

CHANGING AGRICULTURAL PATTERNS OF GUAM (PART 2)

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Abstract

CHANGING AGRICULTURAL PATTERNS OF GUAM (PART 2)

(Bruce G. Karolle)

Guam island's population has more than trebled in this century under U. S. control. However, during the Americanization of this tropical isle, agricultural development has declined; most rapidly during the decade following World War II. Today, less than 1 percent of the island's labor force works at food production, and less than 900 hectares are under cultivation at any given time.

This study examined and measured two spatial distributions within the island's 549 km²: surveyed farms (116) and the human population (101,153). A geographic association was found between the people of Guam, as located by village and district residence, and the existing agricultural operations. This relationship was verified by applying the Pearson Product Moment Coefficient of Correlation.

Cartographic data in the study include several location maps illustrating the population distribution of the civilian and military sectors, and the farm sites. For analytical purposes Guam was divided tri-regionally: North, Central, and South; time based areal density maps drawn by administrative

district provide a clear indication of the regional contrasts. A preliminary migration study conducted among island college students supports the thesis that higher rates of migration were found to be in the northern districts which contained large numbers of farms. For those southern districts with large numbers of farms, out migration rates were found to be relatively low.

CHANGING AGRICULTURAL PATTERNS OF GUAM (PART 2)*

Bruce G. Karolle

Two critical spatial distributions were examined in Guam island. The two features studied were farm sites, and the population distribution for the entire land area of Guam. Selected regional and quantitative aspects were examined. The research hypothesis that the population of Guam, measured by location, growth, and migration, by administrative districts and settlements, correlates positively with established farms. Residential location of the Guam population occurs and continues to increase in the same areas, or in proximity to existing agricultural operations. Therefore, the geographical association between the people of Guam, that is, where they actually resided, and the existing agricultural operations of the island community suggested a close areal relationship. Previously this was not the case.

During the post-World War II period, the historic, or traditional inter-connection between residence and farm changed from a dualistic pattern of town and rural living. No longer did Chamorros reside in a central place, a well defined clustered village and commute to the farm, the lancho. It was

found that with rapid population growth and village/residential sprawl following the advent of paved roads, many farmers moved to their fields and subsequently built permanent homes.¹

Study Area

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

The Central region is generally an irregular area, with varied topography. Rocks are mixed; the gentle surfaces in the Barrigada, Mangilao and Naval Air Station areas contrast with the steep dissection of several streams (Agana, Chaot, and Pago Rivers) in other areas of the Central region. The smoother limestone surfaces of Barrigada and Mangilao extend into the argillaceous limestone found in the transition zone between the North's flat, gently inclined limestone plateau and the conglomerate and andesitic surfaces which extend into the South region. The main urban places of the Central region were

*The fieldwork and research funding for this study were provided by the University of Guam Agricultural Experiment Station (Hatch) No. 0072293. Dr. Karolle is an associate professor of geography in the Department of Anthropology/Geography at the University of Guam.

¹Karolle (1978): 12-13.

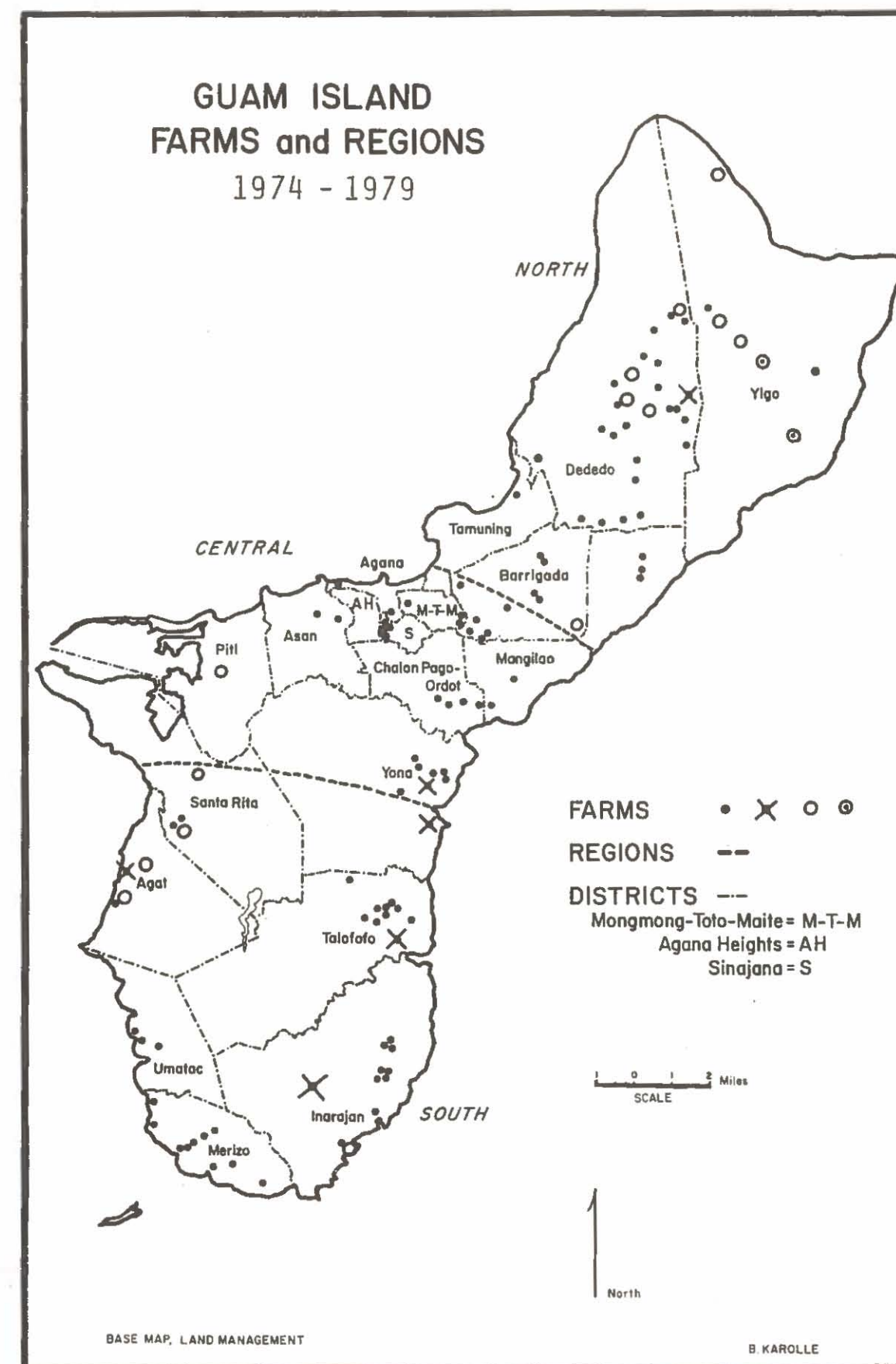
Barrigada south, Agana Heights, Sinajana, Mongmong-Toto-Maite, Chalan Pago-Ordot and Yona north.

