-100

_____ What percentage of your farmland is used for pasture (all
71/72 land used for stock grazing)?

1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. 51-60 7. 61-70 8. 71-80 9. 81-90
10. 91-100

_____ What percentage of your farmland is used for forest
73/74 (includes palm groves, mixed forest of pandanus, breadfruit
and cycad)?

1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. 51-60 7. 61-70 8. 71-80 9. 81-90
10. 91-100



75/76 What percentage of your farmland is used for farm buildings (including your residence, pens, barns, sheds, warehouses, etc.)?

1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. 51-60 7. 61-70 8. 71-80 9. 81-90
10. 91-100

77/78 What percentage of your farmland is used for farm roads (including paths, trails, etc.)?

1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. 51-60 7. 61-70 8. 71-80 9. 81-90
10. 91-100

79/80 What percentage of your farmland is unused (waste, fallow, mountains, etc.)?

1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. 51-60 7. 61-70 8. 71-80 9. 81-90
10. 91-100

1/2 What percentage of your farmland is used for drainage and irrigation ditches and facilities?

1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. 51-60 7. 61-70 8. 71-80 9. 81-90
10. 91-100

Crops and Animals:

3 What amount of land is planted in tomato? (acres)

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
5. 1-2 acres 6. 3-5 7. over 5

4 What amount of land is planted in eggplant? (acres)

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
5. 1-2 acres 6. 3-5 7. over 5

5 What amount of land is planted in beans? (acres)

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
5. 1-2 acres 6. 3-5 7. over 5



6 What amount of land is planted in melons? (acres)

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5

7 What amount of land is planted in cucumbers? (acres)

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5

8 What amount of land is planted in cabbages? (acres)

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5

9 What amount of land is planted in peppers? (acres)

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5

10 What amount of land is planted in corn? (acres)

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5

11 How many acres are planted in all the above crops?

1. less than one acre 2. 1-2 acres 3. 3-5
 4. 6-10 5. 11-20 6. 21-50 7. over 50

12 How many acres are planted to tree crops-banana?

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5

13 How many acres are planted to tree crops-citrus?

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5

14 How many acres are planted to tree crops-mango?

1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5



- 15 How many acres are planted to tree crops-papaya?
 1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5
- 16 How many acres are planted to tree crops-coconut palm?
 1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5
- 17 How many acres are planted to tree crops-betelnut palm?
 1. 0-5% of an acre 2. 6-10 3. 11-50 4. 51-99
 5. 1-2 acres 6. 3-5 7. over 5
- 18 How many acres are planted in all tree crops?
 1. less than one acre 2. 1-2 acres 3. 3-5 4. 6-10
 5. 11-20 6. 21-60 7. over 50
- 19 How much land is planted twice (double cropped) yearly?
 (%)
 1. 0-5 2. 6-10 3. 11-20 4. over 20
- 20 How much land is planted three times (triple cropped)
 yearly? (%)
 1. 0-5 2. 6-10 3. 11-20 4. over 20
- 21 What percent of land is used for interculture (for example,
 tree crops and vegetables in the same field)?
 1. 0-5 2. 6-10 3. 11-20 4. over 20
- 22 Are your crops planted by season?
 1. Yes 2. No
- 23 For your farm operation, how many crop seasons are there
 in one year?
 1. one season 2. two seasons 3. three seasons
 4. more than three seasons

- 24 How much land is used for animal purposes (total fields, lots and pens)? (%)
1. 0-5 2. 6-10 3. 11-20 4. more than 20
- 25 How many hogs (all pigs) do you have on your ranch or farm?
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. 51-60 7. 61-70 8. more than 70
- 26 How many dairy (milking) cows do you have on your ranch or farm?
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. more than 50
- 27 How many beef cattle (cows) do you have on your ranch or farm?
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. more than 50
- 28 How many sheep do you have on your ranch or farm?
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. more than 50
- 29 How many goats do you have on your ranch or farm?
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. more than 50
- 30 How many horses do you have on your ranch or farm?
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. more than 50
- 31 How many buffaloes (carabaos) do you have on your ranch or farm?
1. 0-10 2. 11-20 3. 21-30 4. 31-40 5. 41-50
6. more than 50



