

THE IMPACTS OF TOURISM ON THE ENVIRONMENT:

A CASE STUDY OF GUAM

by

KATHLEEN ROOS

A THESIS

Presented to the Environmental Studies Program
and the Graduate School of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Master of Science

March 1995

"The Impacts of Tourism on the Environment: A Case Study of Guam," a thesis prepared by Kathleen Roos in partial fulfillment of the requirements for the Master of Science degree in the Interdisciplinary Studies Program: Environmental Studies. This thesis has been approved and accepted by:


Chair of the Examining Committee

February 21, 1995
Date

Committee in charge: Dr. Maradel K. Gale, Chair
Dr. Jan Hodder

A 

Vice Provost and Dean of the Graduate School

An Abstract of the Thesis of
Kathleen Roos for the degree of Master of Science
in the Interdisciplinary Studies Program: Environmental Studies
to be taken March 1995

Title: THE IMPACTS OF TOURISM ON THE ENVIRONMENT:
A CASE STUDY OF GUAM

Approved: _____

Dr. Maradel K. Gale

Today, many Pacific island nations look to tourism as a development strategy. Often their leaders do not fully understand the environmental consequences of that decision. Nor do they fully appreciate how difficult it is to control tourism growth or its impacts. Guam provides an example of a Pacific island that focused on tourism development for 28 years, and continues to do so today. While this strategy has been economically beneficial to many, the environmental costs have been high. Moreover, the government's efforts to control tourism and protect the environment have generally failed. The author suggests some reasons why control efforts have failed, and provides recommendations for other small island states contemplating tourism development.

CURRICULUM VITA

NAME OF AUTHOR: Kathleen Roos

PLACE OF BIRTH: Berkeley, California

DATE OF BIRTH: November 13, 1944

GRADUATE AND UNDERGRADUATE SCHOOLS ATTENDED:

University of Oregon
University of California, Los Angeles
University of California, Berkeley

DEGREES AWARDED:

Master of Science in Environmental Studies, 1995
University of Oregon
Master of Arts in History, 1967
University of California, Los Angeles
Bachelor of Arts in History, 1966
University of California, Berkeley

AREAS OF SPECIAL INTEREST:

The Environment and Development

PROFESSIONAL EXPERIENCE:

Technical Assistant, American Samoa Coastal Management
Program, University of Oregon Micronesia and South Pacific
Program, American Samoa, 1994

Research Intern, Greenpeace Pacific Campaign, Guam, 1993.

Executive Director, Guam Humanities Council, Agana, Guam, 1990-1992

Executive Director, La Grande-Union County Chamber of Commerce,
La Grande, Oregon, 1987-1990

ACKNOWLEDGEMENTS

The author expresses sincere appreciation to Professors Gale and Hodder for their encouragement and assistance in the preparation of this manuscript. I also thank the many officials of the Government of Guam who were helpful in providing information and their thoughts about the topic. In addition, I give special thanks to Nancy Weare, my primary contact on Guam once I had returned to Oregon. Finally, I thank my husband, Roger Roos, who contributed many ideas, and provided continual support and encouragement throughout the writing process.

DEDICATION

To the children and future generations of Guam

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	1
II. REVIEW OF LITERATURE	7
III. METHODOLOGY	15
Scope of the Study	15
Interviews	16
Field Observations	17
Literature Research	18
Challenges of the Methodology	20
IV. THE NATURE OF TOURISM ON GUAM	23
Introduction	23
Setting the Stage for Tourism Development	23
The Early Years of Tourism (1967-1974)	29
A Slower Rate of Growth (1975-1986)	32
Tourism Outgrows Tumon Bay (1987-1994)	34
Summary	41
V. GUAM'S ENVIRONMENT PRIOR TO TOURISM	43
Introduction	43
The Impact of the Chamorros	43
The Spanish Impact on Guam's Environment	44
The United States' Impact on Guam's Environment	45
World War II and After	48
Summary	49
VI. EARLY INDICATIONS OF ENVIRONMENTAL STRESS FROM TOURISM AND GOVERNMENT RESPONSES	50
The First Seven Years of Tourism (1967-1974)	50

Chapter	Page
The Middle Years of Tourism Development (1975-1986)	53
The Most Recent Phase of Tourism (1987-Present)	58
Summary	60
VII. GUAM'S ENVIRONMENT TODAY	61
Introduction	61
How Tourism Impacts the Environment	62
Tourism's Impact on the Land	64
Tourism's Effects on Guam's Fresh Water Resources	84
Tourism's Impact on Guam's Marine Environment	92
Summary	105
VIII. ANALYSIS	109
The Role of Private Enterprise	109
Government's Role in Protecting the Environment	111
Preoccupation with Growth	113
The Lack of Political Will Among Leaders	121
The Lack of Public Pressure	123
Summary	125
IX. CONCLUSION	126
Recommendations	126
Conclusion	132
APPENDIX	
A. SUBJECTS INTERVIEWED	134
B. DETERMINATION OF TOURIST-INDUCED POPULATION	136
C. GUAM'S THREATENED AND ENDANGERED SPECIES	137
SOURCES CONSULTED	138

LIST OF FIGURES

Figure	Page
1. Island of Guam	5
2. Sites Suggested for Acquisition by the 1965 Outdoor Recreation Plan .	26
3. Tourist Arrivals on Guam, 1967-1994	30
4. Land on Guam Held by the U.S. Military and the Guam Territorial Government, 1993	40
5. Distribution of Coconut Plantations, 1960	47
6. Proposed Tourism Projects, 1993	75
7. Comparison of Extent of Limestone Forest in 1960 and 1993	78
8. Sources of Fresh Water on Guam	86
9. Degraded Marine Ecosystems, 1993	94
10. Declining Populations of Reef Fish of Guam, 1987-1991	106

LIST OF ILLUSTRATIONS

Illustration	Page
1. Ongoing Hotel Development along Tumon Bay	65
2. Inappropriate Carving of Tumon Bay Cliffline	66
3. Resculpturing of Tumon Bay Cliffline	67
4. Extensive Hillside Alteration to Accommodate Development	68
5. Condominium Development Too Close to Shoreline	70
6. Road Construction Too Close to Shoreline	72
7. Undeveloped Area of Limestone Forest Proposed for Golf Course	77
8. Removal of Vegetation Reduces Ability of Land to Retain Moisture	87

CHAPTER I

INTRODUCTION

Increasing numbers of Pacific island nations are looking to tourism as a development strategy. This is understandable considering the fact that tourism can provide substantial economic benefits to island peoples. It can increase employment, increase income for islanders and improve foreign exchange earnings (Pearce 1991, 193). It is the largest and fastest growing industry in the world (Economist 1989, 73). Most importantly, it is one of the few development options available to small, isolated Pacific island nations with growing populations and limited resources (Beller, d'Ayala, and Hein 1990, 6). For islands blessed with an abundance of natural beauty and seemingly unlimited marine resources, it appears to be a logical fit.

The attention to tourism is new among most Pacific island nations. In the 1980s, tourism in the region focused overwhelmingly on only four island groups: Guam, Commonwealth of the Northern Marianas Islands (CNMI), Fiji and French Polynesia. During that decade, these islands attracted 82% of the travelers to the region (Ikeda and Collison 1990, i). By 1990, however, the demand from tourists for more remote and unspoiled destinations had increased substantially (Ikeda and Collison 1990, ii). The other island states

viewed this as an opportunity to build their economies and actively turned to the business of tourism development and promotion.

A few examples illustrate this trend:

- In 1990, leaders from 20 Pacific island nations assembled in Hawaii to discuss strategies for tourism development (Williams 1990, 39).
- In 1991, the Federated States of Micronesia (FSM) announced that it was placing heavy emphasis on the growth of tourism to meet the expected demands for services and facilities (Micronesian Investor 1991, 2). Three new hotels opened in the FSM soon thereafter.
- In 1991, the government of Palau hosted a Foreign Investment and Tourism Conference to generate interest in its nation among potential investors (Micronesian Investor 1991, 4). Two years later, a foreign firm presented plans to the government to build a 435-acre, 680-room, 12-story resort, estimated to cost more than \$1 billion to construct (Micronesian Investor 1993b, 4).
- In 1992, the government of the Marshall Islands, an island group encompassing 70 square miles on more than 1200 coral atolls and islands, launched a tourism campaign directed at tourists wanting an "out island escape" (Micronesian Investor 1993a, 3). Later that year, a foreign firm proposed a major diving resort on one of the atolls, including an airport for 747 airplanes built on imported landfill (Micronesian Investment 1992, 3).
- In 1993, the government of the Cook Islands joined with a foreign firm to build a 204-room five star hotel (Pearce 1993, 35).

In fact, nearly every Pacific island state is now embracing tourism, in many cases on a large scale.

In their eagerness to adopt tourism as a development strategy, Pacific island leaders often do not fully understand the environmental consequences of such a decision (McKee and Tisdell 1990, 47). Nor do they fully appreciate the difficulty of controlling the growth of tourism and its impact on the environment

(Butler 1991, 201).

Tourism is often viewed as a clean or "smokeless" industry. But this view is incorrect. Tourism can have considerable impacts on the environment. It can generate changes to landforms, loss of species, rapid human population growth, and can overwhelm an area's natural capacities to absorb wastes. Tourism's negative effects can be seen in the example of Saipan island where overpumping has rendered groundwater so seriously contaminated by saltwater intrusion that much of the supply is unfit for human consumption (Guam Territorial Planning Commission 1993c, 87). Or the case of Heron Island on the Great Barrier Reef where tourism development damaged the reef so severely that the island is "permanently washing away" (Walker 1991, 121).

Islands are particularly vulnerable to the impacts of tourism. They have limited supplies of fresh water and soil. Island lifeforms typically exhibit low genetic diversity, high specialization, and a reduced capacity to compete. They exist in a delicate balance with the physical environment that is easily upset by outside influences (Fosberg 1963, 5). This interconnectedness means that damage to one ecosystem gives rise to reverberating effects in other ecosystems. For example, removal of forests leads to loss of terrestrial life and to soil erosion; this leads to increased river and stream siltation, and loss of aquatic life; eventually, the silt flows into nearshore waters affecting coral reefs and mangrove communities. Such damage is often irreversible.

The fragile nature of islands is especially significant because tourism

growth is difficult to control. Based on common property resources, such as beaches, oceans and forests, the tourism industry has a tendency to grow until those resources are degraded so severely that the industry itself declines. For a variety of reasons, island governments are often ill-prepared to exercise the necessary controls to protect their resources. Contributing to the difficulty of control is the fact that environmental impacts are insidious and complex. Degradation often occurs slowly over time often at some distance from the source of the problem.

This paper is an effort to expand the understanding of the impacts of tourism in Pacific island environments and to examine why it is so difficult to control tourism growth and its impacts.

The paper focuses on the island of Guam as a case study. Thirty years ago, Guam was much like the Pacific islands that today are considering tourism as a development strategy. It was a small, remote island with limited natural resources, and thus it had limited development options (see Figure 1). It had a predominantly indigenous population with strong ties to family and to the land. Guam was selected because it has a 28 year history with tourism development over which to assess environmental changes and government responses. During that time, its elected leaders actively encouraged and promoted tourism, as other Pacific island leaders now plan to do. As tourism developed, environmental problems appeared. Numerous efforts were made to control tourism and redress the problems, but those efforts largely failed. Today,

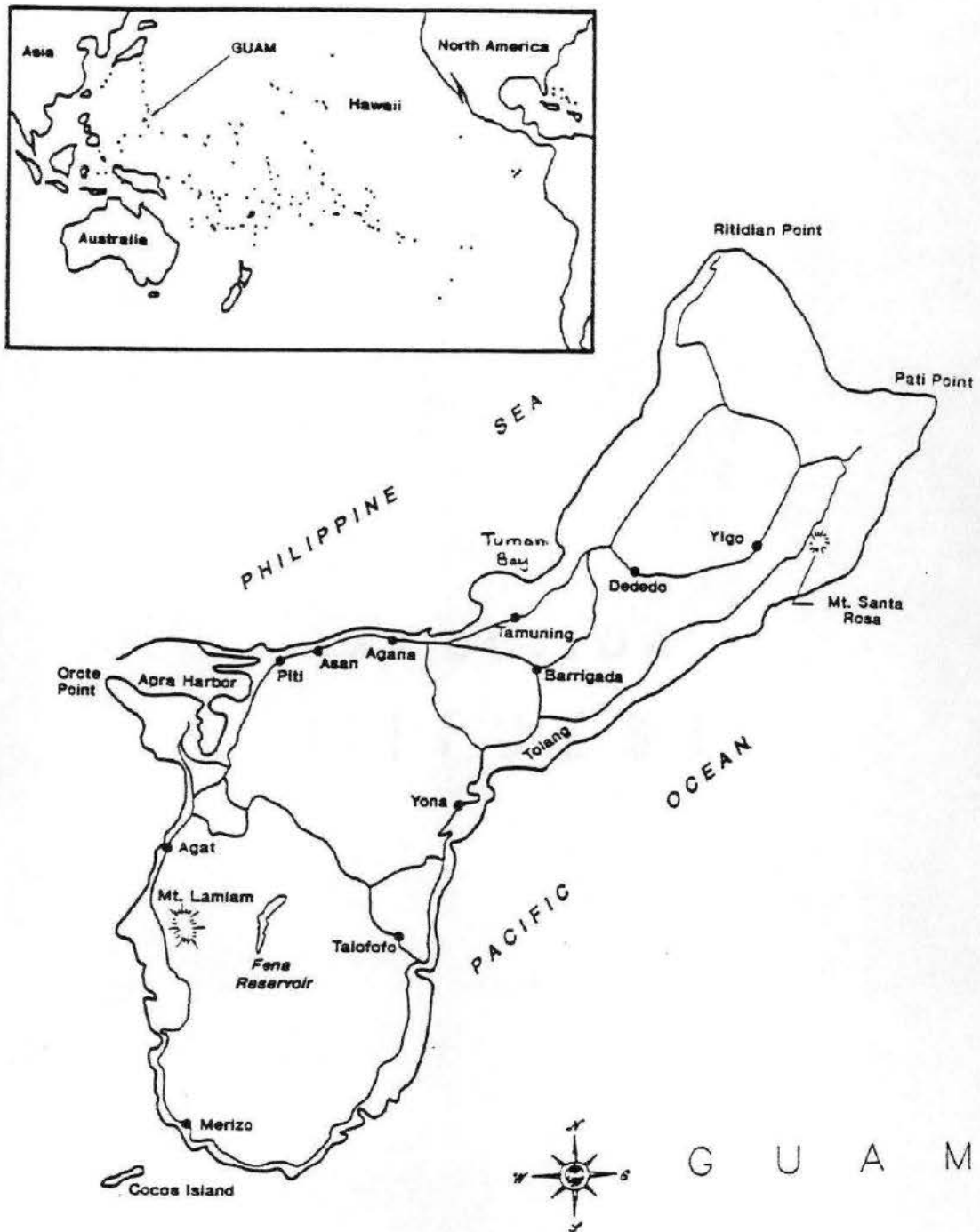


Figure 1. Island of Guam (Reprinted from U.S. Fish and Wildlife Service Final Environmental Assessment for the Proposed Guam National Wildlife Refuge, 1994.)

despite severe environmental problems, tourism continues to grow and to dominate Guam's economy. Guam is the second most popular destination for tourists in the Pacific after Hawaii.

An overview of the literature concerning the relationship between tourism development and the environment is found in Chapter II. Chapter III relates the methods used by the author to obtain information for the paper. The historical development and nature of tourism on Guam are described in Chapter IV. A baseline for Guam's environment prior to tourism is established in Chapter V. Chapter VI explores indications of environmental stress throughout the 28 year history of tourism on the island. The impacts of tourism on Guam's environment today are extensively reviewed in Chapter VII. Chapter VIII analyzes why control of tourism was so difficult in Guam's case. The author's recommendations and conclusion are found in Chapter IX.

It is hoped that this paper will influence the governments of Guam and the currently developing Pacific island states to give greater priority to environment as they plan development strategies; to think carefully about the scale and pace of tourism they chose to embrace; and to establish in advance a vision of what they want their island's future to be. For tourism to be sustainable, it is essential that the vision reflect a balance between the needs of Pacific islanders for economic development and the material things it brings and the needs of their islands for long-term ecological survival. There is very little margin for error in the island setting.

CHAPTER II

REVIEW OF LITERATURE

Literature linking tourism development to changes in the natural environment is relatively new. Interest in the topic first appeared in the 1970s when a tremendous growth in international travel (in the Mediterranean and later in the Caribbean) coincided with an emerging sensitivity about the environment.

Literature in the early years focused on identifying the environmental impacts of tourism through case studies and overviews. Dasmann, Milton and Freeman (1973) were among the first to provide an overview of the environmental costs of tourism development and to emphasize the importance of preserving a quality environment as the base of the industry. They discussed the need to determine the "carrying capacity" of destinations, that is, how many people the environment can accommodate. They described the fragile nature of island ecosystems in particular, and the need for a conservative approach to development on islands. McEachern and Towle (1974) also identified the adverse impacts of tourism and suggested guidelines to assist developers in weighing alternatives.

Walter (1975) provided an excellent discussion of the factors leading to

to mass tourism and distinguished among various types of carrying capacity, including environmental and social. He contended that the concept of carrying capacity is only marginally useful in setting limits to tourism. He also pointed to the problems of applying traditional cost-benefit analysis to the tourism industry, noting that values are never placed on free resources (such as oceans and beaches), nor on costs to society or nature. Cohen (1978) related the environmental problems of tourism to the intensity of use at a particular site. Rajotte (1978) provided a detailed--if complex--method for weighing the social and environmental costs and benefits of tourism development in the Pacific.

