AN ASSESSMENT OF RAINWATER CATCHMENT AND STORAGE SYSTEMS ON MAJURO

Read by

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INTRODUCTION

This paper focuses upon a discussion of freshwater supply systems in Micronesia. Particular attention is paid to the conditions within a small Micronesia atoll environment of the Marshall Islands, the village of Laura on Majuro atoll.

Initial fieldwork in July-August 1981 revealed that a paradox exists between the abundant availability of freshwater as rainwater and groundwater on the one hand, and frequent shortages of freshwater, on the other. In the course of earlier field research in the Eastern Caroline Islands, Micronesia (Winter and Stephenson 1981), the same paradoxical condition was found to exist.

We suggest that the paradox exists owing to inadequate management of water supply and water storage systems in Micronesia. We further suggest that economic, technical and social factors may be called upon to explain this phenomenon. The paper describes the study area in the Marshalls; overviews local water supply and storage systems; examines attitudes towards uses of groundwater versus rainwater catchment; and attempts to explain why rainwater is not utilized more extensively than it is. The paper concludes that, as water consumption is most likely to increase along with modernization in Micronesia, government plans should provide for increased water supply.

The Study Area

Laura village is an atoll community in the southern Marshall Islands of Micronesia. Code named Laura by the Navy, the settlement occupies an elbow-shaped islet at the west end of Majuro atoll. Laura is 2.3 miles long by 0.73 miles at its widest point; the maximum elevation is about 20 feet above sea level. Access to the village is by automobile across a long causeway that links Laura to the district center in Majuro, the Darrit-Uliga-Dalap area (DUD), Navy code named Rita. Constructed in 1961, the causeway is 35 miles in length; it is the longest paved road in Micronesia at present. Laura village encompasses some 200 households and is within the jurisdiction of Iroij (traditional Chief) and an elected senator to the Marshall Islands Parliament.

The settlement of Laura is divided into wato, strips of land running across the islet from the lagoon side to the ocean side. Wato are held and administered by individual matrilineage or descent line groups (Alkire 1977; Mason, Ed., 1967; et al.).

Majuro atoll itself is long, narrow and flat with an average elevation of only a few feet above sea level. Brackish groundwater generally occurs as a Ghyben-Herzberg lens. The coral-based soil is highly permeable, allowing for little or no surface runoff following rains, in spite of the average annual rainfall of 151 inches. For this reason, and because of the small size of the islands, no streams occur on Majuro. Island residents must seek freshwater through other means.

In the course of the field research in Laura, two anthropologists and two Marshallese research aides conducted a household survey among a selected sample of 41 households, asking questions in regard to the development and use of freshwater resources in the village. Rainwater catchment and storage devices were examined and photographed. Groundwater samples were taken from household wells for chloride and bacteria tests. The findings of the field research form the basis of this report.

LOCAL WATER SUPPLY AND STORAGE SYSTEMS

In the village of Laura, freshwater is available from two major sources, rainwater and groundwater. Local villagers utilize both of these sources to obtain needed freshwater. In the rainy season, both rainwater and groundwater are plentiful. During the dry season, however, acute rainwater shortages are experienced.

Informants in Laura were asked to identify sources of their freshwater supply. For drinking, rainwater is almost exclusively preferred over well water (92.7%). For cooking food and washing dishes, 78% of the informants said they use rainwater. In order to bathe and wash clothes, people rely primarily on well water (63.4% and 57.5%, respectively).

Rainwater is collected on rooftops and routed by gutters to various types of storage devices. These consist of portable containers (e.g. plastic buckets), semi-Permanent containers (e.g. barrels, airplane fuel tanks), and permanent cisterns. Cisterns are made of metal, rubber, or, most commonly, concrete. Storage capacity varies from 3 gallons (plastic bucket) to 1000 gallons (concrete cistern). In order of technological sophistication, these rainwater collection and storage systems are listed below according to frequency of occurrence in the sample of 41 households:

Type of Rainwater System	Frequency of Occurrence (%)
No device	7 (17.1%)
Portable containers only	3 (7.3%)
Semi-permanent containers	2 (4.9%)
Incipient gutter, semipermanent containers	3 (7.3%)
Gutter, portable container	1 (2.4%)
Gutter, semi-permanent container	6 (14.6%)
Gutter, cistern	19 (46.3%)

Clearly, the greatest number of people in Laura utilize rooftop rainwater catchment along with a gutter and cistern system. However, the above table also indicates that there are still a significant number of people who rely upon makeshift means of rainwater collection (36.6%).

Though abundant in number, groundwater wells in Laura serve as a secondary source of freshwater to supplement rainwater. Approximately 200 wells have been constructed in the village. In the sample of 41 households, all have wells on their property. The table below delineates the type of well and the frequency of each type:

Type of Well	Frequency of Occurrence (%)
Sand pit	1 (2.4%)
Coral blocks	1 (2.4%)
Coral blocks & concrete	1 (2.4%)
Coral blocks & drum can	1 (2.4%)
Cement/concrete	4 (9.8%)
Drum cans (2 to 7)	32 (80.0%)
No structural data	1 (2.4%)
	41

Various devices are present for drawing water from the wells. The most common device is a one-gallon tin can such as a flour can (31 cases). Other devices include a teapot, a plastic bucket, a hand pump, a diesel-powered pump, and an electric pump.