The South consists largely of 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 coastal 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.

Location of Surveyed Farms

From field work during a five-year period (1974-1979), 116 operative farms in Guam were located and identified (See Map 1 and Table 1). The cartographic symbols for indicating FARMS found on the map are time based and indicate the distribution of the agricultural sites surveyed during the entire five-year period. The solid circle symbol (•), locates the original 100 farms surveyed in 1973-74; the crossed solid circle (X) and the open circle (o), represent the distribution of the twenty farms surveyed in 1977. Of these 20 farms, fourteen (o) represented newly identified farms, and the other six farmer/farms contacted were repeats from the earlier field work. Therefore, the six farm sites located by the symbol, "X" represents those farms surveyed in 1973-74 and again in 1977. In addition, two farms were identified in 1979, and are represented by the symbol "⊙"; both are located in the North.

MAP 1



The North region of Guam contained 43 identified farms, or 37% of the surveyed farms. Dededo included 27 farms, Yigo 7, Barrigada north 5, Mangilao north 3, and Tamuning only 1 farm. More than half of these individual farms (31) included Government of Guam land which was made available to the agriculturalists on a lease basis. Some were entirely privately owned by the individual/farmer. All, with the exception of the ranch on Jinapsan Beach (far north end of Guam), were located on the limestone plateau.

Central Guam had approximately 26% of the known farms (30) scattered widely in this "mixed" region. Nearly all of the farms were privately owned and operated, and constituted the largest number of the smallest size farms, i.e., less than one acre.

Like the North, the South region contained 43 individual farm sites. However, a sharp topographical distinction existed among southern farms. About 16 farms on the west and south, from Agat to Inarajan, were coastal plain and/or river valley locations. In contrast, the South's remaining farms were found to be from Inarajan to Yona and most farm sites were located on relatively level volcanic plateau surfaces.

Table 1 shows the farm site population and surveyed sample. The methodology of the study utilized ground and aerial reconnaissance procedures. The method basically, was to discover the farm, locate it on existing maps, and then identify it a second time, if possible, on aerial mosaics.

Table 1. AGRICULTURAL SITES IN GUAM BY REGION, 1974-79

Farms				
	North	Central	South	Totals
1977-79 Recent farms	10	1	5	16
Established farms, 1973-74	33	29	38	100
Estimated additional farms	<u>67</u>	<u>20</u>	<u>63</u>	<u>150</u>
Viable Guam farms	110	51	106	226

Source: B. Karolle, Guam agricultural fieldwork
(Agana: University of Guam, 1980)

Population Distribution

Based upon the 1978 data found in Table 2, the density of the island was found to be relatively high (See Map 2). The density ratio of 184 people per square kilometer for Guam is comparable to that of many densely settled island countries. The population density of Guam was about the same as that of Jamaica (189) and St. Lucia (186), and more than that of the Philippines (144) and Tonga (143); but less than that of Japan (306) and Taiwan (461).² However, the population density was found to be spatially uneven over the Island. The northern half of Guam contained over 270 people per square kilometer. These density figures are well above the average density of the United States as a