During the 1970s, numerous international meetings also focused on the tourism-environment relationship. In the year of the first Earth Day, a joint United Nations Environment Program (UNEP) and World Tourism Organization (WTO) conference (1970) resolved that a healthy natural environment is the base of the tourism industry and must be maintained. The Pacific Asia Travel Association (PATA) sponsored a workshop titled *Tourism Builds a Better Environment* (1973) emphasizing the positive influences tourism can have on an area's natural surroundings. The Pacific Science Association met in Guam in 1973 to focus on the topic *The Impact of Urban Centers in the Pacific*. The conference highlighted social and environmental problems associated with tourism on Guam in particular. Conferences in Europe during this period also reflected an emerging concern

about the environment.

By the end of the 1970s, it had been determined that there were environmental consequences of mass tourism, and that they sometimes directly threatened the industry. Attention turned increasingly to possible solutions.

Pollution problems in the Mediterranean prompted the Organization for Economic Co-operation and Development (OECD) to initiate a three year study of the impacts of tourism in the Mediterranean. In conducting the study, OECD was one of the first to establish a comprehensive list of ways in which tourism stresses the environment, and to relate those stresses to specific changes in the environment. The study (1980) concluded that adverse impacts are more likely where tourism develops rapidly with little planning and inadequate infrastructure. It also found that market forces are not sufficient to ensure a healthy environment, and that governments should be responsible for protecting the environment and controlling tourism growth.

In 1982, a satellite conference sponsored by the University of the South Pacific focused on *The Impact of Tourism Development in the Pacific* (Rajotte 1982). Many of the speakers noted that coastal areas are the most impacted by tourism in the Pacific, and that these need greater protection (e.g., Baines 1982).

Mathieson and Wall's *Tourism: Economic, Physical and Social Impacts* (1982) provided a needed overview of the subject. The authors concluded

concluded that efforts to remedy environmental problems met with only limited success and that market forces failed to ensure adequate attention to environmental and social concerns. They, too, suggested the need for government intervention.

Krippendorf (1982) in his study of tourism in Switzerland suggested a series of government actions designed to create an industry that is concerned about quality, focused on the long-term, regulated and moderate in its aims rather than maximal. He acknowledged that many of the measures he suggested might be unpopular since they opposed the short term interests of some people. But, he contended, government officials must act with courage.

Ahmad and Sammy (1985) noted that developing countries have special difficulties with controlling tourism. They created a simplified version of an environmental impact statement (EIS), encouraging its use by developing countries to assess the environment impacts of a project prior to its inception, thus saving money and the environment.

The concept of "sustainable" development emerged late in the 1980s. This concept, most often defined as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development (WCED) 1987, 8), was quickly assimilated into tourism literature. Stancliffe (1992) claimed it was time to find a sustainable balance in tourism and stop

the irresponsible destruction of fragile places. The International Working Group on Indicators of Sustainable Tourism and the WTO (1993) published a list of indices to assist governments in determining if tourism development is sustainable. Some attention was focused on community-based approaches--implicit in sustainable development--to exert control over tourism and to protect the environment.

The question of whether sustainable tourism development is feasible was explored by other authors, for example Elliott (1991). Helu-Thamann (1993) provided an island perspective, suggesting that sustainable tourism development was just a new approach to maintaining economic growth, and still involved the development of money rather than people. Mass tourism in particular was viewed as unsustainable and a flood of alternatives, such as science tourism and ecotourism, appeared in the literature. Some authors contended that even small scale, locally-controlled tourism did not automatically protect the environment (Butler 1991).

As tourism continued to grow on a worldwide scale, concerns about its impacts on the environment increased. Case studies documented environmental degradation along the Mediterranean, in the Caribbean and in Fiji (Chiotis and Coccossis 1992, Convery and Flanagan 1992). In some places, damage from tourism exceeded ecological limits, and resulted in severe problems (Elliott 1991, Walker 1991, Pearce 1993).

The search for resolutions continued with government intervention,

definition of carrying capacity and early planning as the dominant themes. Ikeda and Collison (1990) provided case studies of recent tourism development in the Pacific, and encouraged governments to initiate comprehensive tourism planning and to limit tourism development to small-scale operations.

The concept of carrying capacity persisted, with very little evidence of its being applied. O'Grady (1990) saw carrying capacity as a tool for governments to set limits on tourist numbers. Papers presented at the 1990 European Regional Science Association meeting emphasized the use of the carrying capacity concept in planning to attain sustainable development. Others argued that carrying capacity is not a panacea: it is conceptually good, but practically difficult to implement.

Most recently, the literature has addressed the issue of why governments have been unable to manage tourism. Butler (1991) discussed the difficulties in controlling the development of tourism, and managing its impacts on the environment. Bojo, Maler and Unemo (1992) examined the obstacles to efficient environmental management through a case study in the Philippines. They claimed that government officials and landowners exploit the environment for personal profit, and that the public is not well informed about environmental problems.

The special nature of tourism in the small island setting also received attention in recent years. Inskip (1987) suggested that there must be

added concern when developing tourism in especially fragile environments, such as islands. In these cases, there must be more planning and attention to carrying capacity. However, he contended that many government planners and tourism officials in developing nations are insufficiently trained and experienced to meet these needs. He then proposed alternatives to mass tourism, such as village tourism and quality tourism.

McKee and Tisdell (1990) focused on small island economies, casting considerable doubt on even the economic advantages of mass tourism. They emphasized that islands are dependent on the natural resource base regardless of the industry, and the environmental life-support system must be maintained. This appears to be the first study that considered the environment as more than a resource for economic development.

Lockhart, Drakakis-Smith and Schembri (1993) described the process by which small island nations embrace tourism, and the environmental, social and economic consequences of that process. They recommended that development planning fully integrate concerns for island ecosystems.

Case studies in the Pacific islands have focused on Tahiti, Fiji and Hawaii. Minerbi (1992) provided a good overview of the adverse social, environmental and economic impacts of tourism in the Pacific islands in his study for Greenpeace. To the author's knowledge, no case study has focused on the environmental impacts of tourism development on Guam.

Recent literature concerning tourism development and the environment

reflects a level of frustration in the field. After twenty years of increasing awareness of the environmental problems caused by tourism, the problems persist and governments seem unwilling or unable to halt the destruction. Farrell and Runyan (1991) commented that despite all the available information, "How dependent tourism has always been on its surroundings is understood much less than it should be." Other authors echo this concern (McKee and Tisdell 1990, Bojo, Maler, and Unemo 1992).

CHAPTER III

METHODOLOGY

The objective of this paper is to examine the impacts of tourism on Guam's environment and to determine what factors prevented better protection of that environment. I approached this objective in three ways. 1) I obtained oral and written data from individuals at relevant Government of Guam agencies, nonprofit organizations, and other institutions on Guam (see Appendix A). 2) I made field observations while living on Guam for two years from 1990 to 1992, and in the summer of 1993. 3) I did a literature search on the topics of tourism development and the environmental impacts of tourism on the environment.

Scope of the Study

The present study confines itself to the impacts of tourism on Guam's natural environment and to efforts by the Government of Guam to control the impacts. By virtue of that fact, I have omitted much available information on the social and economic impacts of tourism, and focused wholly on environmental aspects. The study also confines itself to that part of Guam's land area affected by tourism development. It does not therefore include

consideration of the land held by the US military or the Government of Guam, together comprising 52% of the island's area (Guam 1993a, 131). While this is a substantial land area to exclude, the government lands are either off-limits or otherwise restricted from the impacts of tourism. Finally, I have focused primarily on assessing the effectiveness of planning on Guam to prevent or mitigate the environmental problems caused by tourism. Planning is the solution to environmental degradation suggested foremost in tourism literature.

Interviews

Interviews with the people listed in Appendix A were held during the period of July through September 1993. The primary focus of each interview was the question "What are the environmental impacts of tourism development on Guam?" Each individual was encouraged to discuss this question in relation to his or her area of special expertise. For instance, the wildlife specialist was asked about the impact of tourism on wildlife. Then I allowed the conversation to flow freely, interrupting for clarification of a point or for more detailed information only as I felt it was necessary. In one or two cases, I directed my questions to very specific areas. For instance, in my interview with the manager of Commercial Sanitation, I wanted to elicit information about the quantity and composition of wastes produced by the hotels, as well as his opinion on a proposed incinerator to handle the

increasing quantities of trash produced on the island.

During all the interviews, I took handwritten notes. In some cases, interviewees provided me with printed material to supplement our discussions. In two instances, I obtained written materials used in preparing this report, but was unable to interview the representative of the agency: the Territorial Planning Commission provided a copy of the draft Land Use Plan for Guam, including several technical reports defining environmental degradation; and the Guam Visitors Bureau provided information on visitors and hotels.

Field Observations

This paper is also based on qualitative field observations made while I lived on Guam for two years from August 1990 to August 1992, and for two months from July 1993 through August 1993. During these periods of time, I thoroughly explored the island, visiting tourist areas, historical and anthropological sites. I drove over nearly every (non-military) road, hiked many inland trails and walked along much of the western and eastern coasts of the island. I explored Apra Harbor by boat, and dove on many of Guam's reefs. I spent several days examining the Cocos Lagoon area. During frequent trips on and off the island, I also had the opportunity to observe tourism development along Guam's coast from an aerial perspective.

During both stays on Guam, I walked almost every day along Tumon or

or Agana Bays, observing hotel construction, operation and tourist activity. I witnessed one phase or another of the construction of over a dozen massive tourist complexes. These included the Leo Palace, Guam Nikko, Hyatt Regency, Tumon Holiday Inn, Onward Agana Beach Hotel, Guam Hilton (expansion), Pacific Island Club (expansion), Guam Hotel Okura (expansion), Palace Hotel Guam, Royal Palm Resort, Pia Marine Hotel, Manengon Hills Resort and others.

During the summer of 1993, between interviews, I focused my attention on observing and recording in notes and photographs the visible effects of tourism. I tried to learn as much as possible about Guam's special ecosystems. For instance, I joined University of Guam Professor Chris Lobban and his class on an interpretive walk through a limestone forest. I visited a five-acre wetland mitigation site at the Manengon Hills Resort, and attempted to learn what had been changed topographically and ecologically as a result of the resort's construction. I attended an environmental conference sponsored for high school youth by the Government of Guam.

Literature Research

The literature used for this study falls into two categories: 1) information specific to Guam and 2) general information about tourism development and its impacts on the environment.

For information on vegetation patterns on Guam prior to tourism, I

Fosberg (1960). For the history of Guam, I used Thompson (1969) and Souder (1992). To obtain an historical perspective of environmental problems since tourism development began, I reviewed numerous Government of Guam land use and economic development plans, and the U.S. Fish and Wildlife Service (USFWS) proposal for a national wildlife refuge on Guam. Also helpful were the proceedings from a 1973 Pacific Science Association conference held in Guam and a 1978 Guam Visitors Bureau document titled *A Decade of Tourism: the Socio-Economic Impact of Guam's Visitor Industry 1967-1977*. Statistics and information regarding hotel development, tourism numbers and tourist surveys came from the Guam Visitors Bureau. Statistics on Guam's population came from Underwood (1973) and the U.S. Census.

In order to place the Guam-specific information in perspective, I did general research on the topics of tourism development and its impact on the environment, focusing particularly on island ecosystems (see Chapter II). Most helpful were Mathieson and Wall's book *Tourism: Economic, Physical and Social Impacts* (1982), a publication by the Organization of American States (OAS) titled *Enhancing the Positive Impact of Tourism on the Natural and Built Environment* (1985) and Douglas Pearce's book *Tourist Development* (1991). All of these identified how tourism stresses the environment and the results of that stress. Particularly useful in understanding the special nature of island ecosystems was the South Pacific

Regional Environment Programme's (SPREP) Training Manual titled *How to Assess Environmental Impacts on Tropical and Coastal Areas* (Carpenter and Maragos 1989). In addition to these overviews, I read numerous case studies describing the environmental impacts of mass tourism.

Challenges of the Methodology

In attempting to define the environmental impacts of tourism, two difficulties arose. First, it was difficult to isolate the impacts of tourism development on Guam from those of development in general. Second, it was difficult to quantify the numbers of permanent residents who immigrated to Guam for tourism-related reasons, the tourism-induced resident population.

An illustration of the first problem is the following. It is a fact that many of Guam's reefs suffer from heavy sediment loads that come from stormwater runoff from developed areas on the land. But is the entire problem of excessive sedimentation related to the growth of the tourism industry? For instance, Cetti and Agat Bays experienced heavy siltation during the construction of a new highway from Agana to Umatac. Was the construction of that highway a result of tourism development? Or would the highway have been built if tourism didn't exist on the island?

There is no definitive answer to the question of where tourism-related development ends and other development begins. For the purposes of this study, however, I basically assume that all development on Guam (outside of

the military bases) in the past 28 years is tourism-related. I base this position on information gathered by Warner (1978) who attempted to determine the influence of tourism on Guam's overall economy from 1967 to 1977. Warner indicated that, apart from the military

...the only other factor providing substantial impetus to Guam's civilian economy during the above 10-year period was the visitor industry, which had spreading effects upon the retail, contracting, service, and insurance, real estate, and finance industries. The growth of these...industries, induced by tourism, required employment increases in...GovGuam (Warner 1978, 52).

In other words, tourism was the primary stimulus for economic development during the early years. Today, tourism continues to dominate the economy, inducing growth in nearly every other sector.

As one planner said to me, "Tourism is the motor that keeps Guam going. It accounts for essentially all the development" (Anonymous 1993). It provides the funds and the motivation for highway improvements; it attracts new residents who require new housing developments, schools and service centers; it generates the need for a myriad new wholesale and retail businesses.

While I know this is not completely accurate, I assume in my paper that all development on Guam is tourism-related. Hence, all environmental impacts associated with development are "tourism-related" problems.

The second difficulty I encountered in this study was the need to quantify the tourism-induced resident population on Guam. Some

quantification is critical in order to assess the environmental impact of that aspect of tourism development on issues such as solid waste generation, water use and land transformation.

Again, there is no way to determine exactly the number of people who have immigrated to Guam over the years as a result of tourism. However, I arrived at an estimate based on a series of assumptions that are described fully in Appendix B. Basic to that estimate is the assumption that 100% of the immigration to Guam from 1967 to the present, over and above the percentage that lived on Guam prior to tourism, is due to tourism. That is, without tourism and the economic and recreational opportunities it offered, people would not have immigrated in increased numbers. They would not have come if Guam had retained its subsistence economy coupled with some military bases. Immigrants did not flock to Wake or to Midway, or to other Micronesian Islands that did not have booming economies.

The above assumption may be questionable. However, it seems a logical way of trying to quantify a population that defies quantification. I am open to suggestions as to other ways of approaching this issue.

CHAPTER IV

THE NATURE OF TOURISM ON GUAM

Introduction

The environmental impacts of tourism are determined largely by the nature of tourism development at any given destination. In other words, impacts are determined by the type of tourism, the way it developed and the characteristics of the developers (Pearce 1991, 57). This chapter examines the nature of tourism development on Guam.

Setting the Stage for Tourism Development

Thoughts of developing tourism on Guam first surfaced in the summer of 1962 when President John F. Kennedy lifted the military security clearance which had restricted travel to the island since World War II (Warner 1978, 1). For the first time in 21 years, civilians could freely visit and enjoy the island. Guam's leaders were eager to capitalize on this turn of events and to help the island develop.

Aware of the economic success of tourism in Hawaii, Guam's leaders viewed tourism as one of several potential development strategies which could reduce Guam's reliance on federal dollars and increase the standard of

standard of living (Guam Bureau of Outdoor Recreation 1965, 73). At the time, virtually the entire economic base was found in civilian employment with the Government of Guam, the military and in associated construction activities (Guam Bureau of Outdoor Recreation 1965, 26). No other industry contributed significantly to the economic base.

The Kennedy administration, already actively promoting economic growth in the lesser developed areas of the world with such programs as the Alliance for Progress, encouraged and supported the development efforts of Guam's leaders (Sachs 1992, 63). There was a pervading belief that economic growth was the key to development, and that all nations could develop simply by following the economic growth models provided by the Western nations (Rostow 1960).

In the fall of 1962, however, Typhoon Karen struck Guam, devastating the island and temporarily ending thoughts of tourism. The typhoon caused an estimated \$40 million in damage and required an extensive reconstruction effort (Guam Bureau of Outdoor Recreation 1965, 25). Over the next few years, roads, utility lines, sewers, schools and public buildings were rebuilt, or developed for the first time in some cases, with extensive grant and loan support from the U.S. Congress (Guam Bureau of Outdoor Recreation 1965, 25). While the destruction of Typhoon Karen made it impossible for the Government of Guam to actively encourage tourism for several years, the reconstruction activities served to improve the infrastructure of the entire

island. These improvements--particularly to roads and utilities--were an essential ingredient in Guam's ability to develop tourism.

By 1965 the attention of Guam's elected leaders returned to economic growth and the development of a tourism industry. The government commissioned an Outdoor Recreation Plan to assess the recreation possibilities on the island and to identify areas in need of development or preservation (Guam Bureau of Outdoor Recreation 1965, 5). The Outdoor Recreation Plan pointed to tourism as an industry with significant potential:

The natural resources, climate, scenic beauty, sea and reef areas, and its proximity to the Far East are the basic ingredients needed to attract a substantial tourist trade. Until recently Guam was not open to tourist traffic, and it is expected to increase substantially as it becomes known as a tropical paradise (Guam Bureau of Outdoor Recreation 1965, 29).