As with rainwater systems, wells may be used by individual households or shared with other families. Nearly 50% of the households surveyed shared their wells with two or more families. Other families are sole users of their wells.

A preliminary survey of well water quality was made in Laura. Bacterial tests of the groundwater during the period August 3-6, 1981, show that the number of bacteria present in the water samples is too numerous to count in more than half of the collected samples. Contamination of well water probably results from the casual sanitary habits of village residents; 14 families (34%) reported that they had no toilet facilities. Some families pen their pigs close to their well. Accordingly, it is not surprising that the rate of water contamination appears so high. In atoll environments where space is limited, water use practices and sanitation habits as they exist may be mutually incompatable.

ATTITUDES TOWARD USE OF GROUNDWATER VERSUS RAINWATER CATCHMENT

In the course of the sample survey, over three-fourths (76.9%) of the respondents indicated that they felt freshwater in general should be regarded as a limited natural resource. When asked under what conditions freshwater should be seen as a limited natural resource, 88.5% of the respondents answered, "In the dry season, particularly." Others (11.5%) spoke of freshwater as a natural resource that is limited in quantity at all times. Surprisingly, in response to the following question, "Does your family conserve water?", only a little over half of the informants (54.5%) replied in the affirmative. In light of the number of people who regard freshwater as a

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LAURA VILLAGE, MAJURO

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	n= 41	(100.0%)

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Drum cans (2 to 7)	32	(80.0%)
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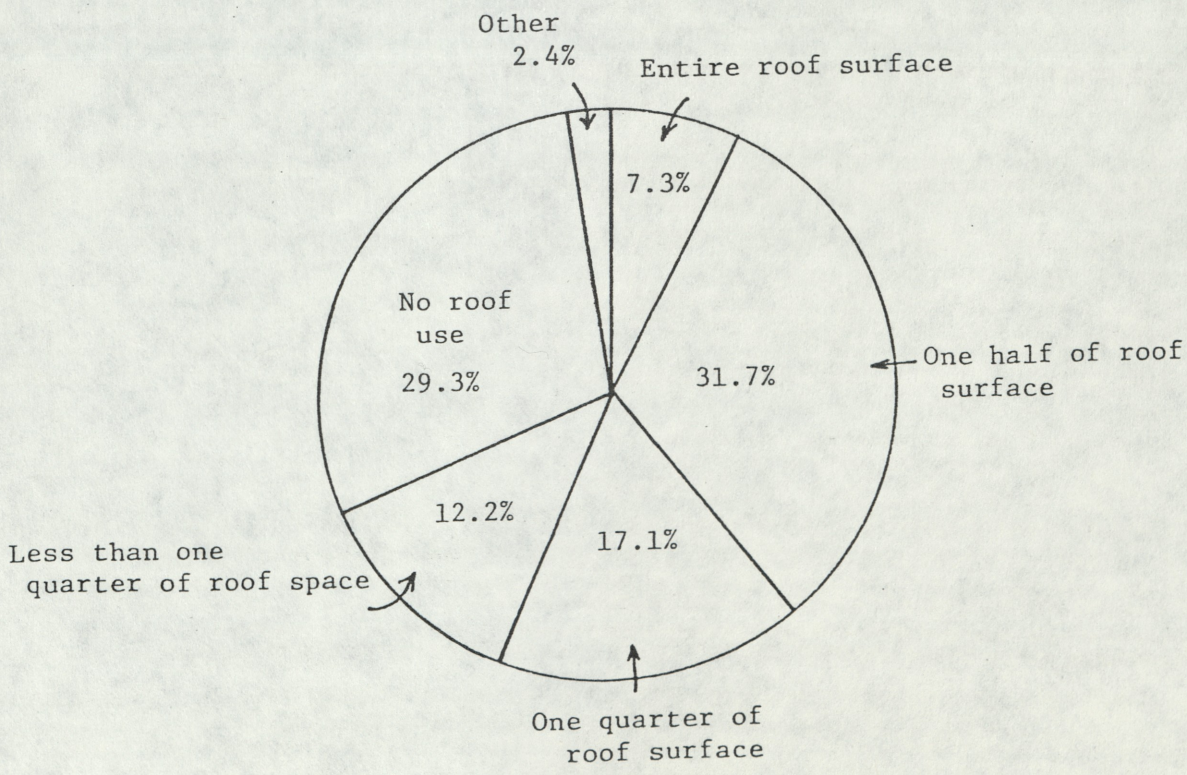
Piediagram Showing the Use of Roof Surface for Rainwater Catchment



limited natural resource, it would seem that more of them would practice water conservation.