²Espenshade (1978): 230

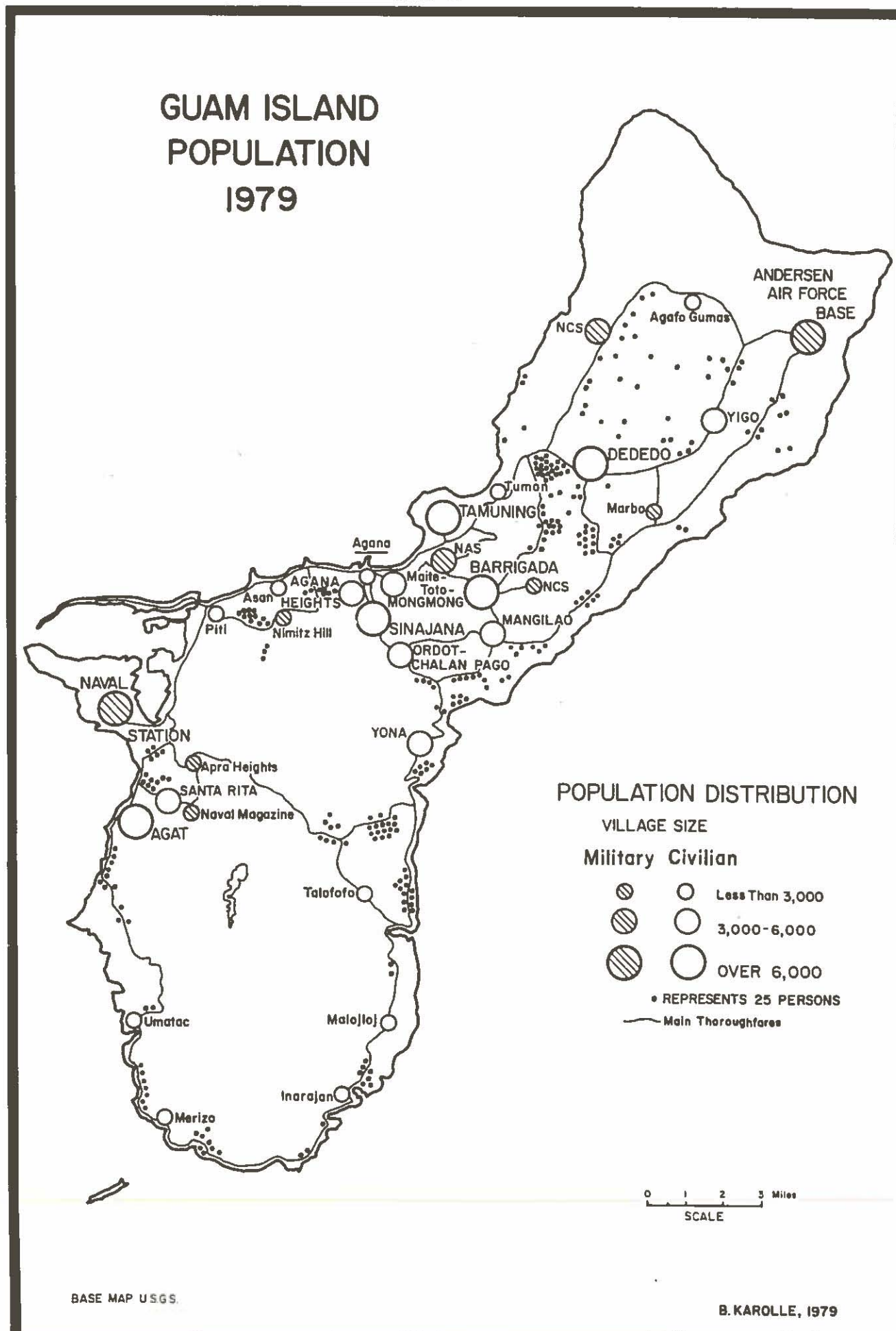
TABLE 2. GUAM POPULATION BY ADMINISTRATIVE DISTRICTS FOR YEARS: 1960, 1970, & 1978

District Name	AREA IN		1960		1970		1978		% of Change 1960 - 1978
	km ²	mi ²	Popula- tion	Density ₂ Per km ²	Popula- tion	Density ₂ Per km ²	Popula- tion	Density ₂ Per km ²	
G U A M	549.18	212.04 ^a	67,044	122	84,996	155	101,153 ^b	184	50.9
Agana	3.00	1.16	1,642	547	2,119	706	906	302	-44.8
Agana Heights	3.00	1.16	3,210	1,068	3,156	1,052	3,352	1,117	4.4
Agat	28.90	11.16	3,107	108	4,308	149	3,332	115	7.2
Asan	15.95	6.16	3,053	191	2,629	165	1,219	76	-60.1
Barrigada	23.72	9.16	5,430	229	6,356	268	9,054	382	66.7
Chalan Pago/ Ordot	15.95	6.16	1,835	115	2,931	184	3,219	202	75.4
Dededo	78.11	30.16	5,126	66	10,780	138	21,843	280	326.1
Inarajan	49.62	19.16	1,730	35	1,897	38	2,392	48	38.3
Mangilao	26.31	10.16	1,965	75	3,228	123	5,096	194	159.3
Merizo	15.95	6.16	1,398	88	1,529	96	1,470	92	5.2

(Table 2 continued)

District Name	AREA IN		1960		1970		1978		% of Change 1960 - 1978
	km ²	mi ²	Popula- tion	Density ₂ Per km ²	Popula- tion	Density ₂ Per km ²	Popula- tion	Density ₂ Per km ²	
Mongmong/Toto/ Maite	5.59	2.16	3,015	539	6,057	1,084	5,436	972	80.3
Piti	18.54	7.16	1,467	79	1,284	69	1,979	107	34.9
Santa Rita	41.85	16.16	12,126	290	8,109	194	8,931	213	-26.3
Sinajana	3.00	1.16	3,862	1,287	3,506	1,169	2,505	835	-35.1
Talofofo	44.44	17.16	1,352	30	1,935	44	1,662	37	22.9
Tamuning	15.95	6.16	5,944	373	10,218	641	13,883	870	133.6
Umatac	15.95	6.16	744	47	813	51	513	32	-31.0
Yigo	91.06	35.16	7,682	84	11,542	127	10,202	112	32.8
Yona	52.21	20.16	2,356	45	2,599	50	4,159	80	76.5

SOURCES: Statistical Abstract: Guam 1975, Vol. 6 (Agana: Department of Commerce, 1976) pp. 2-3.
^aBureau of Planning, "Community Design Plans," (Agana, Government of Guam, 1977) p. 30.
^bBureau of Labor Statistics, Guam Household Sample Statistics & Population Estimates (Agana: Government of Guam, 1978) and B. Karolle, Ph.D. dissertation, "Agriculture, Population and Development in Guam," unpublished, 1978.



whole, which is about 23 persons per square kilometer. An interesting comparison can be made with the northeastern U. S., where overall urban-rural population densities approximate those of central/northern Guam. Since the mid-1960's, a significant daily increase occurs as a result of tourism. Approximately 300,000 visitors per year add to the overall occupancy of an already congested space.³

A major spatial pattern that restricts the general population and limits the availability of agricultural locations is the predominance of undeveloped government lands. Federal, (mainly military) and territorial government agencies exercise control of more than one-half of the entire island.⁴ This results in the total exclusion of people and farms from an estimated 183 km², or approximately one-third of Guam. Therefore, the occupied portion of Guam, about 366 km², provides for a general density of 276 persons per square kilometer.