Further, the Plan recommended that the Government of Guam actively encourage hotel chains to invest on the island (Guam Bureau of Outdoor Recreation 1965, 74). In 1965, Guam's visitor facilities were limited to 4 motels with 100 rooms, largely oriented to military personnel travelling to and from the island. None were on the beach and none offered the first class accommodations desired by those sufficiently affluent to afford the airfare to Guam (Guam Bureau of Outdoor Recreation 1965, 40).

The Plan also suggested that the government buy up land for preservation and development (see Figure 2). It recommended acquiring 1) Cocos Island in the south, the large reef area between the island and the mainland, and selected parts of the mainland for a territorial park; 2) Pago



Figure 2. Sites suggested for acquisition by the 1965 Outdoor Recreation Plan for Guam.

and Cetti Bays as natural walk-in parks; 3) Talofofo Falls as a jungle-setting visitor attraction; 4) the shorefront along Marine Drive as a park and 5) the Tumon Bay area as a beach park for the people of Agana and as the focus of tourist development. According to the Plan, Tumon Bay had "all of the attributes to becoming Guam's Waikiki Beach" (Guam Bureau of Outdoor Recreation 1965, 73).

Little action was taken by the Government of Guam to acquire and develop these particular sites for public use. During the next few years, however, the government did actively attempt to attract private hotel developers to the Tumon Bay area. Domestic and foreign developers were encouraged to locate there through zoning regulations of the 1966 Master Plan (Guam's first) and a variety of tax incentives were made available. For example, the government offered hotel developers "Qualifying Certificates" (QCs) which gave them a 75% rebate on corporate income tax up to 20 years, a 100% abatement of real property income tax up to 10 years, and a 75% rebate on corporate dividend tax up to 5 years (Guam Department of Commerce 1988, 89).

An international airport, a small boat basin and commercial port facilities were constructed. Guam also obtained free port status, enabling vendors to sell imported items without import taxes. These developments, added to the infrastructure improvements necessitated by Typhoon Karen, laid most of the foundation for the tourism industry.

The one missing element was a source of visitors. Guam had little hope of interesting visitors from the continental United States. While the island offered attractions similar to Hawaii's, it was 7 hours farther than Hawaii by air--too far for most people for a week's vacation. The Outdoor Recreation Plan pointed to the Far East as the most likely market (Guam Bureau of Outdoor Recreation 1965, 25). However at the time, much of Southeast Asia was embroiled in the Vietnam War. The remainder of that area--Korea, Hong Kong, Singapore, Taiwan and Thailand--was itself struggling to develop.

Japan alone had recovered sufficiently from World War II (WWII), and had a population affluent enough to travel overseas. Moreover, it was the closest Far Eastern nation to Guam. But one serious obstacle existed with the Japanese market. Following WWII, the Japanese government had restricted foreign travel by its citizens. Fortuitously, travel restrictions were lifted in 1966. This released a tremendous pent-up desire on the part of the Japanese people to explore new areas. Japanese and American airlines moved quickly to establish a Tokyo-Guam route. With both the destination and the travellers ready, the tourism industry was poised for take off.

Given this backdrop--a U.S. administration sympathetic to economic development, a territorial government determined to use the tourism industry as a strategy for economic growth by providing infrastructure, financial incentives and product marketing, and a nearby market that had been

deprived of travel for 22 years--it is not surprising that tourism on Guam did not evolve gradually. It exploded (see Figure 3).

The Early Years of Tourism (1967-1974)

The first seven years of tourism on Guam are characterized by extraordinarily rapid growth in visitor numbers, large-scale hotel development, related residential population growth and a planning effort that could not keep up with the growth.

The official beginning of tourism on Guam is marked by the arrival of the first Pan American Airways flight from Tokyo in 1967. During that year, 6,600 visitors arrived to enjoy the beaches, ocean and warm climate of Guam (Warner 1978, 1). Just seven years later in 1974, visitor arrivals had skyrocketed to 260,500 (see Figure 3). This represents an astounding average annual percentage increase of 83%!

Gross receipts on the island, which were highly correlated to visitor arrivals, grew from \$148 million to \$602 million over the same seven years (Warner 1978, 8). This reflects the fact that growth in the tourism industry led directly and indirectly to growth in the retail, service, construction, insurance, real estate and finance industries. The expanding tourism industry also prompted growth in employment within the Government of Guam due to its demands for expanded airport, public safety, public health, parks and recreation services (Warner 1978, 52). In fact, apart from U.S.

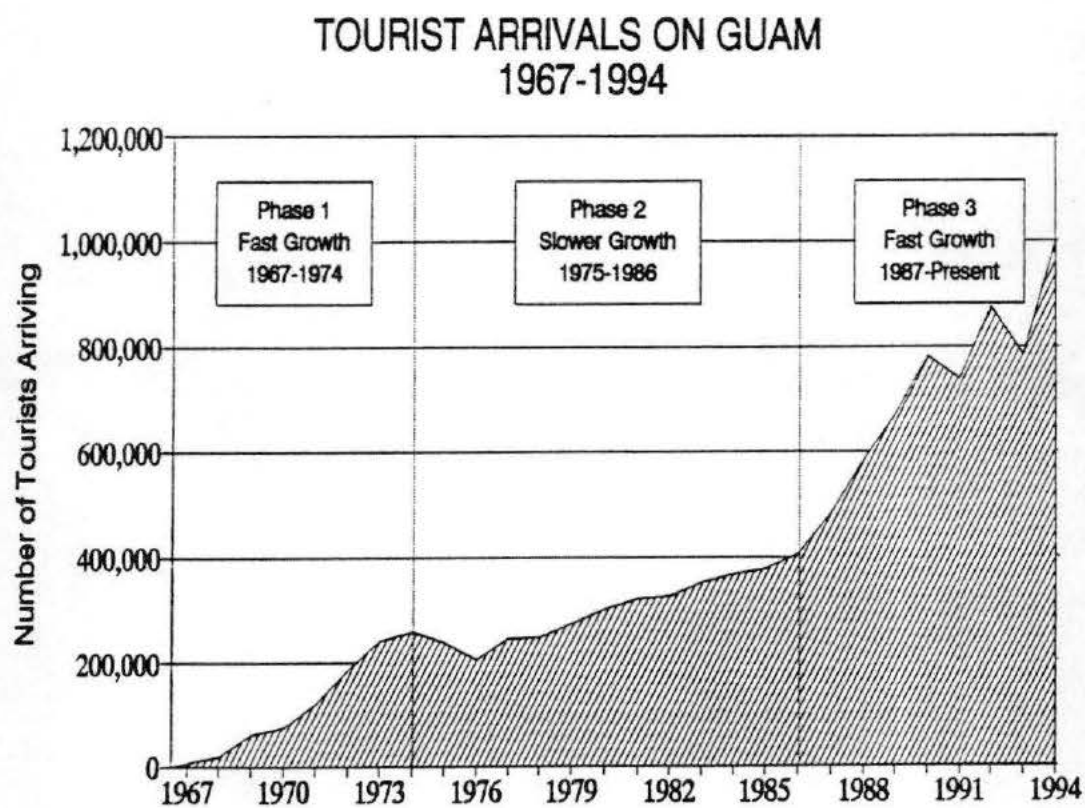


Figure 3. Tourist arrivals on Guam, 1967-1994. (Data from Guam Visitors Bureau.)

funding to the island, tourism quickly became the primary impetus to economic growth in Guam.

Hotel development concentrated in the Tumon Bay area during these years. The first Tumon Bay hotel, the Fujita, opened its doors in December 1968 (Sablan 1994). By 1974 there were eight high-rise, luxury hotels on the Bay. All were financed and controlled by off-island interests. As a result, an estimated 70% of the profits left off the island (Warner 1978, 48).

The labor pool on Guam was insufficient to meet the construction and operation needs of the tourism industry during these years, and workers were brought to the island from the Philippines and other areas (Guam Bureau of Outdoor Recreation 1965, 33). The 1970 census revealed a 16% alien population on Guam, most of whom were imported laborers (U.S. Census 1970, 54-21).

By 1972, the excessively high growth rate of tourism and the population in general had overwhelmed the 1966 Master Plan. There were "pressures for development and immigration...in excess of the plan's scope, creating immediate and significant changes in basic assumptions" (U.S. Department of Commerce 1979, 46). A second master plan was written in 1972 based on new predictions for growth. But it was never completed nor fully implemented (U.S. Department of Commerce 1979, 33). As a result, the government exercised little effective control over tourism development in the mid-1970s. Tourism developed largely in response to market forces.

A Slower Rate of Growth (1975-1986)

The characteristics of tourism established on Guam during the first year's of the industry's existence, continued to manifest themselves well into the 1980's, with the exception that the growth rate of the industry slowed.

Visitor arrivals declined briefly in 1975 and 1976, but picked up in 1977, and increased moderately for the next 10 years (see Figure 3). A study commissioned by the Guam Visitors Bureau indicated the brief downturn was due to the worldwide recession in 1975 and to the damage to hotels caused by Typhoon Pamela in 1976 (Warner 1978, 2). When visitor arrivals picked up again in 1977, they grew steadily from about 246,000 to 407,000 over the next ten years at an average annual rate of 6% (Warner 1978, 3). While this rate of growth was slower than what had been experienced in the first seven years of tourism development, it still represented significant growth in the industry.

Tourism development continued to focus in the Tumon Bay area. While growth in tourist numbers was moderate during this period, hotel construction boomed. By the end of 1986, there were 15 hotels in Tumon claiming 79% (or 3,029) of the hotel rooms on the island (Guam Department of Commerce 1992, 85). In addition, a new construction trend appeared in 1985 with the demand for large condominiums to house the growing resident population. The favorable tax climate still provided an incentive for construction activity.

By 1979 the government renewed its efforts to direct growth on Guam. A new comprehensive development plan and a land use plan were created. In addition, a 1985 Tumon Bay Master Plan attempted to set more detailed guidelines for Tumon area developers to assure the desired density, "human-scale," "informal, low-key development" (Guam 1985, 1, 5).

But these attempts also failed. By this time, land prices in the Tumon Bay area were so high that only tightly packed, high-rise hotels were economically feasible (Guam Department of Commerce 1988, 182). So the government conceded to requests for higher density development. According to the Guam Department of Commerce, in Tumon Bay

density limits set by the Interim Hotel Zone Rules and Regulations and also by the Tumon Bay Master Plan were considered unreasonable in light of the rapid appreciation of land values in Tumon and developers were given variances to exceed these density limits (Guam Department of Commerce 1988, 182).

From 1975 to 1986, Guam continued to experience rapid growth in its population. The need for labor led to the importation of Filipinos, Chinese, Koreans and Japanese as construction workers (Guam Department of Commerce 1988, 56). By 1977, 19% of all laborers and 10% of tourism industry workers were non-immigrant aliens (Warner 1978, 28-29). These workers were allowed to enter the country temporarily (for the duration of a project) for work purposes only.

The tourism industry also induced growth in the resident population of Guam. Many professionals immigrated to the island to operate hotels,

provide services to the growing population and open businesses; less skilled people came to be service workers in the booming economy (U.S. Department of Commerce 1979, 32). Still others immigrated to Guam for retirement, attracted by the amenities offered by the tourism industry, such as golf, gourmet restaurants and fine entertainment.

Immigrants made up an increasingly large portion of the resident population. For example, while foreign-born people represented 16% of the resident population in 1970, it was 29% in 1980 (U.S. Census 1980, 54-2). As a result of the influx of foreigners who came to Guam to live, the indigenous people--the Chamorros--became a minority on their own island by 1980 (U.S. Census 1980, 54-2).

Tourism Outgrows Tumon Bay (1987-1994)

The most recent phase of tourism development on Guam began with the compilation of the 1989-1993 Overall Economic Development Plan. It acknowledged that tourism and the resident population of the island had expanded too rapidly, and recommended among other ideas that growth limitations be instituted (Guam Department of Commerce 1988, 182). But once again, planning was inconsistent and largely unimplemented. The next few years brought substantial growth in both tourism and immigration.

A series of factors precipitated the acceleration in the rate of growth of tourism in 1987. Japan's Ministry of Transport announced its "Ten Million"

project aimed at increasing the number of Japanese travellers abroad each year from 5.5 million in 1987 to 10 million by 1991 (Guam Department of Commerce 1988, 191). This was an effort on the part of the Japanese Government to reduce its trade surplus (Novak 1990: 3). For Guam, this meant an increase in flights between Japan and Guam. In 1987, there were 54 flights weekly; by 1991 that number had nearly doubled at 105 weekly. In addition to the "Ten Million" project, there was an 18% increase in the value of the yen relative to the U.S. dollar in 1987 (Guam Department of Commerce 1988, 175). These two factors encouraged the Japanese to travel overseas.

On Guam, the Guam Visitors Bureau responded with an aggressive \$1 million marketing campaign to assure that many of the new travellers would select Guam as their destination (Guam Department of Commerce 1988, 178). Guam already captured 6% of all Japanese overseas travellers, and hoped to maintain that percentage of the higher numbers of Japanese who would now be traveling (Guam Department of Commerce 1988, 175). The many new, luxurious hotel rooms and condominiums, and an array of new tourist attractions, such as golf courses and the Atlantis submarine underwater tour, provided the lure (Guam Department of Commerce 1988, 180). But as in the past, beaches, ocean and the tropical climate remained the primary attractions (Guam Visitors Bureau 1992b).

Adding its support to expand the industry, the Government of Guam initiated a pilot project in 1988 allowing Japanese to come to the island for 90

days without a visa. Within the year, this program was officially adopted and expanded to include a wide range of Pacific Rim nations such as Singapore, New Zealand, Hong Kong, Australia and Indonesia (Guam Department of Commerce 1992, 85).

Together these factors contributed to a second period of highly accelerated growth in Guam's tourism industry. The number of visitor arrivals increased from about 484,000 in 1987 to 877,000 in 1992, nearly doubling in five years (see Figure 3) (Guam Visitors Bureau 1992b). With the exception of 1991 when there was a sharp drop in the Tokyo stock market, the annual rate of growth during those years ranged from a high of 21% to a low of 13%, extremely high considering the already high number of visitors.

In 1993 an earthquake on Guam, measuring 8.2 on the Richter scale, closed many hotels and brought another temporary decline in tourist numbers (see Figure 3). In response to this downturn, the Government of Guam added Taiwan to its visa waiver program in 1994 (Eastly 1994a, 39). The Guam Visitors Bureau followed with an aggressive \$400,000 marketing campaign designed to attract Taiwanese to the island (Eastly 1994a, 39). Even the U.S. Commerce Department contributed funds to the effort to attract more visitors (Eastly 1994a, 39). By 1994 tourism had fully revived and visitor arrivals for the year eventually topped the one million mark (Weare 1995).

More growth is forecast for Guam's tourism industry in the future.

Visitor arrivals on Guam are expected to increase due to affordable air service and increased interest in international travel (Ikeda and Collison 1990, ii). Guam's planner estimates that visitor numbers may reach 3 million by 2015 (data from Guam Territorial Planning Commission 1993c, Table 14). That means that the peak number of visitors to the island per day will grow from 9,439 (1992) to 32,435 by 2015 (Guam Territorial Planning Commission 1993c, Table 14).

Growth in available accommodations paralleled growth in visitor numbers since 1987. Construction--still dominated by foreign investors--boomed during this most recent phase of tourism development and promises to continue to do so. In 1991 alone, the value of construction permits was \$852 million, nearly five times what it was four years earlier. In 1992, an analysis of hotel projects revealed the following information (Guam Visitors Bureau 1992a, 3):

<u>Status</u>	<u>Hotels</u>	<u>Rooms</u>
Existing	25	5,584
Under Construction	7	1,929
Plans Submitted for Approval	<u>30</u>	<u>10,573</u>
Totals	62	18,086

These figures indicate that the number of hotels in Guam will more than double and the number of rooms available will more than triple in the next two decades, if all proposed projects are approved. The likelihood of this

happening is high.

In addition to large-scale hotel development, this phase of tourism is characterized by a tremendous increase in the number of condominium developments planned for the island. Only one condominium project had been built on the island prior to 1992. But by that year, 41 additional projects, providing nearly 9,000 living units, had been approved for construction. Another 20 projects, with 2,800 living units were pending approval (Guam Territorial Planning Commission 1993, Table IV-31). This increase in housing units is targeted primarily at the tourism-induced, migrant population.

In a significant departure from earlier tourism development, most of the development proposed for the future is planned for undeveloped areas of the island. For instance, if all the proposed hotel projects are completed, more than half of all Guam's hotels will be located outside the Tumon area. In addition, many of the new projects are large-scale resorts with golf courses and condominiums that require substantial land area. One example is the Manengon Hills Resort which opened in 1993 near Yona. This resort includes 200 hotel units, 3000 residential units, 2150 condominium units and 2-1/2 golf courses (Guam Visitors Bureau 1992a, 11-12). The resort occupies 1,286 acres, very nearly 1% of Guam's entire land area.

An analysis of golf courses on Guam reveals the following (Guam Visitors Bureau, 1992a, 10-12):

Status	# Courses	Holes	Acres
Existing Courses	7	135	2,892
Under Construction	9	198	2,313
Plans Submitted for Approval	<u>7</u>	<u>117</u>	<u>2,414</u>
Totals	23	414	7,619

When courses currently under construction are completed, 4% of Guam's 133,760 acres will be dedicated to golf courses. If plans for the additional 7 are approved, golf courses will cover nearly 6% of Guam's total land area.