All the houses encountered in the sample survey have wells as a part of the house compound. Yet, people do not rely on well water. Local people say that groundwater tends to be brackish. Rainwater is viewed as clean and pure. Additionally, rainwater is convenient to use, being found in storage containers near to the house or under the house eves where portable containers are placed to catch roof runoff. With well water, people feel that more labor is involved in order to use it. Most wells are deep, some as deep as 3 meters (9 feet). Therefore, drawing the water out is viewed as physically demanding. A number of informants said their wells have become dirty: "the water is contaminated now", ... "There is junk in the well", e.g., rusty cans, discarded zoris, boards and planks,etc. If wells are used as convenient dump sites, it seems clear that people have mixed views as to the value of wells and well water.

Informants were asked, "Are you satisfied with the present condition of your water supply system?" In the sample, 22 heads of households (55%) answered no. They were asked then how they might consider improving their water supply system at home. In response, twelve people (36%) said specifically, "Build more water catchment facilities" and "Build (more) gutters." Only one informants in the sample of 41 households (3%) mentioned fixing his well. It is clear that improvement of water supply systems for local people is viewed in terms of utilizing rainwater facilities rather than well water.

ATTEMPTS TO EXPLAIN WHY RAINWATER IS NOT UTILIZED MORE EXTENSIVELY THAN IT IS

Since residents of Laura village so clearly prefer to use rainwater rather than well water, it would seem that they would have very efficient rainwater catchment and storage systems. This is not the case. Of the 41 houses observed, only three make use of 100% of available roof surfaces of their buildings in the construction of permanent rain gutters. Of the remaining households, 31.7% utilized approximately 50% of the roof surface, usually just one side of the house being supplied with a gutter. The remaining households (25) use 25% or less of the roof surface.

The reasons for not making maximum use of the available roof surfaces are many and varied. Clearly, some of the reasons are perceived as economic in nature. In the sample survey 18 household heads (48.6%) mentioned that they could not afford to purchase additional gutters and/or barrels. No one, however, spoke of making do with wooden troughs or make-shift gutter-like devices. Four persons (10.8%) explained that their houses were still being built; the building process, however, had been going on for several years. Apparently no need was perceived to build a temporary gutter. One informant explained the lack of gutters on his house by pointing out that it was a very old dwelling. It seemed as through maintenance of the house was no longer necessary. Three persons (8.1%) indicated that such a home improvement was not a high priority item by this statement: "We can get water from the neighbors." In the total sample, 8 persons (21.6%) simply did not perceive a need for further improvements to their rainwater catchment systems, in spite of the fact that 100% of their roofs were not utilized for catchment purposes.

A lack of technical skills needed to design and construct an effective gutter and catchment system was implied when several women and children who were serving as informants mentioned that the male head of their household was deceased, or was not living in Laura at the time of the study. The same lack of technical expertise was implied by informants who were older men, saying that they had no plans for further household improvements. A key social factor may be mobility of the population of Laura. People shift about to different homes within the community, to outer islands, and into Rita for indefinite periods of time.

It has been suggested ~~elsewhere (Spoehr 1962 et al.)~~ that the time perspective in Micronesia is different from the Western model. A present day orientation prevails in Micronesia. The past is already gone and the future is an unknown quantity, so that making special plans for it is useless. Perhaps this explanatory framework is valid in the Marshalls islands. Looking ahead to the future may be practical in plant cultivation (Klee 1976). However, in household matters, daily requirements take first priority. When enough rainwater is available for today, why worry if a sufficient amount of rainwater will be available in the dry season? Such a daily coping strategy may be tempered with a certain degree of fatalism: "The dry season will come when it comes, anyway . . . . Can't be helped". . . .

SUMMARY AND CONCLUSIONS

In this paper, the status of freshwater resources in Micronesian islands is examined. Particular attention is paid to Laura village on Majuro atoll in the Marshall Islands. The apparent paradox between the abundant availability of freshwater on one hand and water shortages in Laura on the other is examined carefully using ethnographic data. The study shows that the water shortage problem is not caused by environmental factors, but rather, it is a phenomenon induced by socio-economic factors. In addition to the factors discussed above, a lack of systematic planning appears evident in a house by house examination of individual water catchment and storage facilities. Careful planning of water supply systems at the household level should result in a more satisfactory water supply, given the rate of high annual rainfall, except perhaps during prolonged drought. A few homes already recognize this situation. Such homes have prepared adequate facilities for catchment and storage; these families generally do not experience water shortages.

While it appears that many of the water-related problems may be solved or reduced at the household level, facilitation for easier purchase and installation of gutters and the building of large water storage devices such as concrete cisterns could be undertaken at the community or regional governmental level. Also, it is important to point out that, as modernization takes place further in remote atolls in Micronesia, water consumption is most likely to increase. Introduction of flush toilets, showers, and washing machines in the villages will undoubtedly demand more freshwater for domestic uses. For the projected future development and modernization of these rural areas, government plans should provide for increased water supply, perhaps including further development of groundwater.

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