- 32 How many laying chickens do you have on your ranch or farm?
1. 0-50 2. 51-100 3. 101-150 4. more than 150
- 33 How many wild (scavenger) chickens do you have on your ranch or farm?
1. 0-50 2. 51-100 3. 101-150 4. more than 150
- 34 How many geese do you have on your ranch or farm?
1. 0-50 2. 51-100 3. 101-150 4. more than 150
- 35 How many ducks do you have on your ranch or farm?
1. 0-50 2. 51-100 3. 101-150 4. more than 150
- 36 How many turkeys do you have on your ranch or farm?
1. 0-50 2. 51-100 3. 101-150 4. more than 150
- 37 Specify other livestock and number on your ranch or farm?
1. 0-50 2. 51-100 3. 101-150 4. more than 150
- 38 What part or percent of your crop production (of all vegetables and fruit together) is eaten by you and your family?
1. 0-20 2. 21-40 3. 41-60 5. 61 and over
- 39 How often are vegetables served to your family?
1. at least once a day 2. 2 to 3 times a week
3. once a week or less
- 40 What part or percent of your livestock production (of all livestock together, such as cows, pigs, chickens, etc.) is eaten by you and your family?
1. 0-20 2. 21-40 3. 41-60 4. 61 and over



- 41 How often is fruit served to your family?
1. at least once a day
 2. 2 to 3 times a week
 3. once a week or less

Agricultural Labor:

- 42 You are classified as a
1. full time farmer
 2. part time farmer

- 43 Do you operate your farm alone?
1. Yes
 2. No

- 44 Do you hold other jobs?
1. Yes
 2. No

- 45 What part or portion of your total income comes from an outside job? (%)
1. 0-20
 2. 21-40
 3. 41-60
 4. 61-80
 5. more than 80

- 46 What is the average number of hours you work per week on outside jobs?
1. 0-10
 2. 11-20
 3. 21-30
 4. 31-40
 5. 41-50
 6. 51-60
 7. more than 60

- 47 What is the average number of hours you work per week on your farm?
1. 0-10
 2. 11-20
 3. 21-30
 4. 31-40
 5. 41-50
 6. 51-60
 7. more than 60

- 48 Do you hire or receive work from others in your farm operation?
1. Yes
 2. No

49 How many hours per week are received from family members?

1. 0-10 2. 11-20 3. 21-30 4. more than 30

50 How many hours per week are received from part and full time employees?

1. 0-10 2. 11-20 3. 21-30 4. more than 30

51 Do you employ contract alien workers?

1. Yes 2. No

52 If yes, how many?

1. 1-2 2. 3-4 3. 5-6 4. more than 6

Investment:

53 How many trucks do you possess in your farm operation?

1. 0-1 2. 2-3 3. 4 or more

54 How many other motor vehicles do you possess in your farm operation?

1. 0-1 2. 2-3 3. 4 or more

55 How many tractors do you possess in your farm operation?

1. 0-1 2. 2-3 3. 4 or more

56 How many planting equipment (plows) do you possess in your farm operation?

1. 0-1 2. 2-3 3. 4 or more

57 How many wheelbarrows do you possess in your farm operation?

1. 0-1 2. 2-3 3. 4 or more

- 58 How many harvesting equipment do you possess in your farm operation?
1. 0-1 2. 2-3 3. 4 or more
- 59 How many hand tools do you possess in your farm operation?
1. 0-1 2. 2-3 3. 4 or more
- 60 How many rototillers do you possess in your farm operation?
1. 0-1 2. 2-3 3. 4 or more
- 61 How many other tools do you possess in your farm operation? (specify tool)
1. 0-1 2. 2-3 3. 4 or more
- 62 How much did you invest in equipment in 1972? (Dollars)
1. 0-100 2. 101-500 3. 501-1000 4. 1000-2000
5. 2001-3000 6. more than 3000
- 63 Do you have electricity on your farm? (GPA service)
1. Yes 2. No
- 64 How much did you spend on electricity in 1972? (Dollars)
1. 0-100 2. 101-200 3. 201-300 4. 301-400
5. 401-500
- 65 Do you have a telephone?
1. Yes 2. No