In order to put tourism in perspective on Guam, it is important to consider that Guam is a very small island--only 4-8 miles wide and 30 miles long. A tall building on one side of the island is clearly visible from the other side. Guam's total land area is about one third the size of the city of Honolulu or about the same size as Santa Catalina island off the west coast of the United States.

More importantly, not all Guam's land area is available for development. One third of it is off-limits in the hands of the U.S. military, and an additional portion is held by the Government of Guam (see Figure 4). That leaves only 48%--or 100 square miles--for private ownership and development, and all of that is not developable due to slope (Guam Territorial Planning Commission 1993c, 49). Golf courses, hotel properties, the airport, the dog race track and other visitor facilities take a very large portion of the land available to the people of Guam.

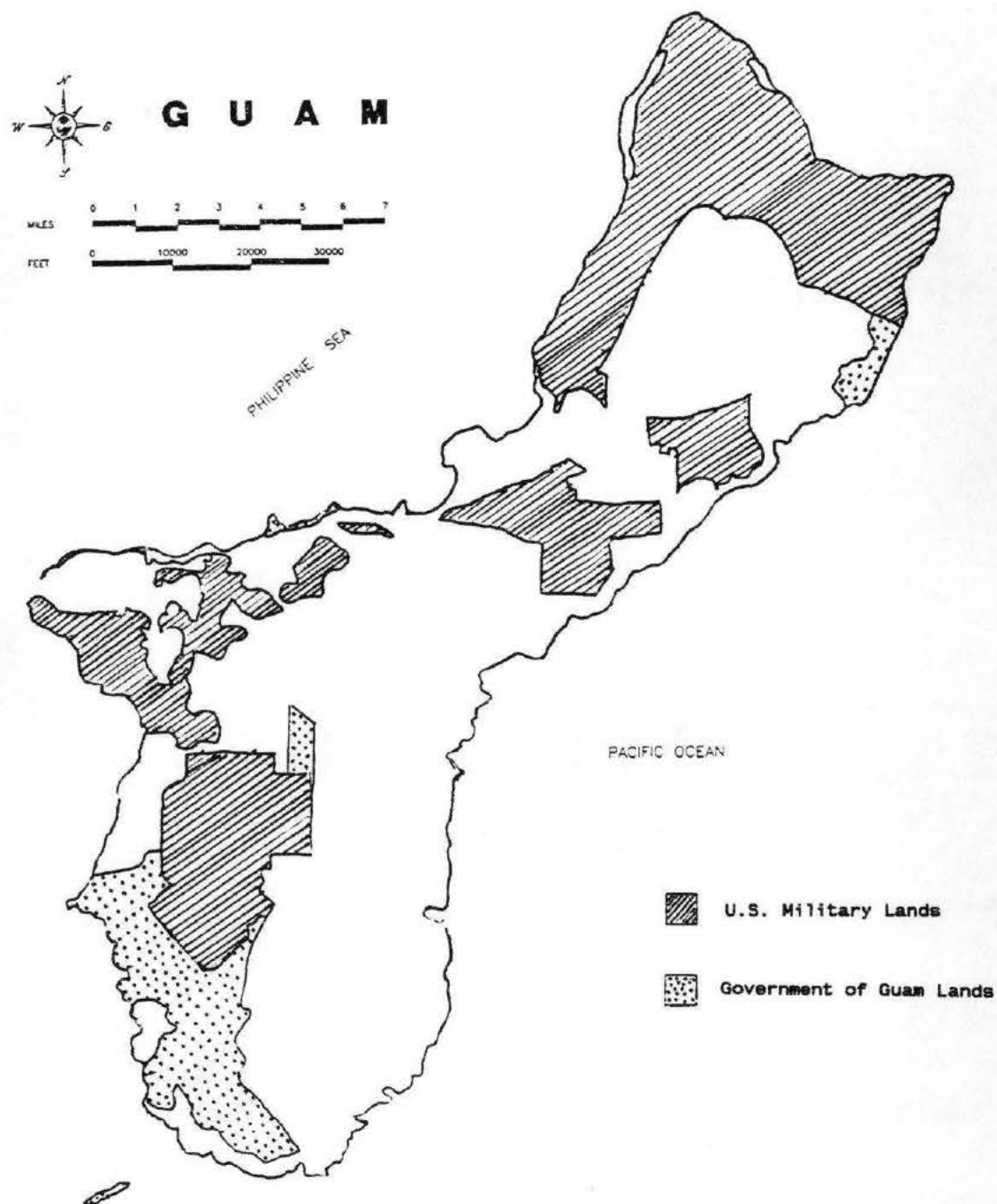


Figure 4. Land on Guam held by the U.S. military and the Guam Territorial Government in 1993. (Data from Guam Territorial Planning Commission 1993a.)

Summary

Several characteristics are apparent from this overview of the development of tourism on Guam.

1. Tourism was a deliberate economic development strategy promoted by the Government of Guam.
2. Tourism on Guam depends heavily on the island's natural resources as its "raw material," primarily the ocean, beaches and tropical climate.
3. From its inception in 1967 to the present, tourism on Guam has been characterized by a rapid pace of growth (in visitor numbers and visitor facilities). Even in the years of "slower" growth from 1975 to 1986, growth in visitor numbers averaged a substantial 6%.
4. Guam's tourism can be characterized as "mass" tourism, that is, tourism based on large-scale, "world-class" visitor facilities, gourmet dining, Las Vegas-style entertainment and high-class recreational opportunities.
5. The industry is foreign-dominated. From the beginning, off-islanders have held controlling interest in all the major hotels of Guam.
6. Tourism has consistently induced growth in the island's resident population to the point that today, foreign-born people (non-US citizens) account for 31% of the population in 1990 (U.S. Census 1990, 15).

7. Tourism growth on Guam is largely uncontrolled. Despite repeated efforts by the Government of Guam to plan tourism growth on the island, it was unable to effectively do so.

These characteristics determined to a large degree the nature and extent of the environmental damage that would occur from tourism over the years.

CHAPTER V

GUAM'S ENVIRONMENT PRIOR TO TOURISM

Introduction

In order to assess the extent of the damage caused by the growth of tourism on Guam, we must know what Guam's environment was like prior to tourism. Was it pristine? Were the native species still prevalent? Or had it been altered? We must have a starting point. This chapter attempts to establish just such a starting place.

Guam's environment was not pristine when tourism was introduced in 1967. It had been modified in a variety of ways by the native Chamorros, the Spaniards, the Americans and also by activities related to World War II.

The Impact of the Chamorros

The first inhabitants of Guam arrived by boat on the island about 1500 B.C. from Southeast Asia. The Chamorros, as they were called, brought with them bananas, breadfruit, taro and rice (Souder 1992, 29), thus introducing new species to the island. It is likely that they also unintentionally brought many other species, including insects, bacteria and fungi. Chamorros used the native plants, birds, bats and fish for food. They constructed shelters

from other plants and trees.

Over the years, the ancient Chamorros acquired an intimate closeness with their environment. They came to believe that all life sprung from the island's rocks and soil, and that the spirits of their dead resided in the trees (Souder 1992, 27-28). They gained considerable knowledge of the properties of plants and trees, and of the habits of the island's wildlife.

Perhaps because of this closeness and understanding of their land, the ancient Chamorros had only a modest impact on the environment, despite a population that reached 30,000 by 1668 (Underwood 1973, 14). From our perspective today, it could be said that the Chamorros had developed a "sustainable" lifestyle, one that functioned well for some 3,000 years within the natural constraints of the tiny island.

The Spanish Impact on Guam's Environment

The Spanish occupied Guam from 1668 to 1898. Through warfare and disease, they nearly annihilated the Chamorros, reducing their numbers from an estimated 30,000 in 1668 to 1,600 by the end of the 17th century (Underwood 1973, 22). According to the US Census, the island's Chamorro population did not return to its 1668 level until the 1940s. However, the Chamorros survived, carrying with them a cultural sensitivity for the land and their environment.

The Spanish intentionally introduced a number of plants and animals

to the island, including corn, papaya, peppers, the horse, carabao (water buffalo), dogs, pigs, poultry, cattle and a Philippine deer (Thompson 1969, 25; Fosberg 1960, 54). The introduction of the animals especially impacted the environment. To this day, deer feed on threatened native species and wild pigs scar Guam's landscape (USFWS 1993:18). The Spanish also introduced a metal-bladed hoe and monoculture in an unsuccessful attempt to stimulate trade in tobacco, sweet potatoes and coffee. The attempt to grow cash crops resulted in some clearing of natural vegetation.

F. Raymond Fosberg summarizes the Spanish influence on the land as follows:

Since Magellan's time, although the population has been smaller, the people have been much better equipped to destroy the forests. Also, since that time they have been ably assisted by the cattle, goats, deer and other four-footed animals brought by the European conquerors (Fosberg 1960, 54).

Despite these modifications to the land, the impact of the Spanish on Guam's environment was still modest.

The United States' Impact on Guam's Environment

In 1898 Spain ceded Guam to the United States. For the next 52 years, with the exception of the Japanese occupation during World War II, the U.S. Navy governed the island. Almost immediately, the military administrators developed a strategy aimed at fostering a cash economy on Guam. For instance, they imposed a land tax that required people to record

title to their land and to generate money by planting cash crops (Thompson 1969, 115). These actions had direct effects upon Guam's environment.

One effect was the conversion of large tracts of land into coconut plantations (Thompson 1969, 130-136). The environmental results of the move to cash crops is visible in figure 5. It illustrates clearly the amount of natural vegetation lost to production of coconuts. Interestingly, by the 1960's, the world price of coconut had fallen so drastically that many of the plantations were idle (Fosberg 1960, 68). It is some of this plantation land along Tumon Bay that was later developed for tourism.

Another effect of the introduction of a cash economy was that for the first time, land was viewed as a commodity, something to be bought and sold. Traditionally, Chamorro families held land communally. That is, individuals did not own the land. Instead, over generations families used certain sections of land as a source of food and housing materials. A family's land was thought to be the source of all life and a place for the spirits of dead family members to reside. As a result, Chamorros viewed themselves as part of the land: their survival was intimately linked to a healthy, functioning environment.

Under the American system, it was money, not land, that was the key to survival and well-being. Environmentally, this cultural change meant that nurturing and maintaining the family land for present and future generations was no longer important. What was important was maximizing the profit that

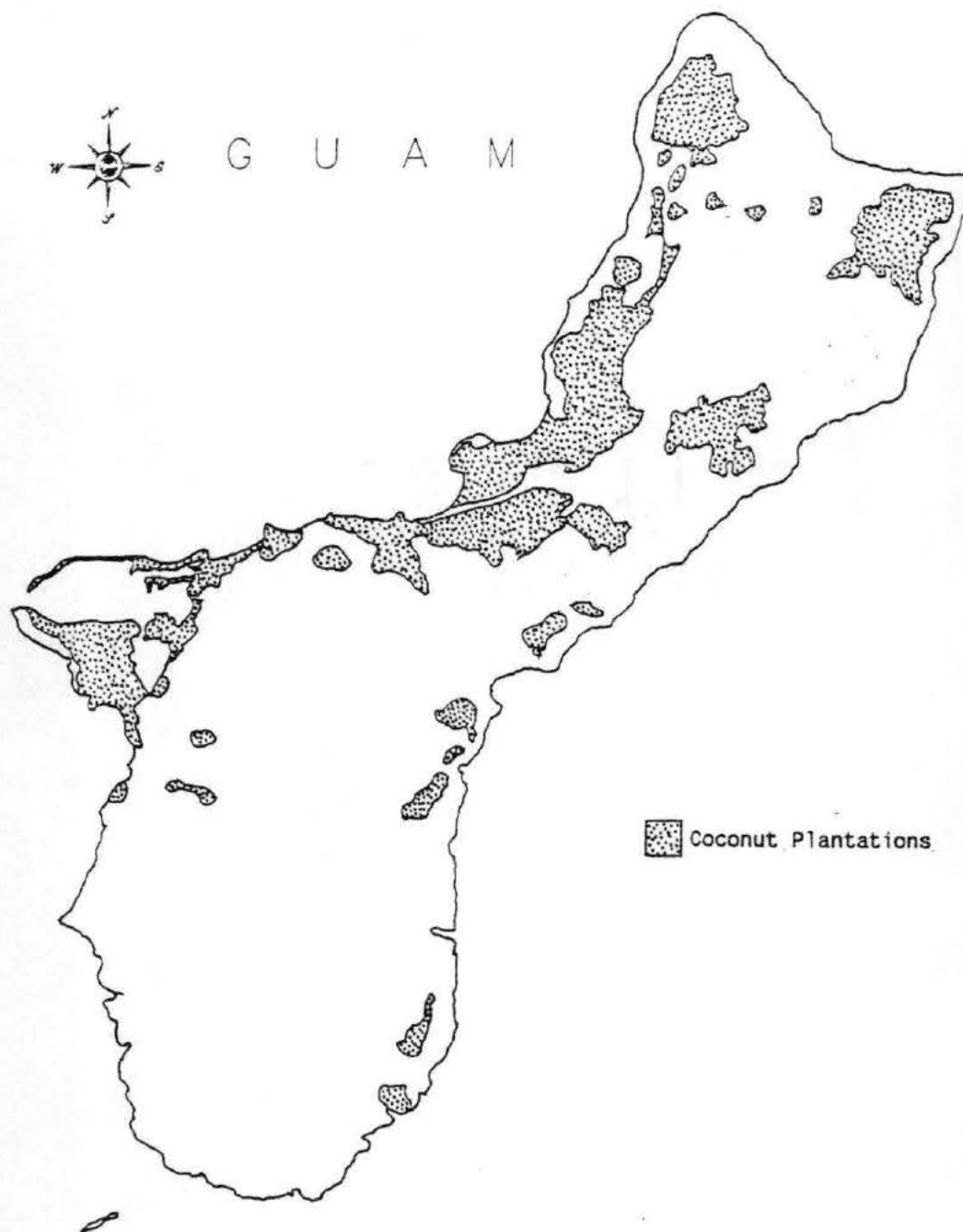


Figure 5. Distribution of coconut plantations on Guam, 1960. (Data from Stone 1970-71, p 20.)

could be made from the land, even if that meant clearing it for a cash crop or selling it. By eroding the Chamorros' traditional ties with the land, the cash economy contributed to the environmental degradation of Guam.

World War II and After

There were other significant impacts to the environment prior to the advent of tourism. The liberation of Guam by the United States at the end of World War II involved intensive bombing of the island. The bombing destroyed much vegetation and wildlife (Fosberg 1960, 54). After the war, in order to prevent soil erosion, the Americans reseeded the disturbed areas with the tangantangan tree from Central America (Lofdahl 1993, 2). Tangantangan is now said to be the most common tree on the island, and is considered by many to be a pest (Lofdahl 1993, 2).

For years after the war, the military dusted, sprayed and fogged the island with DDT on a weekly basis to guard against disease (Hendricks 1986, 21). The southern end of the island received the heaviest concentrations, and use of the pesticide continued for agricultural purposes until the late 1960's (Hendricks 1986, 21-22). The application of DDT and other pesticides undoubtedly contributed to a decline in bird, fish and insect populations on Guam.

It was the accidental introduction of the brown tree snake to Guam after World War II, however, that had the most devastating effect on Guam's

wildlife. Starting in the south and eventually moving over the entire island, the snake has virtually wiped out the island's bird population by feeding at night on eggs and chicks. Initially, pesticides and habitat loss were thought to be responsible for the declining bird and bat populations. But in the early 1980's the snake was identified as the primary culprit (Hendricks 1986, 23).

Summary

Clearly, Guam's environment was altered and in some ways impaired prior to the introduction of tourism. Many species of plants and animals had been introduced. Some of them, such as the brown tree snake, would eventually prove devastating to wildlife. Much natural vegetation had been replaced by crops or destroyed by warfare. Finally, the traditional cultural supports for maintaining a healthy environment were eroded by introduction of the cash economy and disruption of customary land holding patterns. Despite these changes and impairments, Guam's ecosystem remained largely intact. Large expanses of limestone forests remained in the north; the fresh water aquifer was unharmed; the wetlands were undeveloped; the coral reefs teemed with marine life; the beaches were alive with hermit crabs and still provided a nesting place for green and hawksbill turtles. This was to change with the advent of mass tourism.

CHAPTER VI

EARLY INDICATIONS OF ENVIRONMENTAL STRESS FROM TOURISM AND GOVERNMENT RESPONSES

The First Seven Years of Tourism (1967-1974)

In the late 1960's no concern was given to the environmental implications of the decision to use tourism as a development strategy on Guam. The environmental movement as we know it today was just taking shape in the continental United States (Miller 1994, 38). In the continental United States, biologist Rachel Carson was introducing the public to the idea that chemicals were having an impact on songbirds with her book *Silent Spring*. But the other environmental problems which would eventually galvanize public opinion in the United States--the oil-polluted river which caught fire in Ohio, the Santa Barbara oil spill, the first Earth Day--had not yet occurred. Thus when Guam produced its first master plan in 1966 and launched its visitor industry the following year, safe-guarding the environment was not a consideration.

The extremely rapid expansion of Guam's tourism industry from 1967 to 1974, however, created environmental problems almost immediately. Large tracts of land in the Tumon area were converted to tourism uses; raw

sewage flowed into nearshore waters until the first sewage treatment plant opened in 1972; and the consumption of fresh water resources soared.