Guam's population distribution was found to be regional, being heavily concentrated in the central and northern parts of the island. The physiographic dividing line of the Adelup Fault⁵ provides a physiographically useful boundary line for comparison. This fault extends from Asan Village on the west coast through Agana Heights, crosses the narrow "waist" of the island, and ends on the east side of Yona Village. Seventy-five percent of the population resides in

³Karolle (n.d.): 113-114

⁴Karolle (1978): 4-5

⁵Tracy (1964): 55

the area north of this line which comprises 49 percent of the land mass. The only densely settled area in the southern half of the island (283 km² or 51.5%) is the Naval Station and the adjacent villages of Agat and Santa Rita, all south of Apra Harbor. The remaining small villages of the South are restricted to the coastal road (Umatac, Merizo and Inarajan), and the plateau towns of Talofofo and Yona.

The traditional regions of Guam are socio-political units and consist of 19 administrative districts. They essentially constitute local governmental municipalities (See Map 1 and Appendix A). Table 2 presents data by these districts to show several important characteristics of the island's population. In the last eighteen years, Guam's population has grown nearly 51 percent. However, this represents a slower rate of growth than during the previous 18 years. Guam's population more than trebled since 1898 when America took possession of Guam.⁶

Only five districts, Agana, Asan, Santa Rita, Sinajana and Umatac showed decreases in both absolute numbers and relative growth rates, or percent of change. Agana, the Capital city, reflected a significant drop in population because of the decline in residential occupation; not because of commercial and tertiary decreases. Asan and Santa Rita districts have experienced decline as a result of U. S. military personnel reductions. Sinajana experienced an urban renewal program beginning in the 1960's which limited residential expansion. Umatac Village continues to remain isolated.

⁶Karolle (n.d.): 52

The three districts that demonstrated the greatest upward change in population growth were Dededo (326%), Mangilao (159%) and Tamuning (134%). Yigo, entirely in the North region, is dominated by the U. S. Air Force Base; however, the civilian population growth rate is high. Map 3 clearly indicates the rapid increase in population growth in Central and North Guam. Table 2 and Map 4 show the changes in the overall population in each of the nineteen administrative districts. The spatial trend over the eighteen years measured in this study showed a definite areal shift northward, and an intensification of residential growth in the Central and North regions. Guam's rapidly increasing population is moving from the west, or lee side of the island to the east, the Pacific Ocean side.

Analysis:

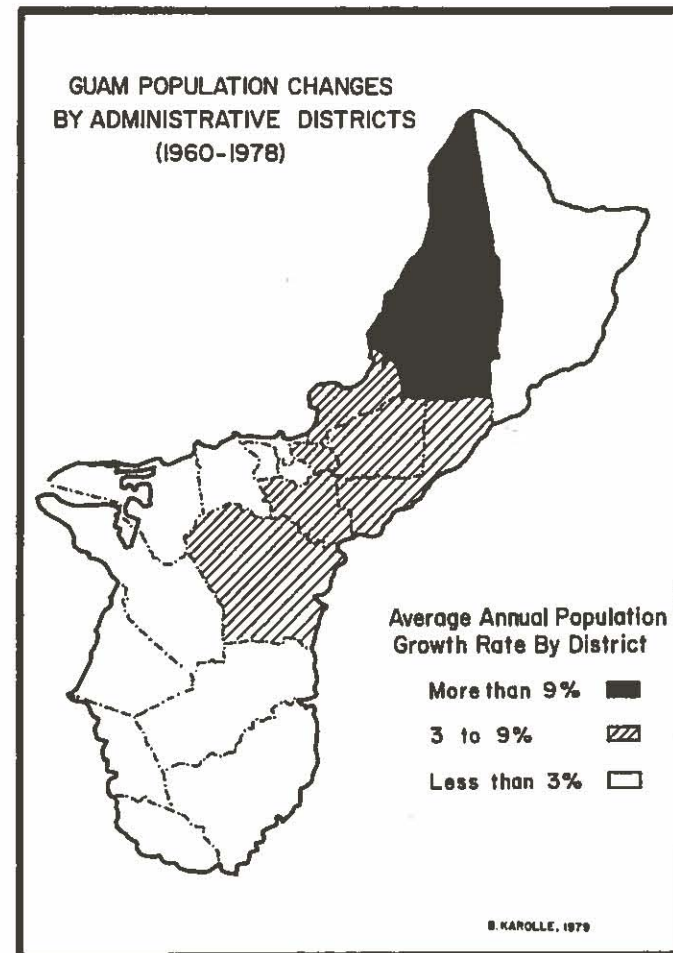
For more precise analytical purposes, two regional designations were utilized for measuring the geographical association of the populace and the operational farms. The first involves the data set in Table 3.

The method used for measuring this relationship is the Pearson Product Moment Coefficient of Correlation. This statistical method requires solving the following equation, which shows a ratio where the numerator and denominator are built up from the totals of columns in Table 3.⁷

$$r = \frac{(N \cdot \sum xy) - (\sum x \cdot \sum y)}{\sqrt{(N \cdot \sum x^2) - (\sum x)^2} \cdot \sqrt{(N \cdot \sum y^2) - (\sum y)^2}}$$