Farm Expenditures:

- 66 What is the yearly expense for feed? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451

- 67 What is the yearly expense for animal purchase and breeding? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451
- 68 What is the yearly expense for fertilizers? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451
- 69 What is the yearly expense for seed? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451
- 70 What is the yearly expense for fuel? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451
- 71 What is the yearly expense for gas? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451
- 72 What is the yearly expense for water? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451
- 73 What is the yearly expense for herbicides? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451
- 74 What is the yearly expense for insecticides? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451
- 75 What is the yearly expense for medicine? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451

- 76 What is the yearly expense for hand tools? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451
- 77 What is the yearly expense for labor? (Dollars)
1. 0-500 2. 501-2,000 3. 2,001-5,000
4. 5,001-10,000 5. over 10,000
- 78 What is the yearly expense for other items? (Dollars)
1. 0-50 2. 51-100 3. 101-150 4. 151-200
5. 201-450 6. over 451
- 79 How much did you spend in 1972 for equipment repairs and maintenance? (Dollars)
1. 0-100 2. 101-200 3. 201-300 4. 301-400
5. 401-500 6. over 500
- 80 Do you use veterinarian services?
1. Yes 2. No
- 1 Do you use water (for ranching or the farm operation) from the Public Water System?
1. Yes 2. No
- 2 If yes, do you receive the agriculture cost rate?
1. Yes 2. No
- 3 If available, would you use a Public Water System designed for irrigation only (watering your plants)?
1. Yes 2. No
- 4 If yes, what is the highest water rate you would be willing to pay?
1. If the water cost \$0.50/1000 gal. 2. If the water cost \$0.37/1000 gal. 3. If the water cost \$0.25/1000 gal.



Improvements:

- 5 Did you add water works (irrigation facilities) in your farm operation?
1. Yes 2. No
- 6 Did you add drainage facilities in your farm operation?
1. Yes 2. No
- 7 Do you rotate your crops seasonally or yearly?
1. Yes 2. No
- 8 Do you fertilize regularly?
1. Yes 2. No
- 9 How often?
1. Weekly 2. Monthly 3. Yearly
- 10 Do you fertilize by using:
1. Only manures 2. Only chemicals 3. Both of the above
- 11 How much fertilizer do you put into your soil yearly? (lbs.)
1. 0-25 2. 26-50 3. 51-75 4. 76-500
5. 501-2000 6. more than 2000 lbs.
- 12 Do you terrace on sloped land?
1. Yes 2. No
- 13 Do you have any tanks, ponds, barrels, or water reservoirs on your farm?
1. Yes 2. No

14 If yes, how many?
1. 1-2 2. 3-4 3. 5 or more

Credit:

15 Do you have a mortgage on your ranch or farm?
1. Yes 2. No

16 Do you have any long term loans?
1. Yes 2. No

17 Do you get loans for yearly operational needs?
1. Yes 2. No

18 Do you receive money (financial aid) from any government agency?
1. Yes 2. No

19 How much is your overall farm debt at this time? (Dollars)
1. 0-1,000 2. 1,001-5,000 3. 5,001-20,000
4. more than 20,000

Role of Government:

20 Are you a member of a farmers' organization (such as a co-op or agriculture club)?
1. Yes 2. No

21 If yes, what is the name?
1. Guam Farmers' Association (Co-op) 2. Others



22 Does the Department of Agriculture offer any assistance to you and your operation?

1. Yes 2. No

23 If yes, is it in financial aid (money)?

1. Yes 2. No

24 Is it in technical knowledge?

1. Yes 2. No

25 Is it in equipment loans?

1. Yes 2. No

26 Is it in seed and plant aid?

1. Yes 2. No

27 Is it in training and education?

1. Yes 2. No

28 Is it in crop and animal subsidies?

1. Yes 2. No

29 Is it in other assistance? (Specify)

1. Yes 2. No

BIBLIOGRAPHY

BIBLIOGRAPHY

- Aflague, Juan S., "Agricultural Report," Vol. 12, Guam Recorder (Agana, Guam, 1935) pp. 204-205.
- Aguon, Frank B., J.V. Hurst, and W.G. Firestone, Vegetable Gardens, Bulletin No. 3 (Agana: Department of Agriculture, 1966) 32 pp.
- Annual Report of the Governor of Guam (Agana, Guam, 1910) 25 pp.
- Barrau, Jacques, editor, Plants and Migrations of Pacific Peoples: A Symposium (Honolulu: Bishop Museum, 1963) 136 pp.
- _____, Subsistence Agriculture in Polynesia and Micronesia, Bulletin 233 (Honolulu: Bishop Museum, 1961) 94 pp.
- _____, "Plant Introduction in the Pacific: Its Role in Economic Development," Pacific Viewpoint, Vol. 1, No. 1 (Wellington, N.Z.: Dept. of Geography, 1960) pp. 1-10.
- Barrett, Ward J., Mission in the Marianas: An Account of Fr. Diego Luis de Sanvitores and His Companions, 1669-1670 (Minneapolis: University of Minnesota Press, 1975) 62 pp.
- Blumenstock, David I., "Distribution and Characteristics of Tropical Climates," Ninth Pacific Science Congress Proceedings, Vol. 20, (Bangkok: PSC, 1957) pp. 3-24.
- _____, in J. Tracey, et. al., General Geology of Guam, U.S.G.S. Professional Paper 403-A (Washington, Government Printing Office, 1964) pp. 9-11.
- Bowers, Neal M., "The Mariana, Volcano, and Bonin Islands," Otis W. Freeman (ed.), Geography of the Pacific (New York: Wiley, 1951) pp. 205-236.
- Bryan, Edwin H., Jr., Guide to Place Names in the Trust Territory of the Pacific Islands, Pacific Scientific Information Center (Honolulu: Bernice P. Bishop Museum, 1971).
- _____, "Notes on the Ancient Culture of Guam," Guam Recorder (Agana: Micronesian Area Research Center, 1971) pp. 6-7.
- _____, "Check List of Atolls," Atoll Research Bulletin, No. 19, (Washington: Pacific Science Board, 1953) pp. 1-19.

- _____, "Geographic Summary of Micronesia," Douglas L. Oliver (ed.), Economic Survey of Micronesia, (1947), typescript, microfilm, Library of Congress.
- _____, Maps of the Islands of Micronesia, compiled by the Research Section, United States Commercial Company Economic Survey (1946), 148 pp.
- Carano, Paul and Sanchez, Pedro C., A Complete History of Guam (Tokyo: Charles Tuttle Co., 1964) 452 pp.
- Carey, Edwin L., (editor), Guam 1970: An Economy in Transition (Agana: Department of Commerce, Government of Guam, 1971) 46 pp.
- Dasmann, Raymond F., John P. Milton, and Peter H. Freeman, Ecological Principles for Economic Development (New York: Wiley, 1973) 252 pp.
- Department of Land Management, General Land Use Data and Trends (Agana: Government of Guam Department of Land Management, 1973) 11 pp. unpublished.
- Douglas, Gina, "Draft Check List of the Pacific Oceanic Islands," Micronesica, Vol. 5, No. 2 (Agana: University of Guam, 1969) pp. 332-462.
- Emery, K.O., Marine Geology of Guam, U.S.G.S. Professional Paper 403-B (Washington, Government Printing Office, 1963) 76 pp.
- Environmental Impact Statement Ammunition Pier, p-550 Sella Bay, Guam, Mariana Islands (Washington: Department of the Navy, June 1971) 30 pp.
- Freeman, Otis W., (editor), Geography of the Pacific (New York: Wiley, 1951) 573 pp.
- Gawel, Michael J., Guam Coastal Planning Bibliography, Sea Grant Publication U.G.S.G. 76-07 (Agana: Bureau of Planning, 1976) 205 pp.
- Gillham, Koebig, and Koebig, Inc., Irrigation Feasibility Study (Agana: Department of Agriculture, 1973) 77 pp.
- Greenleaf and Telesca-Ahn, Guam Master Plan, Phase I: Problems, Opportunities, and Alternatives (Agana: Government of Guam, 1972) 308 pp.
- Guam Historic Preservation Plan (Agana: Government of Guam Department of Parks and Recreation, 1976) 145 pp.