It is interesting that highly placed representatives of the tourism industry and the government were the first to bring these problems to public attention. Speaking at a 1973 meeting of the Pacific Science Association in Guam, Norbert R. Unpingco, the Managing Director of the Guam Visitors Bureau made the following remarks about the island's environment:

The natural beauty of the island is forgotten and lost as a source of inspiration and tranquility. Coupled with the decreasing consciousness and concern for Guam's natural assets is the increasing pollution of our environment. Improper and short-sighted sewage and solid waste disposal; the systematic destruction of virgin lands;...traffic congestion; and the intolerable noise from automobiles, aircraft and construction; wasteful consumption of valuable water and mineral resources; these are only a few examples (Unpingco 1975, 110-111).

Unpingco went on to say that he did not want to see Guam repeat the "deplorable mistakes of Puerto Rico and Hawaii" (Unpingco 1975, 111). He called for legislative controls of the tourist industry, enforcement of existing controls, as well as public education about and participation in industry decision making (Unpingco 1975, 111). Unpingco closed his speech by asking the question "Do we love the beauty of this world enough to preserve what is left of it at the sacrifice of a few dollars?" (Unpingco 1975, 114).

Also speaking at the conference was Gerald S. A. Perez, Director of the Guam Department of Land Management. Perez pointed to the "urgent conservation problems" facing Guam as a result of rapid tourism

development and population growth (Perez 1975, 90). Growth of population and tourism, he opined, was like a "spring flood which leaves behind depletion of marine resources, soil erosion, disappearance of plant and animal life, pollution and socio-economic dislocation" (Perez 1975, 90).

Perez commented that tourism development on Guam was taking place at a "high cost to the island's fragile environment" (Perez 1975, 89). With an understanding of ecological interrelationships uncommon for the times, he remarked:

No one resource can be manipulated without knowingly or unknowingly affecting others. The management and use of each land parcel will have sequential effects upon everything with which it is associated and not just upon an area established by political boundaries. Increased development in Mongmong and Toto, for instance, is bound to create excessive run-off problems in Agana. The excessive erosion created by poorly constructed roads in the hills of Inarajan is bound to affect the quality of fishing and swimming along Inarajan Bay and the streams that feed into it (Perez 1975, 93).

In words that presaged the modern debate over preserving natural resources versus development in the continental United States, Perez noted that,

It is just as wrong to starve people in the pursuit of an environmental policy as it is to annihilate a bird such as the endemic Guam rail in the pursuit of economic development (Perez 1975, 93).

Perez closed his speech advocating that environmental planning be integrated with the land use planning process.

It is of extreme importance, therefore, that any comprehensive land-use plan for Guam be required to identify the minimum and maximum ranges of environmental tolerance, within which other human requirements must be reconciled....(We must view) man

as a member of the natural community (Perez 1975, 95).

In other words, Perez believed that environmental limits established the boundaries within which human activities must be contained.

Other Chamorro speakers at the conference noted the overcrowded air terminal and commercial port facilities which were just one year old. They talked of the traffic congestion, the rapid and heavy concentration of tourist facilities at Tumon Bay and the excessive strain on the new sewer system (Sanchez, G. C. 1975, 98).

As early as 1973 then, there were clear signs that tourism had already negatively impacted Guam's environment. Problems ranged from loss of natural areas and inadequate sewage systems to erosion and siltation of nearshore waters. Certain levels of environmental impacts are expected from any kind of development activity. But the impacts from tourism on Guam were significant enough after just five years for top business and government officials to express concerns in public.

The Middle Years of Tourism Development (1975-1986)

Unfortunately, their concerns went unheeded. A decline in tourism numbers in 1975 and 1976, caused by the worldwide recession and Typhoon Pamela respectively, refocused the attention of business and government leaders on economic growth and environmental concerns took a back seat. The Guam Visitors Bureau commissioned a study to determine how to attract

more tourists to Guam, and initiated a program to follow the study's recommendations.

Following the typhoon, the Guam Legislature passed reconstruction legislation that was especially harmful to coastal areas. It replaced earlier legislation requiring a special permit to build within 330 feet of the shoreline with a similar restriction at only 30 feet (U.S. Department of Commerce 1979, 46). This resulted in a flurry of building very near the shoreline. Given the overriding attention to strengthening tourism on Guam, concerns about the environmental impacts of the industry faded away.

The first comprehensive inventory of Guam's natural resources was conducted in the late 1970's as a data base for planning purposes. It revealed some disturbing facts. Inappropriate development had occurred on beaches, on steep slopes, in flood hazard zones, in wetlands and in or near groundwater sinks (U.S. Department of Commerce 1979, 62). The Agana Bay Shopping Center, built in wetlands, and the proposed Urunao Point hotel complex threatened fragile and unique plant and animal life (U.S. Department of Commerce 1979, 65). Development had caused serious erosion problems. It threatened limestone forests, watersheds and the primary aquifer (U.S. Department of Commerce 1979, 56, 61). Sandmining for construction, landfill and golf courses had degraded beaches (U.S. Department of Commerce 1979, 163).

The survey also indicated that coastal water quality had been affected

by the intensive development. Reef flats, seagrass beds and other marine environments were threatened by siltation and by thermal effluent generated by electric power plants located on the coast (U.S. Department of Commerce 1979, 64, 57). Point source pollution from sewer outfalls, storm drains and septic tanks in heavily developed urban areas had created "serious pollution problems" in Tumon and Agana Bays (U.S. Department of Commerce 1979, 64). Outbreaks of the crown-of-thorn starfish in 1968 and 1979 in Tumon and Agana Bays indicated the high levels of stress in coastal waters adjacent to developing areas (Birkeland 1984, 22).

The 1979 Comprehensive Development Plan and the 1979 Guam Coastal Management Program drew heavily from data developed in the natural resources inventory. Noting the degree of environmental deterioration already present, the Comprehensive Development Plan recommended strict zoning based on the Guam's limited natural resource base and priority attention to the coastal areas where population density was the highest (South Pacific Regional Environment Programme (SPREP) 1993, 6).

The Coastal Management Program recommended additional protection of areas which were especially fragile or had unique characteristics, such as Cocos Lagoon, Urunao Point, limestone forests, the primary aquifer, wetlands and numerous reefs. It noted that "Guam's coral reef-associated resources are outstanding" and must be protected (U.S. Department of Commerce

1979, 65).

By the end of the 1970s, concerns about the effects of uncontrolled economic development on the environment had fully surfaced in the continental United States. In the field of tourism, numerous case studies appeared pointing to the environmental degradation caused by the industry in the Mediterranean and Caribbean. The people of Guam had also become more aware of the presence of tourism and some of its impacts. In an opinion survey in 1979, they agreed that greater control of development was needed (U.S. Department of Commerce 1979, 37). Nearly everyone polled agreed that the 30-foot zone was inadequate to protect the coast, and that more coastal areas should be protected (U.S. Department of Commerce 1979, 37). The majority felt tourism development should be carefully restricted (U.S. Department of Commerce 1979, 37). Those people living in the south of Guam were most opposed to resort development (U.S. Department of Commerce 1979, 37).

Despite these public concerns and numerous government efforts to regulate tourism development, tourism continued to grow with minimal controls and additional stresses on the environment. By the 1980's many of these stresses were caused by an infrastructure that was inadequate to meet the increased demands of tourism and related population growth.

There were problems generating electricity. Despite significant increases in power supply generation, for instance, electrical outages

occurred frequently--sometimes daily (Guam Department of Commerce 1988, 111, 113). Most of the electrical generating plants were located at the shoreline so that ocean water could be used as a coolant. In 1982, the Tanguisson power plant, located just north of Tumon Bay, accidentally released boiler cleaner into nearshore waters. This resulted in a "sizeable fish kill" (Zucker 1984, 335).

There were problems getting fresh water into homes and businesses. The primary water lines, installed just after World War II, had never been improved and leaked substantially (Guam Department of Commerce 1988, 107). While Guam had ample fresh water for the population in the 1980s, inefficient distribution favored the tourist and residential areas of the north, sometimes requiring rationing of water to residences in the south.

Infrastructure problems appeared everywhere. The sewage system was overloaded. Both line capacity and the capacity of sewage treatment plants were exceeded to the point that excess sewage occasionally flowed onto the roads in Tumon and eventually into the Bay (Guam Department of Commerce 1988, 181). The landfill was nearing capacity (Guam Department of Commerce 1988, 121), and new space would have to be set aside to handle the growing volume of solid wastes. Roads were choked with cars, and additional land area was needed for improved transportation (Guam Department of Commerce 1988, 115). Indeed, the growth of tourism and its associated growth in population seemed to be overwhelming Guam.

The Most Recent Phase of Tourism (1987-Present)

Acknowledging all of these problems, the 1988 Overall Economic Development Plan made yet another attempt at limiting the growth of tourism. It recommended a shift from the policy of "just expansion for the sake of growth" to one of establishing growth limits for tourism based on Guam's ability to meet the needs generated by growth (Guam Department of Commerce 1988, 4, 183).

As with all previous plans, the recommendations for limiting growth and for regulating its impact on the environment were largely ignored. In fact, during the next five years, hotel development continued even more rapidly than it had in the previous five years.

As tourism moved from its enclave in the Tumon-Agana area into the undeveloped areas of Guam, public awareness and resistance grew. In August 1989 a public debate erupted over a massive resort development proposed for southern Guam (Workman 1989, 1). The developers of the proposed resort had requested a zone variance from the Territorial Planning Committee (TPC). Many people expressed concern about the project and the government's failure to stick to a plan. One speaker commented, "What's the use of making it (the Master Plan) law if TPC can change it?" (Workman 1989, 2). Another noted, "(There is a) need to control economic growth....TPC should delay this and all other proposals" (Workman 1989, 2). Still another said, "(This is) Spot zoning. It doesn't tie in to any Master Plan"

(Workman 1989, 3).

In 1990, a student organization at the University of Guam proposed a public vote on a six-month moratorium on development. One spokesperson commented, "I'm all for development. Actually development at the expense of the environment is also at the expense of the economy" (Amesbury 1990, 6-7). Another stated, "We're not against development, but we're trying to remind ourselves who we're developing for. We're developing for the people of Guam" (Amesbury 1990, 6-7). The issue never got to the ballot.

In 1991-2 efforts to develop a new land use plan necessitated village meetings. Significant issues were again raised. Residents favored protecting and conserving the island's natural resources (Guam Territorial Planning Commission 1993b, 5). They expressed concern over possible contamination of the aquifer by golf course development, polluted beaches, dying reefs and erosion (Guam Territorial Planning Commission 1993b, 5). Many villagers thought hotel development should not increase (Guam Territorial Planning Commission 1993b, 6). Others sought a halt in population increases (Guam Territorial Planning Commission 1993b, 5).

The 1993 Land Use Plan that evolved from the public meetings and from an analysis of Guam's natural resources acknowledges the problems identified by the people of Guam. It restates the environmental constraints faced by the island. But in the end, this newest Land Use Plan simply accommodates the anticipated growth in tourists and in resident population.

As one disgruntled government official commented, "It is a plan for the developers, not for the people of Guam." It offers no "limited growth" alternatives.

Summary

From the first five years of its existence to the present, there have been indications that tourism did significantly impact the environment. Aware of the environmental problems, government officials attempted to regulate tourism development and to protect Guam's natural resources. Gradually, the public became concerned. They, too, supported stricter control of the industry and greater protection of the environment. Yet, little effective regulation of the industry was achieved.

CHAPTER VII

GUAM'S ENVIRONMENT TODAY

Introduction

Guam's environment has been ravaged by nearly 30 years of unrestrained mass tourism development. Immense areas of limestone and ravine forests are gone; primary sources of fresh water are threatened by overuse and contamination; floodplains are filled with hotels and covered with asphalt; wetlands are partially filled and polluted; all of the island's native terrestrial mammals and birds are in immediate danger of extinction; large portions of coral reefs are dead or dying; and many offshore fisheries are near collapse. As the 1993 Land Use Plan for Guam indicates:

Perhaps the most striking impact of growth and development in the Territory has been the environmental damage that has occurred to the land and marine ecosystems (Guam Territorial Planning Commission 1993a, 9).

Indeed, this is true. This chapter will detail the environmental damage from tourism on Guam. It begins with a discussion of how the tourism industry in general adversely impacts the environment. It then assesses the effects of the industry on Guam's land, fresh water resources and nearshore waters.

How Tourism Impacts the Environment

Large-scale tourism development stresses the environment in numerous ways. While it appears innocuous, and in fact was known in the 1960s as the "smokeless" industry, tourism is not benign. The construction and operation of tourist facilities and the supporting infrastructure, tourist activities and the growth in the resident population induced by tourism, all impact the surrounding environment (Pearce 1991, 232; Mathieson and Wall 1982, 95). In the case of a small island, such as Guam, those impacts can be quite severe.

The construction of hotels, restaurants, shopping arcades, entertainment facilities and the infrastructure to support all of them takes much land out of primary production, destroys wildlife habitats and requires the permanent restructuring of local environments (Pearce 1991, 230). The construction process often places demands on local resources, such as sand and plants, and always generates considerable waste, much of it toxic. Mass tourism requires the development of an infrastructure of power, roads and wastewater treatment far in excess of what would be required otherwise. The construction of these facilities also involves environment damage.

The magnitude of the environmental impact of these construction activities is related to the length of the construction period, the number, size and concentration of the projects. Until recently on Guam, 89% of the hotels were concentrated in the Tumon Bay area. So far, the major environmental

disruptions have appeared in that area.

The operation of tourist facilities also impacts the environment. Hotel operations require the continual use of heavy-duty chemicals to maintain the rooms and the grounds. It involves the use of toxic chemicals in swimming pools and the use of pesticides and fertilizers in the gardens. In addition, a great deal of liquid and solid waste is generated by large hotels on a day-to-day basis. The environmental impacts of tourist facility operations are related to the number, size and concentration of the facilities and the number of visitors.

The activities of the tourists also can harm the environment (Pearce 1991, 230). Tourists demand high quantities of water and electricity, for showering, air conditioning and television. Tourists collect live corals and shells as souvenirs. They trample vegetation and compact soils and sand (Pearce 1991, 230). They inadvertently destroy species (Pearce 1991, 230). The damage wrought by tourists is directly related to their numbers and concentration. On a peak tourist day on Guam in 1992, tourists numbered 9,439 (or 7% of the island's population) and were concentrated around Tumon Bay (Guam Territorial Planning Commission 1993c, Table 14).

Lastly, and often overlooked in tourism impact analyses, tourism induces growth in the resident population, and that has environmental impacts (Pearce 1991, 230). People move to the tourist area for jobs in or supporting the industry. Others, attracted by the amenities of tourism, buy

land and retire there. The new Manengon Hills Resort on Guam, for instance, has 3000 residences and 2150 condominiums in addition to its 200 hotel rooms. The residential portion of the resort is marketed in Japan, not Guam.

This "tourism-induced" population requires housing, infrastructure and services. Thus it places additional demands on an area's natural resources. Again, the demands are related to the numbers of people involved. In Guam's case, an estimated 17% of the resident population came to Guam as a result of the development of tourism (see Appendix B). Therefore, we can assume that on Guam roughly 17% of the demand on natural resources--fresh water, electricity, and land for houses, for instance--can be attributed to tourism-induced population growth.

Clearly, tourism impacts the environment in many ways. The degree of impact is related to the size and the scale of the industry. Mass tourism, characterized by many large hotels and high numbers of affluent tourists, is very destructive to the environment. As we have seen, this is the type of tourism actively cultivated on Guam.

Tourism's Impact on the Land

Development along Tumon and Agana Bays

The Tumon Bay area has been the focus of tourism on Guam for the past 28 years. Hotels sprung up first along the beach, then gradually filled in



Illustration 1. Ongoing hotel development along Tumon Bay.



Illustration 2. Inappropriate carving of Tulum Bay cliffline.



Illustration 3. Resculpturing of Tumon Bay cliffline.



Illustration 4. Extensive hillside alteration to accommodate development.

the flood plain farther inland. Much of the area had been coconut plantations, but hotel construction also removed natural vegetation. Construction involved clearing the land, and then resurfacing it with hotels, parking lots and roads (Illustration 1). In the process, acres of soil were exposed to heavy rains for prolonged periods of time (2-3 years, at times), resulting in substantial soil erosion.

As the Tumon floodplain was filled with hotels and asphalted, its ability to moderate the flow of water off the land was increasingly impaired. Drainage and flooding problems --previously existent due to the lowland nature of the area--were exacerbated (Guam Territorial Planning Commission 1993a, 99).

As flat land in the Tumon area became more scarce, development proceeded inland, resculpturing the cliffline, and eventually up the cliffs (Illustrations 2, 3 and 4). The cliff sides, too, were cleared of vegetation and then paved. This intensified the flooding problems in the floodplain (Guam Territorial Planning Commission 1993a, 29). Rainwater, normally held by the vegetation and the soil, rapidly ran off paved surfaces, overflowing storm drains and rushing into the Bay. This problem has been chronic in Tumon, and even today, roads regularly flood during heavy rains.

Development of the Agana Bay area proceeded in a similar way, although as the island's capital and business center, its development was not solely oriented to tourist facilities. Businesses, government buildings, shops



Illustration 5. Condominium development too close to shoreline.

and roads covered the large Agana floodplain. Eventually the surrounding cliffs were developed, exacerbating the flooding problem in the low areas.

Agana Swamp--the largest freshwater wetland in Guam--occupies the center of Agana. It is fed by rainwater from the hillsides, springs and rivers, and exits to the sea via the Agana River. As growth in the area occurred, Agana Swamp was increasingly threatened. In 1978, ten acres of it were filled to build the Agana Shopping Center. Additional filling and development has occurred around the edges. It is chronically polluted by runoff from developments on the surrounding hillsides and by raw sewage from the inflowing Chaot River (Wiles and Ritter 1993, 139). In 1990, chlorine bleach, used to remove algae from the sidewalks of the Agana Shopping Center, flowed into the swamp and the Agana River, resulting in a "sizeable fish kill" (Castro 1990). The Agana Swamp is seriously compromised.