⁷Yeates (1974): 69-97; Alexander (1979): 423-434

Map 3. Guam Population Changes



Map 4. Guam Population Density

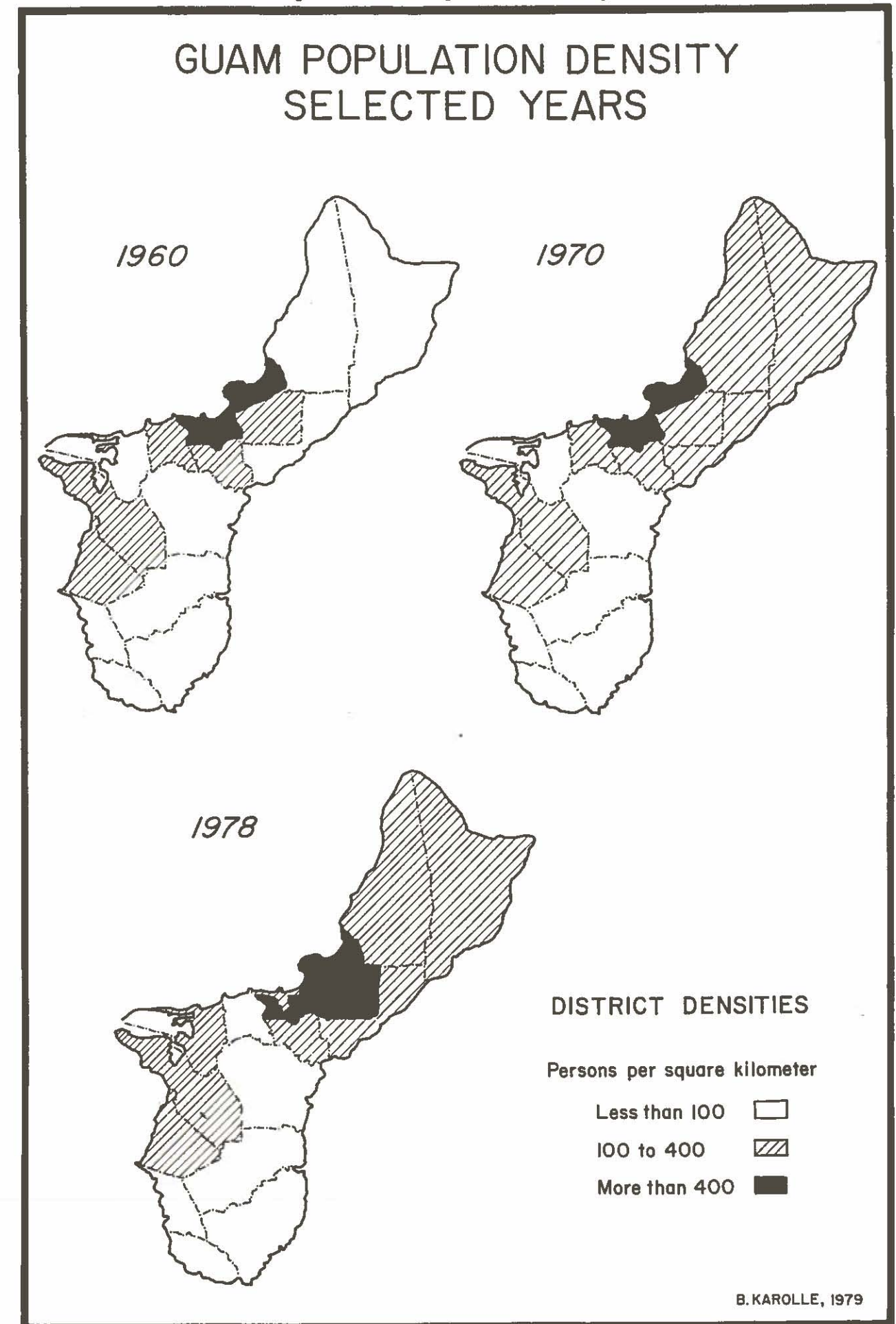


Table 3. GUAM ADMINISTRATIVE DISTRICT POPULATION AND FARMS

	1	2	3	4	5
District (N to S)	Total Population (In Thousands)		Farms		
1. Yigo	10.2	104.04	7	49	71.4
2. Dededo	21.8	475.24	27	729	588.6
3. Tamuning	13.9	193.21	1	1	13.9
4. Barrigada	9.1	82.81	11	121	100.1
5. Mangilao	5.1	26.01	5	25	25.5
6. Mongmong-Toto-Maite	5.4	29.16	3	9	16.2
7. Agana	0.9	0.81	2	4	1.8
8. Agana Heights	3.4	11.56	0	0	0.0
9. Sinajana	2.5	6.25	3	9	7.5
10. Asan	1.2	1.44	2	4	2.4
11. Piti	2.0	4.00	1	1	2.0
12. Chalan Pago-Ordot	3.2	10.24	4	16	12.8
13. Yona	4.2	17.64	8	64	33.6
14. Santa Rita	8.9	79.21	4	16	35.6
15. Agat	3.3	10.89	4	16	13.2
16. Talofofo	1.7	2.89	10	100	17.0
17. Umatac	0.5	0.25	3	9	1.5
18. Inarajan	2.4	5.76	11	121	26.4
19. Merizo	1.5	2.25	10	100	15.0
TOTALS	101.2	1603.66	116	1394	984.5
	x	x ²	y	y ²	xy

SOURCE: B. Karolle, Changing Agricultural Patterns of Guam, Technical Report No. 2 (UOG: College of Agriculture and Life Sciences, 1978) pp. 8-13. Bureau of Labor Statistics, Guam Household Sample Statistics and Population Estimates (Agana: GovGuam, 1978).

It is difficult to design a general theory in geography that can be completely verified under all possible areal conditions. However, if two phenomena vary similarly from place to place (people and farms), i.e., if both tend to reach their high values in the same places and their low values in other, similar places, the coefficient r under the Pearson formula will be a positive number. If such covariation of the district farms and population is perfect, then the coefficient r would be +1.00. On the following page, if the small circles (dots) on the scatter diagram conformed to a straight line, called the regression coefficient, this would show a perfect linear relationship.