- Hankin, Jean, Dwayne Reed, Darwin Labarthe, Milton Nichaman, and Reuel Stallones, "Dietary and Disease Patterns Among Micronesians," The American Journal of Clinical Nutrition, Vol. 23, No. 3, March 1970, pp. 346-357.
- Haverlandt, R.O., "The Guamanian Economic Experience," Vol. III, Part VI, The Social-Economic Impact of Modern Technology Upon a Developing Insular Region: Guam (Agana: University of Guam Press, 1975) pp. VI-97-123.
- Huxel, C.J. "Water Resources in Limestone Islands," Seminar on Conservation Education, South Pacific Commission Report, 1973, unpublished.
- Jennison-Nolan, Jane, "Land Use on Guam," Chapter I, Social Baseline Study for the Island of Guam, University of Guam (Agana: Micronesian Area Research Center, 1976) pp. 1-60.
- Johnson, Walter D. and Carey, Edwin L., Guam 1969: A Developing Pacific Economy (Agana: Guam Technical Services, 1970) 37 pp.
- Johnsrud, Lawrence and Associates, Outdoor Recreation on Guam (Agana: Territorial Planning Commission, 1967) 70 pp.
- Lee, David, "Problems in Tropical Agriculture: A Case Study from Guam," Yearbook, Vol. 33 (Corvallis: Association of Pacific Coast Geographers, 1971) pp. 47-64.
- Leon Guerrero, Wilfred P., R. Muniappan, Jack Ishida, and Victor Artero, Trends in Agricultural Development in Guam and Micronesia (Agana: University of Guam, 1976) 46 pp. unpublished.
- Marshall, Mac and James D. Nason, Micronesia 1944-1974; A Bibliography (New Haven: HRAF Press, 1975) 337 pp.
- Mayer, Peter C., "The Visitor Industry on Guam", Vol. II, The Social-Economic Impact of Modern Technology Upon a Developing Insular Region: Guam (Agana: University of Guam Press, 1975) pp. III-33-42.
- McDonald, James B., Guam Annual Economic Review 1975 (Agana: Department of Commerce, 1976) 64 pp.
- Oxford Economic Atlas of the World, 3rd edition (London: Oxford University Press, 1965).
- Pray, Martin, "Growth and Effect of Air Charters on Guam's Tourist Industry," PASA, Vol. 1, No. 2 (Agana: Pacific Asian Studies Association, 1976) pp. 5-19.
- Randall, Richard H. and L.G. Eldredge, Atlas of the Reefs of Guam (Agana: Bureau of Planning, 1976) 190 pp.