The beaches along Tumon and nearby Agana Bays are also affected by tourism development. The 1976 post-typhoon Pamela decision to allow development within 30 feet of the mean high water line was never rescinded (Guam Territorial Planning Commission 1993a, 57). As a result, hotels, condominiums and roads crowd the beach, sometimes disregarding even the 30 foot rule. For example, one Marine Drive condominium is built so close to the water that its foundation is partially submerged at high tide (Illustration 5). In other instances, hotels and their grounds are so close to the ocean that sea walls must be erected to protect hotel property. Marine Drive, which

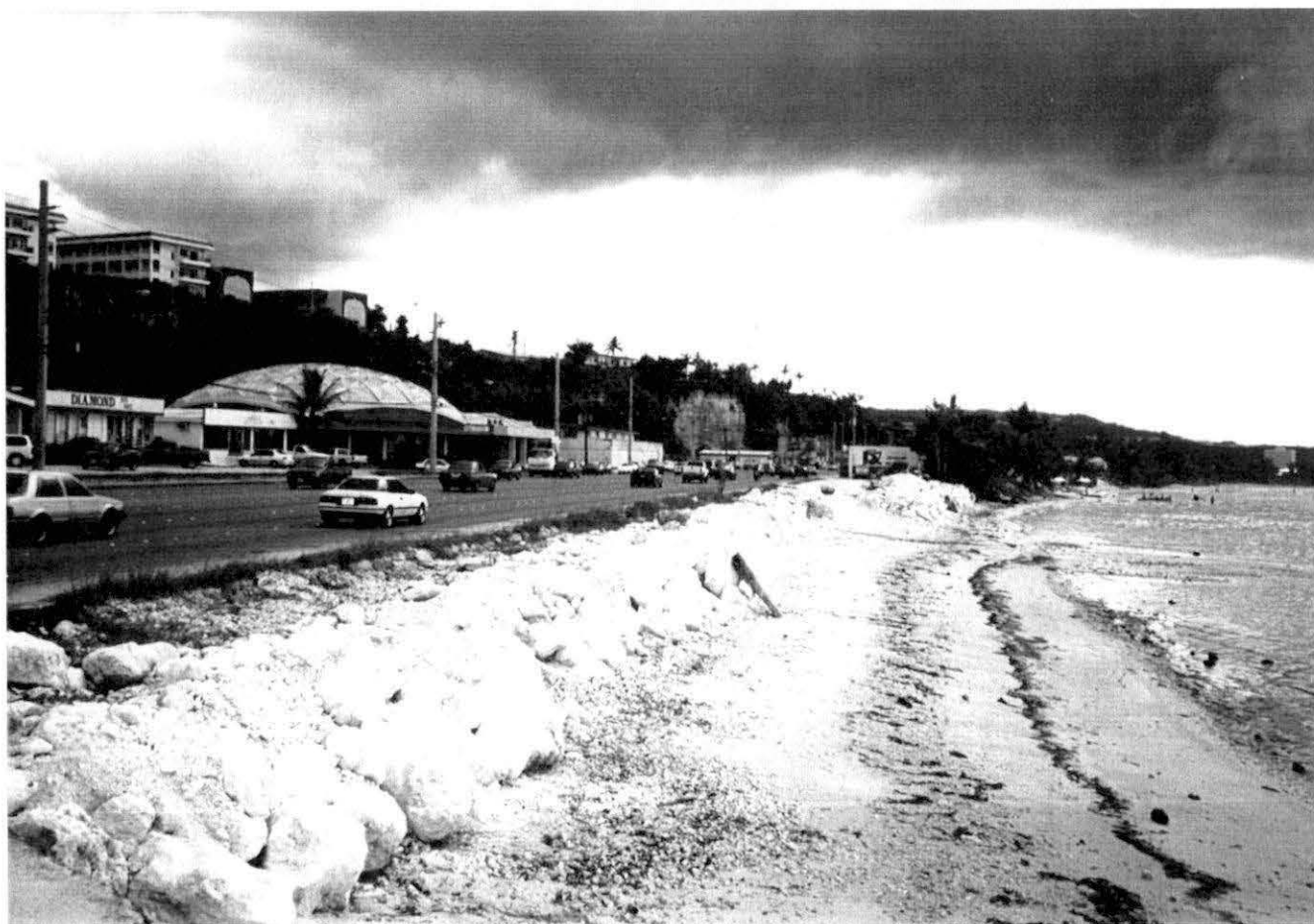


Illustration 6. Road construction too close to shoreline.

runs adjacent to the ocean for many miles, lies so close to the shoreline in some places that its rock foundation must constantly be restored (Illustration 6). All of these construction activities on the beach destroy natural beach vegetation, alter beach topography and disrupt the natural migration of beach sand (Carpenter and Maragos 1989, 206).

Construction, operation and tourist activities also alter beach habitats. Heavy construction equipment compacts the sand, making it uninhabitable for many small beach creatures (Raulerson 1993). Heavy pedestrian traffic and vehicles used to offload water sports equipment have a similar impact (Pearce 1991, 230). The beaches are "cleaned" regularly for the tourists by sweeping them with manual and motorized rakes. In the process, habitats and microfauna--which play important roles in the food web--are destroyed (Taitano 1991, 4). Sea cucumbers, the "earthworms of the sea," are physically removed from the beach because they are distasteful to the tourists. At one time, Tumon and Agana beaches provided nesting areas for sea turtles, and they teemed with hermit crabs and other life forms. Today, as a result of hotel lights, tourist activity and beach alteration, this is no longer true (Davis 1993b, 7).

Landscaping of the hotels and building sand traps on golf courses impacts environments far away from the construction site. For instance, many of the plants used in landscaping hotels came directly from Guam's forests and plantations (Perry 1993). Everything from full-grown coconut

trees to ferns and orchids were plucked from their natural homes and replanted at the hotels. Sand was mined from the beaches and nearshore waters for use on golf courses and for nourishment of other beach areas. These construction activities deplete Guam's natural resources. In addition, the dredging of sand from the ocean for uses on land potentially introduces toxic substances onto the landscape.

Floodplains, cliff sides, vegetation and soil levels, beaches and a wetland all were adversely affected by tourism development during its first phase in the Tumon and Agana Bay areas. The developed land no longer served its function in the natural ecosystem: it no longer provided natural flood control, retained water or provided suitable habitat for wildlife. While these impacts to the land were serious, they were confined to a small area of the island. The Tumon area, for instance, consists of less than 1% of the land mass of Guam (Guam Territorial Planning Commission 1993c, 84).

A Shift to Undeveloped Areas and Golf Courses

Prior to 1992 the vast majority (89%) of hotel development and all condominium development occurred in the Tumon area. But recently, there has been a shift in that pattern. If all the hotel projects now submitted for approval are completed, over 53% of the tourist facilities will be outside the Tumon Bay area (Figure 6) (Guam Territorial Planning Commission 1993a, 20). Just under half of the planned condominiums will be located outside

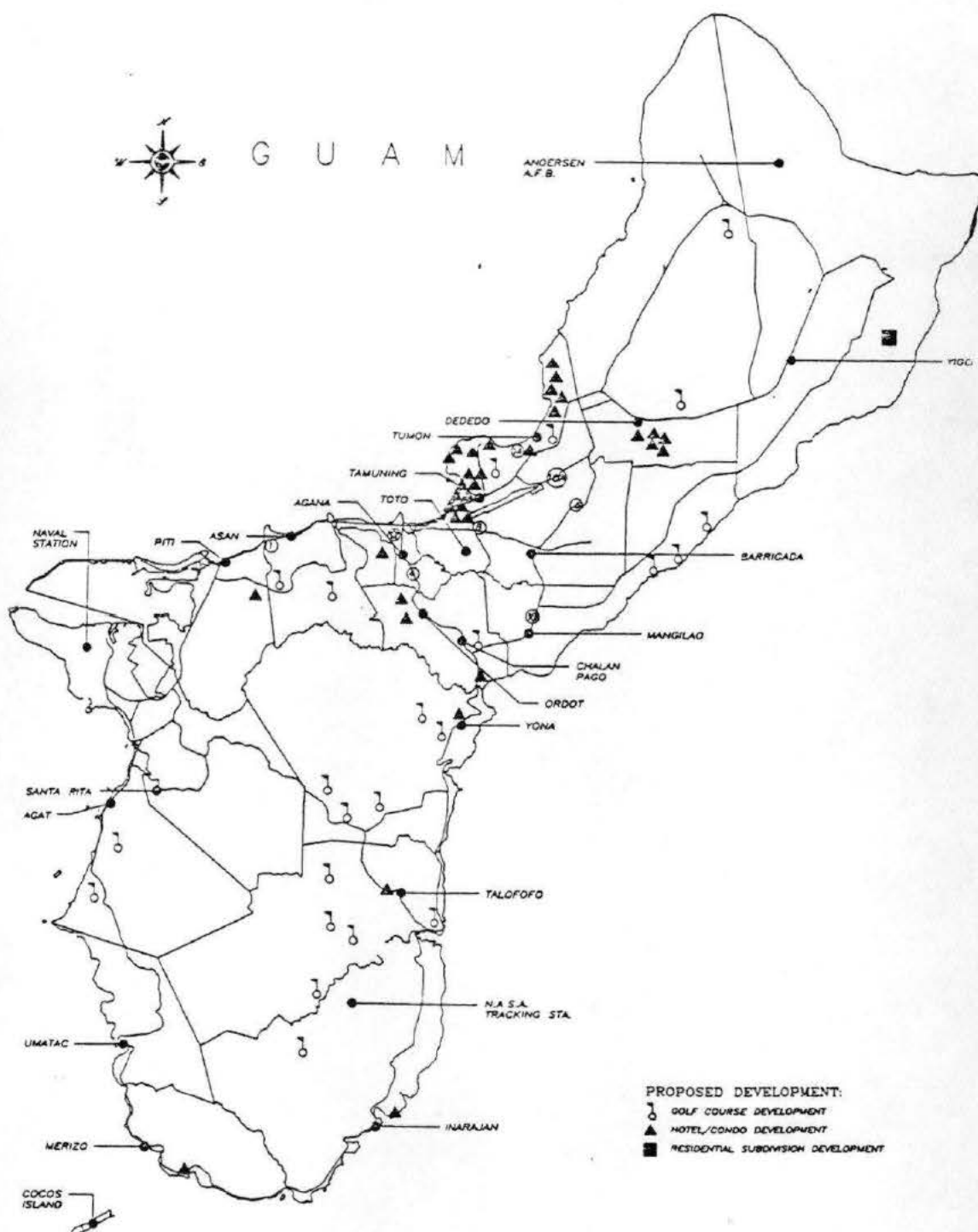


Figure 6. Proposed Tourism Projects, 1993. (Reprinted from Guam Territorial Planning Commission, *I tano'-ta: The Land Use Plan for Guam* (draft).)

Tumon. Moreover, many of the new resorts will include golf courses and will require more expansive areas of land.

The shift to undeveloped areas and to the use of larger tracts of land has serious environmental consequences for Guam, including the loss of wildlife habitat, natural vegetation and soils (see Illustration 7). Projects already approved and pending threaten much of what remains of Guam's limestone forests (see Figure 7). For instance, the seven golf courses and the residential subdivision proposed for the northern end of the island will destroy over a thousand acres of limestone forest. In the south, proposed golf courses, resort and condominium developments threaten thousands of acres of ravine forests and savannas. Soil erosion is particularly worrisome in southern Guam where as much as 30 tons of soil per acre erode each year (Amesbury 1990, 7). By comparison, forested areas on Guam erode at only 1 ton per acre (Amesbury 1990, 5).

Wetlands, predominantly located in the south, are also threatened by this new phase of development. The construction crews of the 1286-acre Manengon Hills Resort filled 5.2 acres of wetland and diverted stream channels during construction (Wiles and Ritter 1993, 133). While the Guam Environmental Protection Agency (GEPA) forced the developers to recreate the wetland, experts indicate that it is "not as ecologically valuable as natural habitats" (Amesbury 1990, 7).

Several golf courses and resorts are planned for the broad alluvial



Illustration 7. Undeveloped area of limestone forest proposed for golf course development.

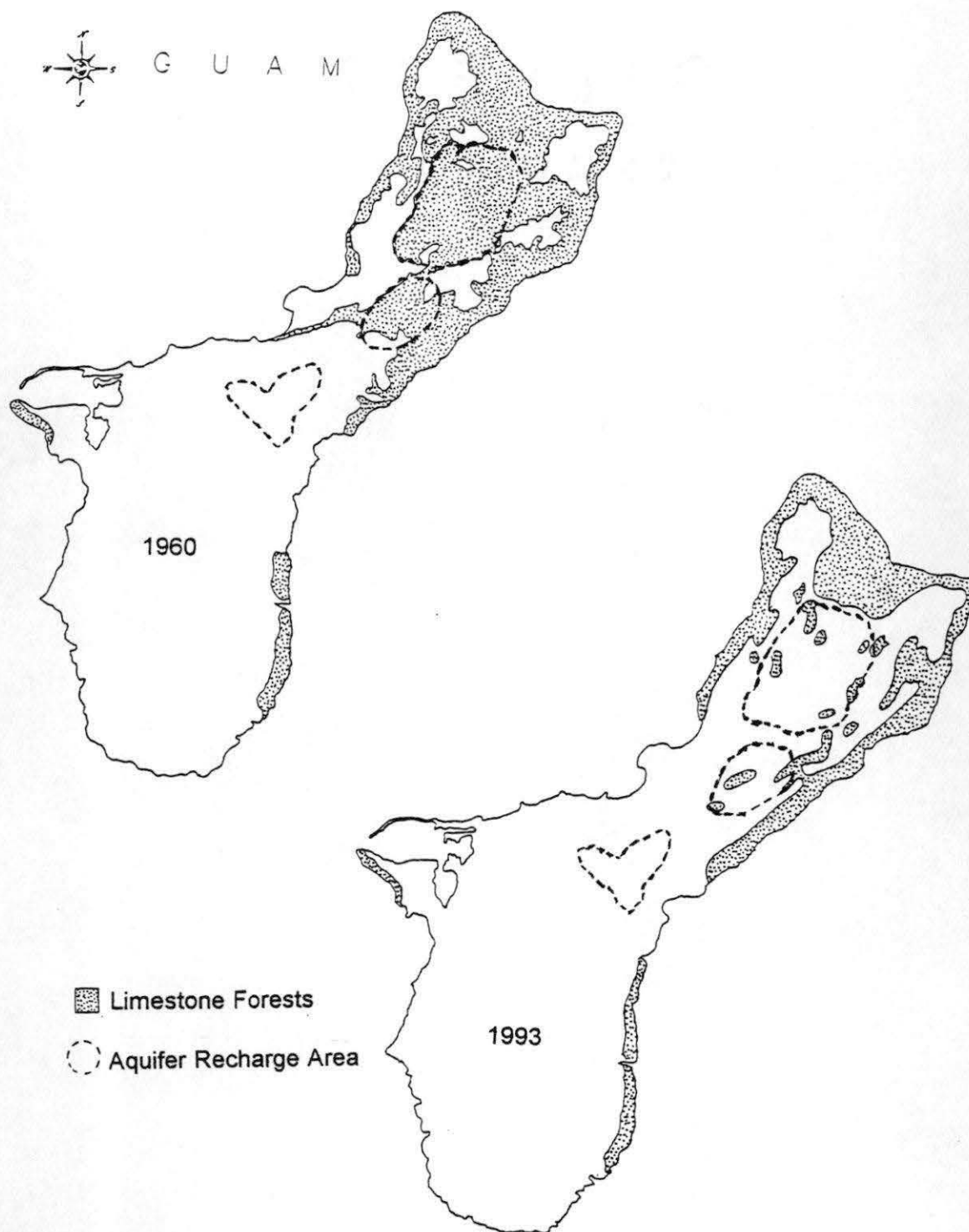


Figure 7. Comparison of extent of limestone forest in 1960 and 1993. (Data from Stone 1970-71 and Guam Territorial Planning Commission 1993c).

plain along the Talofofo River (Wiles and Ritter 1993, 167). The adjacent wetland is the largest contiguous wetland in Guam and contains the island's largest population of endangered Island Swiftlets (Wiles and Ritter 1993, 165). The wetland is already impaired by sediment-laden runoff from agriculture on the surrounding hillsides. Large-scale development of tourism facilities on the plain will exacerbate the soil erosion and sedimentation problems.

Sarasa Marsh, a small freshwater marsh near Talofofo, is located on a large piece of property recently put up for sale. It is likely that an off-islander will purchase the land, that a resort will be built on it, and that construction activities will impair the functioning of the wetland (Wiles and Ritter 1993, 169). A hotel development also is anticipated adjacent to the Achang Bay mangroves, one of the two sizeable areas of mangrove forest on Guam (Wiles and Ritter 1993, 174).

According to a recent publication of the USFWS, the loss of wetland habitat from development on Guam is the "primary cause of the decline of the Mariana mallard and the Mariana common moorhead" (USFWS 1993, 14). Other species are also likely threatened by development in and around the wetlands.

In addition to the impacts caused directly by tourism, the 17% of the resident population induced to move to Guam by tourism have also affected the land. In particular, they require housing and construction of housing

translates into cleared natural vegetation, soil erosion and the permanent alteration of land surfaces.