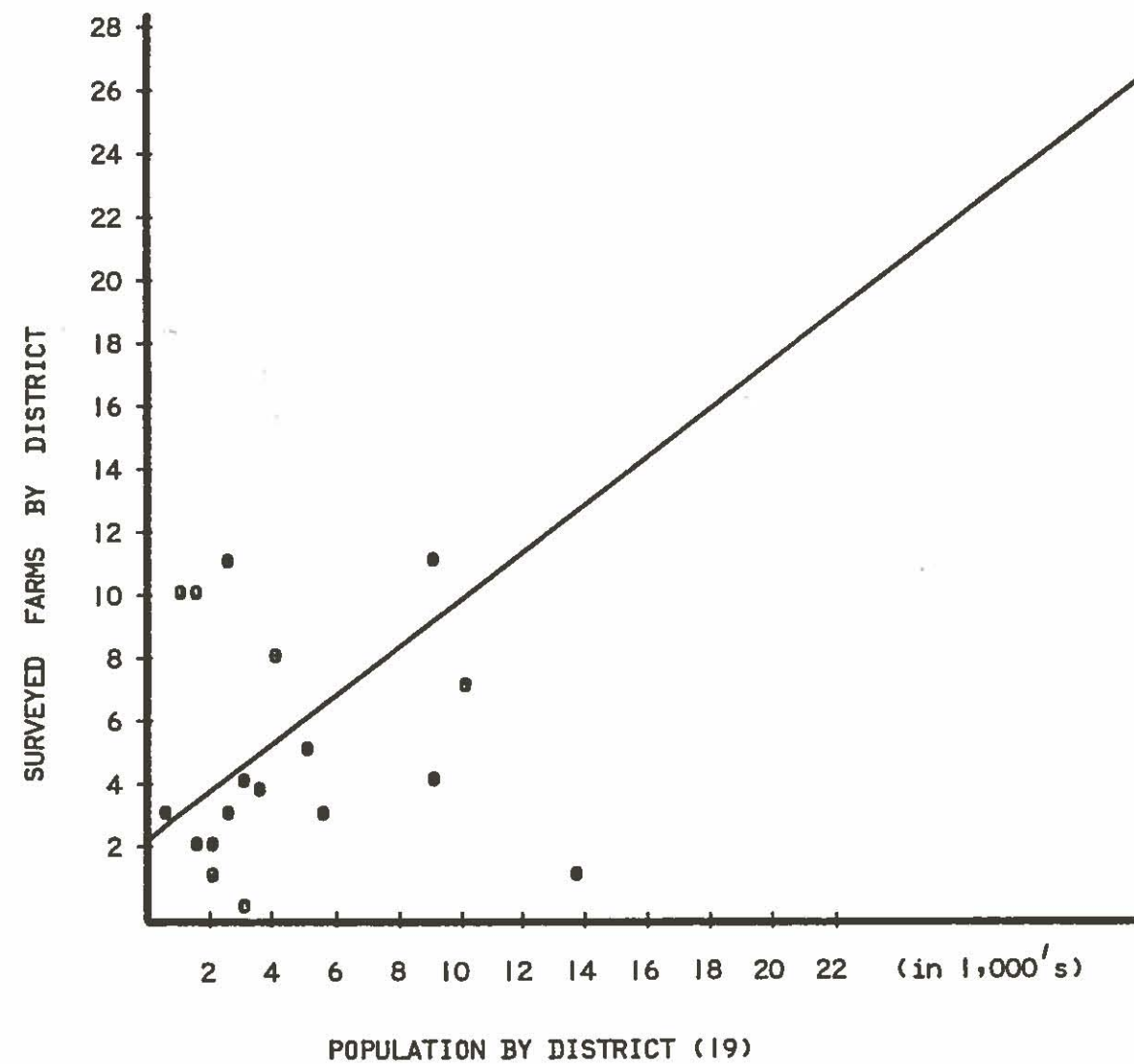
Utilizing the Pearson formula the coefficient of correlation was found to be $r = .61$ (level of r for significance at .05 with 2, 18 degrees of freedom must be equal to or greater than $r = .44$).

The scatter diagram shows the 19 administrative districts represented by small circles, scattered about the line of best fit regression coefficient (the diagonal straight line). The vertical and the horizontal axis are scaled for plotting the two variables; the vertical axis represents the numbers of surveyed farms by district and the horizontal axis indicates the district population. In addition, the color format (key) cross references the scatter diagram points and the percent of change data found on Map 3 and Table 2.

The second quantitative procedure utilized in this study for measuring the geographical association of the Guam populace and agricultural sites involved data from a preliminary migration survey.⁸ A written questionnaire, completed

⁸Workman, Carter, Karolle (1979): 4

FIGURE 1. SCATTER DIAGRAM OF GUAM FARMS AND POPULATION*



* % of Population change: high • (red); medium • (green); low • (yellow) see Map 3.

by a sample of 187 college students, contained residency information. Examination of Table 4 provides some assurance that the UOG student migration survey is at least partially representative of Guam's entire residential population. The distributions of current residences (of the students surveyed) and the total population are highly correlated ($r = .92$ $p \leq .05$). However, limitations exist since no time frame was specified, i.e., within the previous year or five years, and the sample was relatively small.

Interpretation of the migration rates: On Table 4, the IN migration rates reflect the number of students in the sample who moved into the area (current residence) per 100 persons originally living in the area (the area is, of course, the District). In other words, the IN rate is determined by dividing M_{ij} by N_i . OUT migration rates reflect the number of persons who moved out of the area per 100 persons originally living in the area. For example, in Dededo the data show that for every 100 persons who originally lived in the District, about 87 persons have moved in and 39 persons have moved out, therefore, a net gain. However, the weakness of these data is illustrated by Piti (5 students previous residence, and 0 students current residence). The "0" indicates a deficiency, yet by checking with previous measurements (Map 3), it may be safe to conclude that Piti is not an area of rapid population growth.