- Reinman, Fred M., "Guam Prehistory: A Preliminary Field Report," Prehistoric Culture in Oceania (Honolulu: Bishop Museum Press, 1968) pp. 41-50.
- Russell, Walter E., "Soil Survey of Lalo Farm, Mangilao, Guam," Micronesica, Vol. 2 (Agana: University of Guam, 1965) pp. 77-85.
- Safford, William E., The Useful Plants of Guam, U.S. National Herbarium, Vol. IX (Washington, D.C.: Smithsonian, 1905) 416 pp.
- Sailing Directions for the Pacific Islands (2nd edition), Vol. 1, H.O. Pub. No. 82 (Washington: U.S. Naval Oceanographic Office, 1964) 453 pp.
- Solenberger, Robert R., "The Changing Role of Rice in the Marianas Islands," Micronesica, Vol. 3, No. 2 (Agana, Guam: University of Guam, 1967) pp. 97-103.
- Souder, Paul B., "Guam: Land Tenure in a Fortress," in Land Tenure in the Pacific, edited by Ron Crocombe (Melbourne: Oxford University Press, 1971) pp. 192-205.
- Spoehr, Alexander, "Marianas Prehistory, Archaeological Survey and Excavation on Saipan, Tinian, and Rota," Fieldiana: Anthropology, Vol. 48 (Chicago: Chicago National History Museum, 1957) 187 pp.
- SRI, A Study and Review of Laws Pertaining to Alien Investment on Guam, Vol. 1 (Menlo Park: Stanford Research Institute, 1974) 287 pp.
- Statistical Abstract, Guam, 1973, (Agana: Department of Commerce, Government of Guam, 1974) 48 pp.
- Sterling, Jeanne B., "Report on Eating Habits of Junior High School Students," (Agana: Department of Public Health and Social Services, 1976) 6 pp., unpublished.
- Tansill, William R., "Guam and Its Administration," Public Affairs Bulletin, No. 95 (Washington: Legislative Reference Service, 1951) 140 pp.
- Thompson, Laura, Guam and Its People (Princeton, N.J.: Princeton University Press, 1947) 367 pp.
- _____, The Native Culture of the Mariana Islands, Bulletin 185 (Honolulu: Bishop Museum, 1945) 48 pp.
- _____, Archaeology of the Mariana Islands, No. 100 (Honolulu: Bishop Museum, 1932) 82 pp.



Tracey, Joshua I., Jr., et. al., General Geology of Guam, U.S.G.S. Professional Paper 403-A (Washington, Government Printing Office, 1964) 104 pp.

Underwood, Jane, "The Native Origins of the Neo-Chamorros of the Mariana Islands," Micronesica, Vol. 12, No. 2 (Agana: University of Guam, 1976) pp. 203-210.

_____, "Population History of Guam: Context of Micro-evolution," Micronesica, Vol. 9, No. 1 (Agana: University of Guam, 1973) pp. 11-45.

U.S. National Park Service, Proposed Guam National Seashore (Washington: U.S. Department of the Interior, 1967) 59 pp., unpublished.

Vail, Carl J., Jr., "The Economy," The Social-Economic Impact of Modern Technology Upon a Developing Insular Region: Guam, Vol. II (Agana: University of Guam Press, 1975) pp. III-1-18.

Wilson, Walter Scott, "Historical Summary of Cultural Influences on the People of Guam," Vol. III, Part VI, The Social-Economic Impact of Modern Technology Upon a Developing Insular Region: Guam (Agana: University of Guam Press, 1975) pp. VI-91-96.

_____, and McGrath, William, A., "The Marshall, Caroline and Mariana Islands," in R. Crocombe, editor, Land Tenure in the Pacific (Melbourne: Oxford University Press, 1969) pp. 172-191.

_____, Land Activity and Social Organization of Lelu, Kusaie, "Copra Making," pp. 103-105, (Unpublished Ph.D. Dissertation, Department of Anthropology, University of Pennsylvania, 1968) 452 pp.

_____, "The Copra Industry in the Trust Territory of the Pacific Islands," Appendix 8, Report of a Special Subcommittee on Territorial and Insular Affairs of the Committee on Interior and Insular Affairs, House of Representatives, 83rd Congress, (Washington: U.S. Government Printing Office, 1955) pp. 68-73.

_____, "The Copra Industry in the Trust Territory of the Pacific Islands," Quarterly Bulletin, Vol. 3, No. 3 (Noumea, New Caledonia: South Pacific Commission, 1953) pp. 33-34.

Yawata, Ichiro, "Rice Cultivation of the Ancient Marianas Islanders," Plants and the Migrations of Pacific Peoples, A Symposium (Honolulu: Bishop Museum, 1963) pp. 91-92.

MICHIGAN STATE UNIV. LIBRARIES



31293101793895