The Significance of the Impacts to Land

In Chapter IV it became evident that Guam's environment was impaired prior to tourism development. Tourism adds enormous stress to the land. As a result of the industry's development, natural vegetation, watersheds, habitats and soils have been lost. These losses are permanent. To quote from Guam's most recent land use plan:

Ecologically valuable limestone forests have been destroyed and mangroves and beaches have been filled or dredged to accommodate development...the functioning of these vital areas has been impaired by encroaching development. These losses are irrevocable...(Guam Territorial Planning Commission 1993a, 11).

Thus losses have occurred. But are they of significant magnitude?

Today, about 6,477 acres--just under 5% of the island's land area--is directly devoted to tourism facilities already existing and under construction (data from Guam Territorial Planning Commission 1993c, 84). An additional estimated 1,363 acres is used for housing alone by the tourism-induced population (data from Guam Territorial Planning Commission 1993c, 84). These figures do not include the acres used for airport runway expansions, tourist shopping malls, dog race tracks and certain highways which exist primarily for the tourists. Even without including these land areas, a full 6% of the island's land has been cleared, reshaped, resurfaced and dedicated to

the tourism industry and its supporting population.

In addition, already in the system for approval and eventual construction is another near 5,000 acres for hotels and golf courses (Guam Visitors Bureau 1992a, 11-12). If the tourism-induced population continues to be 17% of the growing resident population, by 2015 an additional 1,689 acres of land will be devoted to housing that population (data from Guam Territorial Planning Commission 1993c, Table 14). These acreages comprise an additional 5% of Guam's land.

Altogether, the land for tourism facilities that are existing, under construction or pending approval added to the land dedicated to the existing and planned housing for the tourism-induced population amounts to 11% of the land area of Guam. This is a significantly high portion of the land to be transformed for one purpose.

To gain an even better appreciation of the dominance of tourism on Guam's land area, however, let us relate the tourism-dedicated acreage to the acreage on Guam actually available for private use. As indicated earlier, only 48% of the land mass is available for private development; the remainder is held by the federal and territorial governments. Tourism now takes up 12% of the available private land on Guam. If future development proceeds as anticipated, an astounding 23% of available land will go to tourism.

An Indirect Result of Tourism

The frenzy for land on which to develop tourist facilities began in earnest in the 1980s, and resulted in a rapid appreciation of land values on the island (Guam Territorial Planning Commission 1993a, 8). While this had beneficial effects for private landowners wishing to sell, it has effectively eliminated the possibility of setting aside land for wildlife preserves. The government simply cannot afford to acquire land at today's prices. Moreover, the government is faced with enormous pressures from individuals and private industry to develop, rather than preserve, its land.

The battle currently raging on Guam over a proposed wildlife refuge serves to illustrate this point. Guam's wildlife has experienced a catastrophic decline for a variety of reasons, including predation from the brown tree snake and the loss and degradation of habitats due to development (USFWS 1993, i). According to a recent study by the USFWS, "All of Guam's native terrestrial mammals and birds are on the threshold of extinction in the wild" (see Appendix C) (USFWS 1993, i).

As a result, the USFWS proposed a refuge that included some of the best remaining habitats for endangered species and consisted only of federal (military) and territorial lands (USFWS 1993, ii). No private lands were included. According to the proposal, this refuge represents the best hope for these species, and also for the preservation of substantial tracts of native

vegetation (USFWS 1993, 1-3).

Yet political and public resistance to the refuge has been intense. Several owners of beachfront property adjacent to the proposed refuge oppose the refuge, claiming that it will compromise their ability to develop resorts on their property (Eastly 1994b, 42). Other citizen groups insist that excess federal military lands should be returned to private owners, and not turned into a refuge. (Normally, excess lands under the jurisdiction of one federal agency are offered to other federal agencies before being offered to state or territorial governments or the public.) The public debate is framed in terms of individual property rights versus the federal "taking" of the land (Pollot and Van Zandt 1994, 2-4). Confounding the issue further, politicians have brought Guam's political status as a territory into the discussion.

All of these outcries obscure the real issue. Resistance to the wildlife refuge is a direct result of the shortage and escalated value of land on Guam. Both of these arise from uncontrolled tourism development. As one government staff member indicated, if land prices on Guam today were what they were even ten years ago, the refuge would not be an issue (Anonymous 1993).

Other Environmental Impacts on the Land

Tourism impacts Guam's land environment in other ways. Despite a recent increase in size, Guam's landfill is nearing capacity; despite recent

expansions, its roads are clogged with cars. In the areas of solid waste and transportation, tourists probably contribute to the problems to a similar degree as residents. Thus they are directly responsible for about 7% of solid waste generated and of the traffic congestion. If the "tourism-induced" resident population (17%) is added to the tourist population, tourism accounts for nearly one quarter of all the solid waste generated.

Solid waste and transportation systems negatively impact the environment. Every time landfills or highways are sited or expanded, they alter natural landscapes, destroy valuable open space and natural habitats, and in the case of roads, contribute to soil erosion. Guam is currently considering an incinerator to dispose of its solid waste. If this option is adopted, highly toxic dioxins, furans, and heavy metals will be released into the air over Guam, and hazardous waste in the form of fly and bottom ash will be generated (Miller 1994, 525-526; Manuel 1994, 932). All of this contributes further to a degraded island environment.

Tourism's Effects on Guam's Fresh Water Resources

In addition to impacts on the land, tourism has also affected Guam's fresh water resources. Fresh water is a vital and precious resource on a remote island such as Guam. While renewable if used at a sustainable rate, fresh water resources can be depleted or polluted by overuse and contamination. This has already happened on many Pacific islands including

Saipan, Okinawa and Majuro. These island are forced to obtain bottled water from off-island or desalinize ocean water, both very expensive options.

Sources of Fresh Water on Guam

Guam obtains fresh water from two sources. About 80% comes from three underground water lenses (possibly interconnected), located in the northern and central parts of the island (see Figure 8) (Guam Territorial Planning Commission 1993a, 24). Water from these lenses is withdrawn by wells, and is replaced by rainfall percolating through areas of porous limestone. The northern water lenses are estimated to have a sustainable yield of 50-60 million gallons per day (mgd) (Guam Territorial Planning Commission 1993a, 24). As of 1993, about 31 mgd were being used, but the quantity increases annually.

The remainder of Guam's water comes from surface sources in the south. There, where the ground is less permeable, rainwater drains off the hillsides into streams and rivers, and eventually flows to the ocean. The amount of water flowing in the rivers fluctuates naturally over the seasons. As a result, two reservoirs were built--one in the early 1950s and the other in 1992--to provide a continual supply of water. Water from these reservoirs and several small springs constitute the remaining 20% of Guam's fresh water (Guam Territorial Planning Commission 1993a, 93).

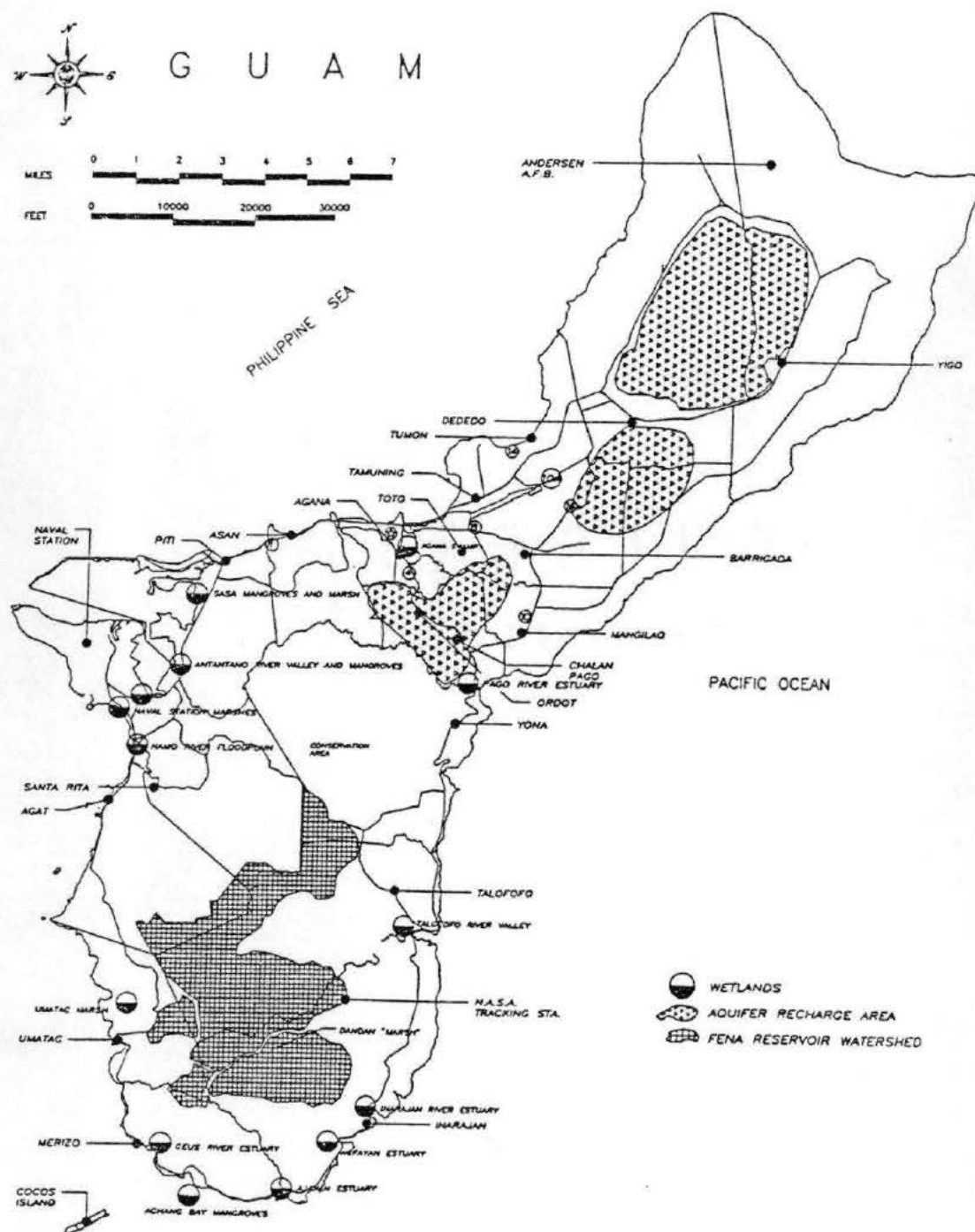


Figure 8. Sources of fresh water on Guam. (Reprinted from Guam Territorial Planning Commission 1993a.)



Illustration 8. Removal of vegetation reduces ability of land to retain moisture.

Tourism's Impact on Water Quantity

Tourism and associated residential and commercial development affect the quantity of fresh water resources on Guam in two ways.

First, tourism development permanently alters the land surface so that less water is retained. When large-scale resorts are constructed in the rural areas of Guam, limestone forests, ravine forests and other natural vegetation are cleared, and much of it is replaced by roofs, parking lots and roads. Often, the topography of the land is altered to conform with the developer's vision, and natural drainage patterns are obliterated.

In the northern half of the island, removal of vegetation permanently reduces the ability of the land to retain moisture and it accelerates erosion (see Figure 7 and Illustration 8). When large impermeable surfaces are constructed over the aquifer recharge areas, they obstruct the percolation of water into the limestone, and permanently reduce the recharge capabilities of the aquifer.

In the south, development results in the loss of watershed, increased runoff and soil erosion. This is particularly disturbing when coupled with the fact that serious erosion problems already exist in the south. The loss of aquifer recharge area, the loss of watershed and the loss of soil are permanent. Ultimately, these losses lower the natural carrying capacity of the island and, hence, lower the number of humans (and wildlife) the island can support.

The second way the tourism industry affects the quantity of fresh water is by demanding a disproportionately high quantity of this limited resource. Planners on Guam estimate that tourists use 2-1/2 times the water of residents (Guam Territorial Planning Commission 1993c, Table 14). Together, the 133,000 residents (@ 100 gpd) and 9,400 tourists (@ 250 gpd) consume about 15.4 million gallons of water per day.

If existing plans for expansion of tourism materialize, there will be twice the number of residents (263,000) and nearly 3-1/2 times the number of visitors (32,400 daily peak) on the island by the year 2015 (Guam Territorial Planning Commission 1993c, Table 14). At that point, tourist consumption will account for 26% of all water supplied to these two populations. The disproportion is magnified as tourist numbers grow.

Fresh water is also needed by the tourism industry to water hotel landscaping, fill pools and to irrigate golf courses. This latter use is especially demanding, and requires an estimated one half to one million gallons per day per 18-hole course (Minerbi 1992, 55). Currently there are 7 courses on Guam, requiring up to 7 million gallons of water per day. If the golf courses now at various points in the construction and planning process are all developed, up to 23 million gallons of water per day will be required to keep them green.

Planners are well aware that this amount of fresh water usage, combined with the other demands, exceeds Guam's fresh water resources.

So they urge future developers to use brackish water, desalinize sea water or tap surface sources of fresh water (Amesbury 1990, 7). All these approaches have environmental drawbacks. For example, the use of brackish waters may result in the accumulation of salt in the soil. Desalinization results in the dispersion of hyper-saline effluents in nearshore waters. Golf course and resort developers in the Talofofo valley have asked to pump water from the Talofofo River for irrigation. According to studies, this will reduce stream flow and increase salt water intrusion up the Talofofo River (Wiles and Ritter 1993, 167). It may also affect the nearby wetlands.

Thus the tourists themselves, and the activities they pursue, require a disproportionately large amount of the island's fresh water. This is a problem because water consumption on Guam is rising rapidly and the sustainable supply of water on the island is limited. The demand for fresh water more than doubled in the last decade (Guam Territorial Planning Commission 1993a, 94). During the same years, the population grew only 26%. Some of that increased "demand" is attributed to losses in the system from leakage and unauthorized taps. However, much of it is related to the increase in tourists, the associated residential and commercial growth and the irrigation requirements of golf courses (Guam Territorial Planning Commission 1993a, 28). In 1990, the Director of the University of Guam Water and Energy Research Institute (WERI) commented that if the "ever-increasing demand for water does not taper, resources may eventually be exhausted" (Amesbury

1990, 7).

Tourism's Impact on Water Quality

Tourism also impacts the quality of Guam's fresh water supply. Contamination of the northern aquifer can result from leaky sewer lines, septic tanks and industrial spills over the recharge area. In addition, contamination can occur in artificial ponding basins and at well-heads in developed areas (Guam Territorial Planning Commission 1993a, 52). However, one of the biggest threats to the quality of the northern aquifer is the possibility of contamination from accidental spills and runoff of pesticides and fertilizers used on golf courses over the recharge area (Amesbury 1990, 7). About 440,000 pounds of fertilizers are applied during the first year of operation of a golf course (Minerbi 1992, 55). An estimated 3% of that enters ground or surface waters (Minerbi 1992, 55). According to the GEPA Administrator, "We've reached a point where the cumulative number of golf courses in northern Guam is approaching the...hazard level" (Amesbury 1990, 7). The Director of WERI added, "While green pastures appear ecologically salutary, chemicals used in their maintenance may destroy the aquifer" (Amesbury 1990, 7).

In the southern half of the island, pesticide and fertilizer runoff from golf courses can enter surface waters and eventually contaminate drinking water supplies. In fact, monitoring by GEPA consistently shows high nutrient

content in these waters (Anonymous 1993). Contaminated runoff from rivers in the south can adversely impact nearshore aquatic communities as the polluted fresh water flows into the ocean.

In an effort to mitigate these potential problems, the GEPA requires a turf management plan from each golf course. The plans must identify the pesticides and fertilizers that will be used, and GEPA can ban the use of certain ones which are deemed the most harmful. In addition, GEPA monitors the golf courses twice a year. However, as one GEPA staff member commented, this does not preclude an accidental spill leaking into the aquifer.

GEPA also requires developers to bury containment liners when constructing golf courses over aquifer recharge areas (Amesbury 1990, 7). This is a very questionable practice for two reasons, both of which are detrimental to the aquifer. Either the liner works, and obstructs the flow of rainwater into the aquifer; or it leaks, and allows the pesticides and fertilizers to enter the aquifer. In most cases, it leaks. After extensive studies, the federal EPA acknowledges that even the "best-available-technology" liners leak, often within a year (Miller 1994, 559).

Tourism's Impact on Guam's Marine Environment

A speaker at the 1990 Congress on Coastal and Marine Tourism noted, "Perhaps the single most important indirect effect of tourism development

worldwide is that of a decline of local (ocean) water quality" (Clark 1991, 119). Certainly this is true in Guam. The quality of coastal waters in many areas is severely degraded (Figure 9) (Guam Territorial Planning Commission 1993a, 9). Coral reefs are severely stressed. Some local fisheries are near collapse.

Tourism development is responsible for these problems in several ways. Most importantly, construction of tourist facilities and transportation routes on land leads to an increased quantity and a decreased quality of stormwater runoff. In addition, thermal and sewage effluents are discharged into nearshore waters in increased quantities as a result of tourism. It has been calculated that more than 90% of the material entering coastal waters remains in the coastal sediment (Tolba 1987, 89). Less than 10 percent is disbursed into the open ocean.

Tourists also impact coastal waters directly by souvenir hunting, scuba diving, jet skiing and other activities. Underwater construction, such as the dredging of lagoons and the creation of underwater tourist attractions, also impacts marine communities. All of these factors affect the quality of nearshore waters and aquatic communities.