Table 4 also shows several districts with a net gain and thus tend to be in the northern areas; Yona definitely is the exception. However, the relatively high net losses tend to be in the southern areas. No significant correlations (at the .05 level) were revealed between the location of farms and the IN or OUT

Table 4. PERCENT DISTRIBUTIONS OF THE TOTAL POPULATION AND A SURVEY OF COLLEGE STUDENTS BY DISTRICTS, FARMS, MIGRATION RATES AND CORRELATION COEFFICIENTS FOR GUAM.*

District	Percent of		Number of Farms	Migration Rates ²		Correlation between:	Level of r for signi- ficance at .05 level			
	Total Population ¹	Student Survey		IN (per 100)	OUT (per 100)		r	(df)	(df)	r
<u>Northern Region:</u>										
Yigo	10	8	7	36.4	9.1	Percent of Total Population and Student Survey...	.92	2,	18	
Dededo	22	19	27	86.9	39.1					
Tamuning	14	11	1	16.7	50.0	Farms and In Migration All Districts.... Northern Region. Southern Region.	.31 .58 -.04	2,	18	(2, 8) (2, 9) (2, 18)
Barrigada	9	6	11	38.5	53.9					
Mangilao	5	10	5	100.0	30.0					
M-T-M	5	8	3	28.6	21.4	Farms and Out Migration All Districts.... Northern Region. Southern Region.	-.20 -.15 -.36	2,	18	
Agana	1	1	2	20.0	100.0					
Agana Hts.	3	5	0	42.9	28.6					
Sinajana	3	2	3	14.3	57.3					
Asan	1	2	2	40.0	60.0					
<u>Southern Region:</u>										
Piti	2	0	1	0.0	100.0					
Chalan Pago-O	3	5	4	57.1	28.6					

(Table 4 continued)

District	Percent of		Number of Farms	Migration Rates ²		Correlation between:	Level of r for signi- ficance at .05 level			
	Total Population ¹	Student Survey		IN (per 100)	OUT (per 100)		r	(df)	(df)	r
Yona	4	4	8	133.3	0.0					
Santa Rita	9	7	4	42.9	50.0					
Agat	3	6	4	44.4	33.3					
Talofofo	2	3	10	16.7	33.3					
Umatac	1	1	3	50.0	50.0					
Inarajan	2	2	11	20.0	60.0					
Merizo	2	1	10	0.0	50.0					

¹Source: Bureau of Labor Statistics, 1979.

²Migration Rates: Using a college student survey, U.O.G. (N=187), "movers" and "nonmovers" were classified by the similarity of current and previous residence on Guam. IN MIGRATION = $\sum M_{ij}/N_i \times 100$, where M_{ij} is persons who moved into area 'i' from area 'j', and N_i is persons who previously lived in area 'i'. OUT MIGRATION = $\sum M_{ji}/N_i \times 100$, where M_{ji} is persons who moved from area 'i' into area 'j'.

*Author credits Dr. Workman for the construction of this data table.

migration values. However, the $r = .58$ for IN in Workman's Northern Region demonstrates a considerable coincidence, and strengthens the observation that North Guam has the greatest overlap between population growth and operative farms. Furthermore, with the correspondence of farms and OUT migration, a negative correlation in the southern districts suggests a tendency for people to move out ($r = -.36$, Workman's Southern Region).

However, for the South, an additional indication is apparent from the data. A given area may have a net loss; the district could have a high number of farms and a lower OUT migration than areas with OUT migration and a low number of farms. Such examples include Tamuning and Agana (North and Central) compared to Talofofo and Inarajan (South). The data support the observation that people in agricultural areas are generally staying on their lands, especially those in the South.

The migration data indicate that further research is required; it may be more promising if the tri-regional and/or a proposed settlement structure were analysed separately. The 1980 census should provide helpful data for further investigation regarding internal migration.

Conclusions

Field work results over a five year period (1974-79) show that Guam's agricultural base contains less than 300 operative farms. As a result of an intensive survey, 116 individual farms were located and mapped over the entire area of Guam (549 km^2). The distribution of these farms, referenced on the

locational map, show a tri-regional pattern: North, Central and South, with 43, 30 and 43 operative farms respectively.

The study showed that the distribution of population on Guam is highly regionalized and that the greatest density occurs in the Central and North regions. Approximately 75 percent of the present population lives in the northern half (266 km^2) of Guam. Precise measurements of the relative population changes by percentages, and densities by administrative district reveal that the major population growth areas are near identified farms.

Verification of the geographical association between Guam's active farms and the location of the population, especially the growth areas, utilized selected quantitative methods. A correlation was shown to exist between the surveyed farms by district and district total populations by applying the Pearson Product Moment Coefficient of Correlation ($r = .61$). A scatter diagram shows this correlation. However, when utilizing a migration test and a 35 areal settlement design no such correlation was found. A pre-test migration study conducted with University of Guam students, although only qualitatively significant, supports the thesis that the higher the number of farms in the districts of Guam the higher the rates of population growth. For the northern areas, the tendency for migration was into districts with a high number of farms. Conversely, the southern districts with a large number of farms showed moderate to low out migration values on the student survey.

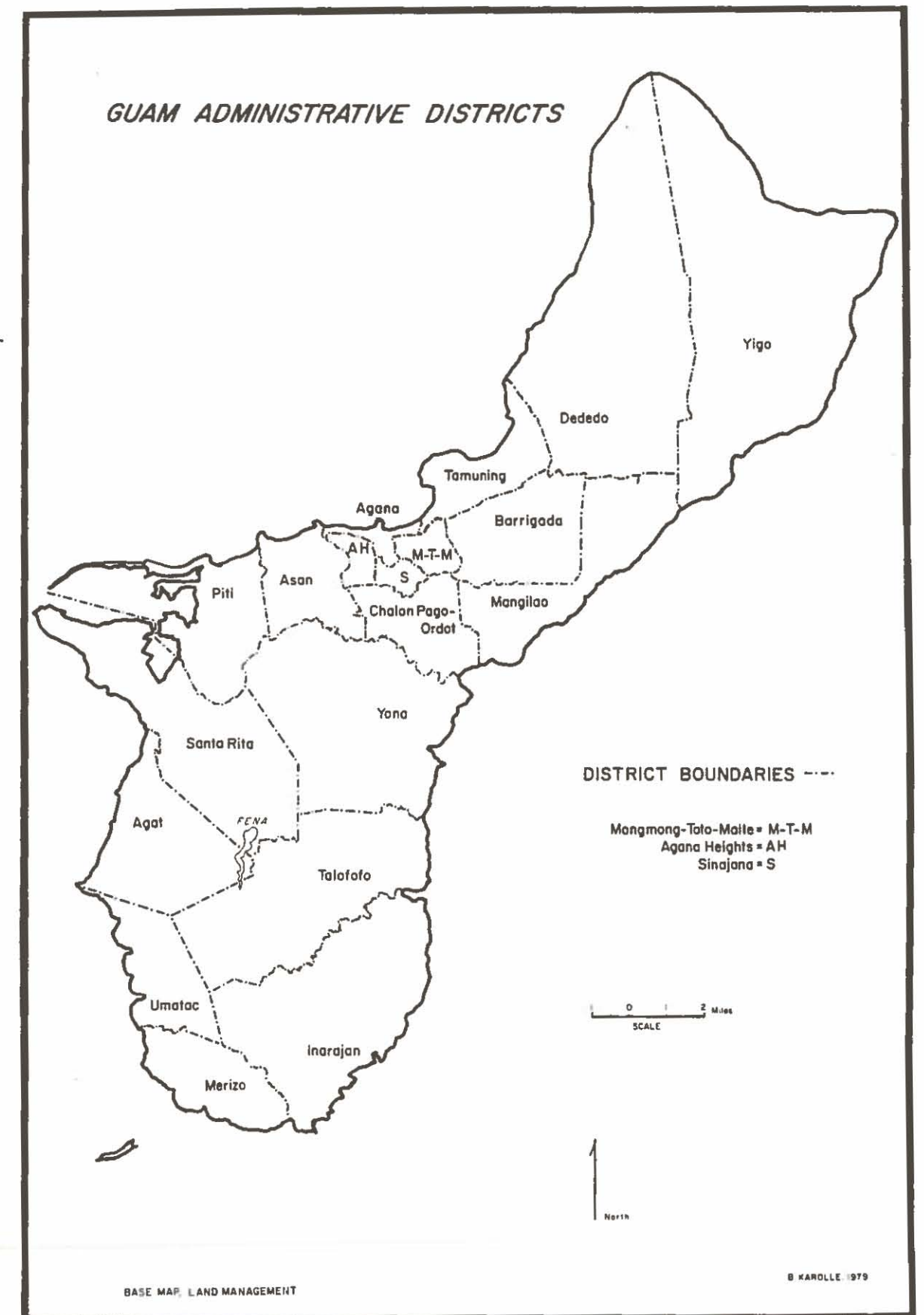
For the near future, the Guam agricultural community is likely to experience the direct effects of a relatively rapid population growth and subsequent spatial

encroachment from non-farm users. Competition for available private lands has reached critical proportions. Clearly, this small Western Pacific tropical island illustrates the impact of "modernization". By viewing the land use patterns established by the populace and their agricultural operations, long-term planning can be benefited. The crucial relationships of local resources and outside political/economic determinants must include and consider these locational patterns.

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APPENDICES



NORTH

1. Andersen AFB
2. Andersen AFB south (Marbo)
3. Barrigada north (Barrigada Heights & Mt.)
4. Dededo south (Village, Liguana, Macheche)
5. Dededo north (Astumbo, Agafo Gumas)
6. Mangilao north (Asbeco, Pagat, Latte Heights)
7. Naval Communication Area Master Station-NCS
(North & South Finegayan)
8. Tamuning, Tumon & Harmon
9. Yigo

CENTRAL

1. Agana
2. Agana Heights
3. Asan village area
4. Asan, Maina area
5. Barrigada village
6. Chalan Pago-Ordot
7. Naval Air Station
8. Naval Communication Station, Barrigada
9. Mangilao south (UOG, Maga)
10. Mongmong-Toto-Maite
11. Naval Regional Medical Center
12. Naval Station (Sumay, North & South Tipalao, Lockwood Terrace)
13. Nimitz Hill (Enlisted, Flag Circle, Officer)
14. Piti
15. Yona north (village area)
16. Sinajana

SOUTH

1. Agat
2. Apra Heights (Old, New, BCQ, Camp Covington, Naval Magazine)
3. Inarajan south (village area, Pauliluc, Agfayan)
4. Inarajan north (Malojloj, Dandan)
5. Merizo
6. Santa Rita
7. Talofoto village area
8. Talofoto-Ipan
9. Yona south (Ylig)
10. Umatac

APPENDIX C

District	Non- Movers	N _i Origin Population	M _{ij} In Movers	M _{ji} Out Movers	(I-0) Net Movers
Yigo	10	11	4	1	3
Dededo	14	23	20	9	11
Tamuning	15	30	5	15	-10
Barrigada	6	13	5	7	-2
Mangilao	7	10	10	3	7
Mongmong/Toto/Maite	11	14	4	3	1
Agana	0	5	1	5	-4
Agana Hts.	5	7	3	2	1
Sinajana	3	7	1	4	-3
Asan	2	5	2	3	-1
Piti	0	(5)	0	5	-5
Chalan Pago/Ordot	5	7	4	2	2
Yona	3	3	4	0	4
Santa Rita	7	14	6	7	-1
Agat	6	9	4	3	1
Talofoto	4	6	1	2	-1
Umatac	1	2	1	1	0
Inarajan	2	5	1	3	-2
Merizo	1	2	0	1	-1

Source: Randall L. Workman, Lee D. Carter and Bruce G. Karolle, 1979.
"Family and Migration Survey", University of Guam.