Stormwater Runoff

Stormwater runoff may be the primary culprit in the deterioration of Guam's coastal waters. It is known that "in areas of heavy rainfall the total

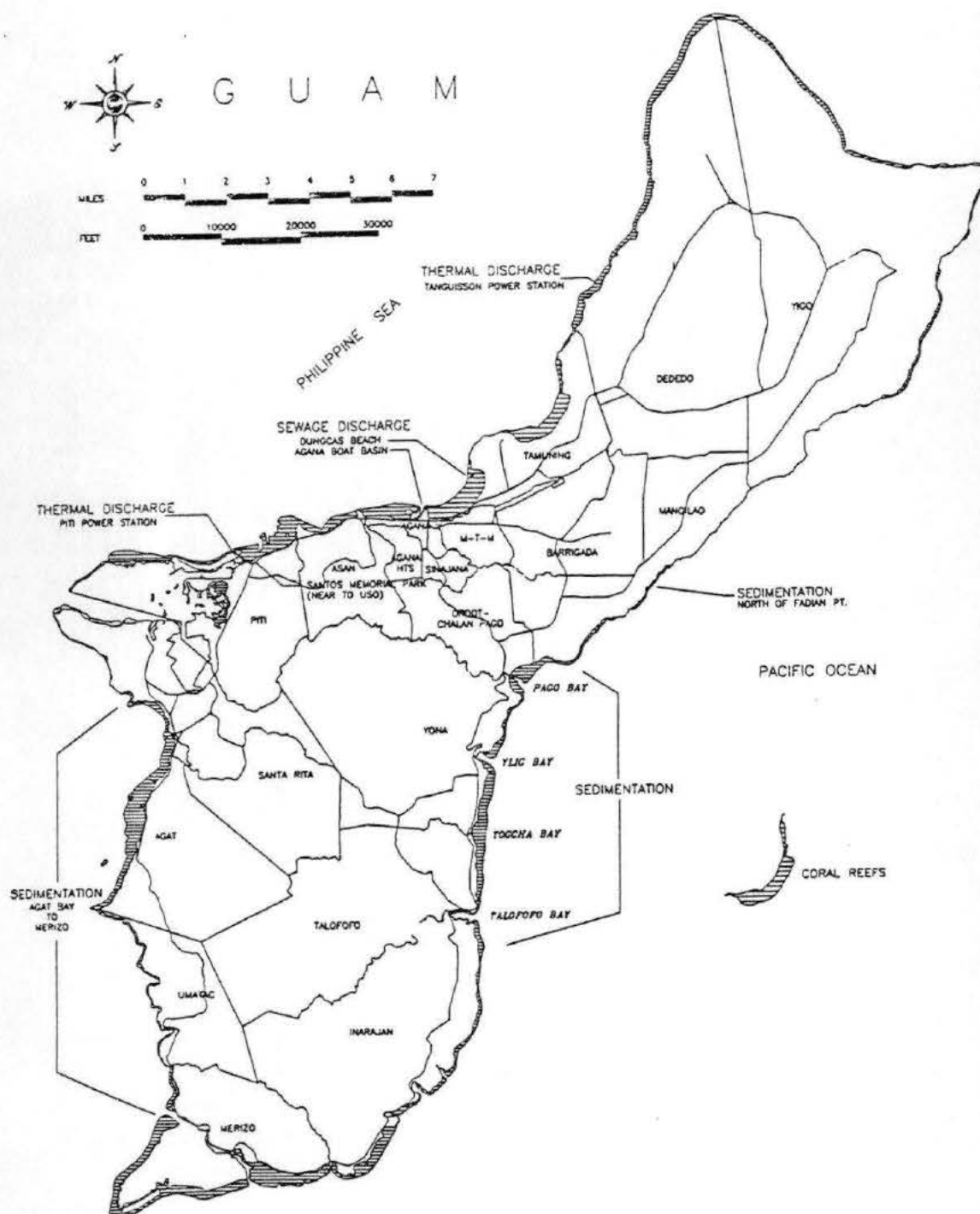


Figure 9. Degraded marine ecosystems, 1993. (Reprinted from Guam Territorial Planning Commission 1993a.)

annual contaminant loads from runoff can greatly exceed those from the discharge of sewage effluent" (Bell and others 1989, 122). Stormwater contains sediments, pollutants and large quantities of fresh water, which itself can be a "contaminant" to coral reefs (Bell and others 1989, 122).

Sediment in stormwater runoff increases the turbidity of the water, and eventually may settle on coral reefs, mangroves and seagrass beds. After heavy rains in Guam, large brown plumes of silt can be seen spreading from the mouths of rivers into the bays and lagoons. Certain reefs in southern Guam have received deposits of "up to two inches" of sediment (Amesbury 1990, 6). In those areas, 95% of the corals have died (Amesbury 1990, 6). In other bays adjacent to developing areas, sedimentation has affected up to 70% of the reef (Guam Territorial Planning Commission 1993c, 65).

Sediment blocks sunlight (energy) from the corals, preventing photosynthesis in their symbiotic algae. Excessively heavy sediment loads also smother mangrove roots and prevent sunlight from reaching seagrasses. When healthy, these nearshore communities are exceptionally productive and serve as nurseries for local fisheries. Heavy sedimentation impairs these functions.

Stormwater runoff also contains chemical pollutants from construction materials, resort landscaping and coastal highways. Pesticides, herbicides and fertilizers, along with oil and grease, are regularly flushed off the land into coastal waters. Excess nutrients from fertilizers, such as nitrogen and phosphorus, are particularly damaging to corals, impacting them directly as a

toxin or promoting the growth of algae which outcompetes the coral.

According to one study, even small increases in the background phosphorus level damage coral reefs by decreasing calcification rates (Bell and others 1989, 122).

Stormwater runoff deposits 80-90% of the heavy metals (lead, zinc, copper, cadmium and chromium) that reach Guam's coastal waters (Guam Territorial Planning Commission 1993b, 35). Excess heavy metals are toxic to plankton, fish and other aquatic life, reducing their ability to reproduce (Guam Territorial Planning Commission 1993b, 35).

Stormwater runoff from roads and development sites also flushes high volumes of fresh water into the ocean. Corals, in particular, have a limited tolerance for changes in salinity, and prolonged fresh water flows that reduce salinity can kill the animals (Carpenter and Maragos 1989, 250).

Researchers on Guam are uncertain as to precisely which factor in stormwater runoff is adversely affecting Guam's coral reefs (Amesbury 1990, 6). Most likely, however, the various factors are cumulative as well as synergistic in their impacts (Bell and others 1989, 126).

Thermal and Sewage Effluents

The discharge of sewage and thermal effluents also affects coastal waters. Sewage effluent on Guam comes from primary treatment plants which discharge sewage into the ocean from submarine outfalls, or in one

instance, into a stream which then flows to the ocean. Thermal effluents come from two power generating facilities located at Tanguisson and Piti on the west coast of Guam. The power plants use ocean water as a coolant, and discharge hot, contaminated water back into the ocean (Carpenter and Maragos 1989, 161).

The amount of effluents discharged into coastal waters is determined by the population. The portion contributed by tourism can be estimated by adding the portions contributed directly by the tourists (9,439 peak daily count) to that contributed by the tourism-induced population (17% of the resident population, or 22,636). If we assume that tourists and residents consume electricity equally, then about 22% of the wastes from electricity generation can be attributed to tourism.

Wastewater generation is related to water use, therefore tourists generate about 2.5 times the wastewater as a resident (Guam Territorial Planning Commission 1993c, Table 14). If we combine the elevated amounts estimated to be generated by tourists with the amounts estimated to be generated by tourism-induced residents, they account for 32% --or nearly one third--of all wastewater produced. All in all, tourism contributes significantly to the quantities of effluents being discharged into nearshore waters. The greater the quantity of discharge flowing through the outfalls, the greater the adverse effects on the marine environment, all other things equal (Bell and others 1989, 127).

The high amounts of wastewater generated by tourists is significant because Guam's wastewater system is already overloaded. According to the 1993 Land Use Plan,

Rapid development and population growth are creating an overloaded condition on the wastewater treatment system. The problems are in both the capacity and location of collection lines, as well as the capacity in the treatment plants. This situation has...resulted in the discharge of untreated or poorly treated effluent into streams and coastal lagoons (Guam Territorial Planning Commission 1993a, 7).

Thus here again, tourism contributes directly and significantly to the degradation of coastal waters.

Recently, developers of resorts proposed for areas not served by sewers have been asked to build independent systems. This approach is not necessarily successful. In the case of Manengon Hills Resort, for instance, the developers agreed to install a tertiary treatment system and to use the treated water for golf course irrigation. However after the project was approved and construction began, they did not fulfill this agreement. Now partially treated sewage from the resort sometimes runs into a nearby river (Anonymous 1993).

The main components of wastewater are fresh water, biological wastes, nutrients, surfactants, dispersants, and suspended solids (Bell and others 1989, 123). In addition, a wide variety of chemicals, many of them toxic, find their way into the sewers. Tourism may increase the toxicity of wastewater. Tourists demand a level of cleanliness that exceeds what is

found in the average residence. Every day of the week housekeepers enter the thousands of hotel rooms on Guam and use large quantities of industrial-strength chemicals to clean the bathrooms. Daily, they send large quantities of soiled linen to the laundry. Residues from the highly concentrated chemical cleaners, detergents and disinfectants are washed down the drains and into the sewers on a daily basis. The primary treatment of sewage available in Guam does not remove these pollutants. Instead they flow into nearshore waters. More information is needed to confirm the higher toxicity of wastewater from tourist facilities relative to residents.

GEPA tests for bacteriological water quality on a variety of Guam's reefs every week. Their records indicate a significant increase in polluted waters since 1987: 104 tests revealed pollution in 1987; 141 in 1988; 312 in 1989; and 158 in 1990 (Guam Territorial Planning Commission 1993b, 63). Agana Bay, popular with swimmers, snorkelers and jet skiers, was polluted about half the time (Guam Territorial Planning Commission 1993b, 64). Tanguisson, Agat Bay and Apra Harbor were also frequently polluted. Unfortunately, foreign visitors to Guam rarely read the local newspapers to learn which beaches are polluted. Nor do the hotels inform them.

Thermal power plants also adversely affect the marine environment in Guam. These plants have cooling systems that require the intake and discharge of large volumes of ocean water. The intake usually traps and kills fish and other marine organisms that get sucked into the system and caught

on the screens (Carpenter and Maragos 1989, 161). Those organisms which make it through the screens are killed by the cooling process or by chemicals *added* to the water to prevent organisms from settling on the inside of pipes and clogging *the* system (Carpenter and Maragos 1989, 161). Dispersal of the coolant into nearshore *waters* alters the temperature and introduces the chemical poisons into the aquatic environment (Carpenter and Maragos 1989, 161). The possibility of accidental discharges of chemicals, such as occurred in the early 1980s, continues to exist (Zucker 1984, 6).

In addition, thermal power plants require the storage, transfer and handling of fuel oil, creating numerous opportunities for spills. More than 70% of oil in the marine environment results from the every-day, operational small spills of shipping and handling (Carpenter and Maragos 1989, 167). Several large oil spills, one killing several acres of mangroves, have already been documented on Guam (Wiles and Ritter 1993, 145-6). The future does not look much brighter. With the residential population anticipated to double in the next 20 years and the number of tourists to more than triple, the demand for energy and hence for additional power stations will drastically increase. So, too, will the potential for accidents.

Tourist Activities Degrade the Marine Environment

Excessive numbers of tourists in a small island setting also directly degrade the marine environment. Most visitors to Guam come to swim in the

ocean, scuba dive, jet ski, snorkel and to collect natural souvenirs. In small numbers, these activities could be absorbed by the environment. But with the numbers of tourists on Guam the impacts are serious.

Day after day, hundreds of snorkelers swim along the reefs in Tumon and Agana Bays, walking on the reefs, feeding fish and collecting live coral and shells (USFWS 1993, 19). Snorkelers wade out onto reef flats, often unaware that they are walking on living organisms. Studies indicate that the damage they cause by trampling can be severe (Hawkins and Roberts 1993, 25). It has been estimated that a "10-minute walk over a coral reef can destroy as many years of coral growth" (Beller, d'Ayala and Hein 1990, 97). Fish feeding alters the fish population structure on the reef by favoring certain species. Collecting live coral and shells depletes certain species. Uneducated or uncontrolled divers also cause irreparable damage to reefs at more remote locations with fin motions or attempts to steady themselves by holding onto the reef (Snow 1991, 281).

Tourists on jet skis, circling buoys at several locations in Agana Bay, churn the water of the lagoon and increase turbidity. Fish and coral reef populations are compromised by these stresses to their habitats (Carpenter and Maragos 1989, 250).

Boats carry scores of tourists each day to off-shore reefs for diving and fishing. The boats drop anchors onto coral reefs. Double Reef, north of Tumon Bay, and Apra Harbor are especially damaged by this activity (Guam

Territorial Planning Commission 1993b, 63). There are no public waste pump facilities for boats on Guam. As a result, instead of dumping waste three miles out or taking it home for disposal, it is often illegally dumped in nearshore waters. Boats also discharge bilge and gasoline residues into nearshore waters.

Underwater Construction Activities

Construction activities related to tourism also occur in the ocean, impacting aquatic communities directly. Perhaps the most damaging underwater activity on Guam up to the present is that of dredging to create a swimming holes in front of hotels. The Guam Hilton, the Nikko, the Onward Agana and probably other hotels have dredged in Tumon and Agana Bays. Dredging is also done in Apra Harbor and the new Agat marina to improve boating and cruise ship navigation.

The direct impacts of dredging are increased turbidity, sedimentation and destruction of bottom-dwelling creatures. Indirectly, it leads to long-term degradation of water quality, loss of species, and toxicity (either on land or at sea) from the disposal of dredged material (Carpenter and Maragos 1989, 205).

The construction of underwater tourist attractions also adversely affects the marine environment (Carpenter and Maragos 1989, 205). This is an activity that has just begun on Guam. One project is currently in the

construction phase and another is awaiting approval. Pilings for the first, an underwater observatory, are being pounded into sand and reef at Piti, where six depressions provide protected prime habitat for reef animals, a high diversity of fish and mollusks and abundant sea grasses (Guam Territorial Planning Commission 1993b, 60). Construction activities will undoubtedly generate silt, destroy habitats, introduce toxins and impair the normal functioning of the community (Carpenter and Maragos 1989, 205). The placing of the observatory will permanently change circulation patterns in Piti Bay, and perhaps alter the feeding dynamics of the coral animals and filter feeders.

The second tourist attraction, a replica of a sunken Spanish galleon, is proposed for Cocos Lagoon. This area was identified as unique and worthy of preservation as early as 1965:

Cocos Island, the large reef area between the island and the mainland and selected land at Merizo, should be included in a large territorial park. The outstanding land and marine resources of this area make it one of the highest priority sites for acquisition....(Guam Territorial Planning Commission 1965, 71).

Numerous government plans and documents since that time, including the Survey and 1978 Species Inventory of Representative Pristine Marine Communities on Guam, have reaffirmed the area's special qualities and recommended its protection. It is an area characterized by an aqua lagoon, mangrove forests and seagrass beds. Endangered sea turtles forage there, and juvenile fish find food and protection.

Placement of a sunken ship will alter circulation patterns in the lagoon, threatening seagrass communities (Clark 1991, 119). It will attract numbers of tourists, potentially disturbing aquatic life, in particular the foraging patterns of endangered sea turtles. The location may obstruct the migration of pelagic fish species moving from their protected nurseries in the seagrass beds and mangroves to open waters.

The Results of Degraded Coastal Waters

According to the 1993 Land Use Plan for Guam, there are significant signs of deterioration of Guam's coastal waters, especially in Tumon Bay, Tanguisson, Agana Bay, Apra Harbor, Pago Bay and Cetti Bay (Guam Territorial Planning Commission 1993a, 9). One sign is the decline of Guam's coral reefs. Another is the decline of its nearshore fisheries.

Coral reef fertility in Guam's nearshore waters has dropped drastically. There are essentially no new colonies being established, and growth of existing colonies is sluggish. In a study conducted at the University of Guam, it was determined that coral specimens subjected to runoff initially experienced a 50% reduction in fertility (Amesbury 1990, 6). If the specimens remained in the polluted water, fewer than five percent developed.

Some of Guam's reefs have lost 90-95% of their coral habitats in the last five years alone (Guam Territorial Planning Commission 1993b, 66). If stress on the corals continues, they will be unable to rebound following

natural disturbances such as an infestation of the Crown-of-Thorn starfish or damage from typhoons. The loss of the reefs around Guam would impact tourism, fisheries and the viability of the coastline itself (Carpenter and Maragos 1989, 250).

Degradation of Guam's coastal waters has had a second significant effect: the total collapse of several nearshore fisheries. Between 1985 and 1991, harvests of popular food fish dropped precipitously. For instance, the 1991 harvest of emperor fish was only 57% of the 1985 harvest; goatfish, only 53%; surgeonfish, only 38% and trevally, only 29% (see Figure 10). In addition, the size of the harvested fish has declined (Davis 1993a). Marine biologists attribute these declines to a drop in fertility due to degraded coastal waters and to overharvesting (Davis 1993a).

Summary

Mass tourism has had an enormous impact on the environment of Guam. On the land, the construction and operation of tourist facilities, the activities of tourists and the demands of the tourist-induced population have caused a depletion of natural vegetation, a loss of biodiversity and wildlife habitat, serious erosion, increased flooding and depletion of species. Tourism-inflated land prices make it extremely unlikely that any remaining natural areas will be preserved.

The quantity and quality of fresh water resources also have been

Trends in Fish Catch Samples, 1987-1991

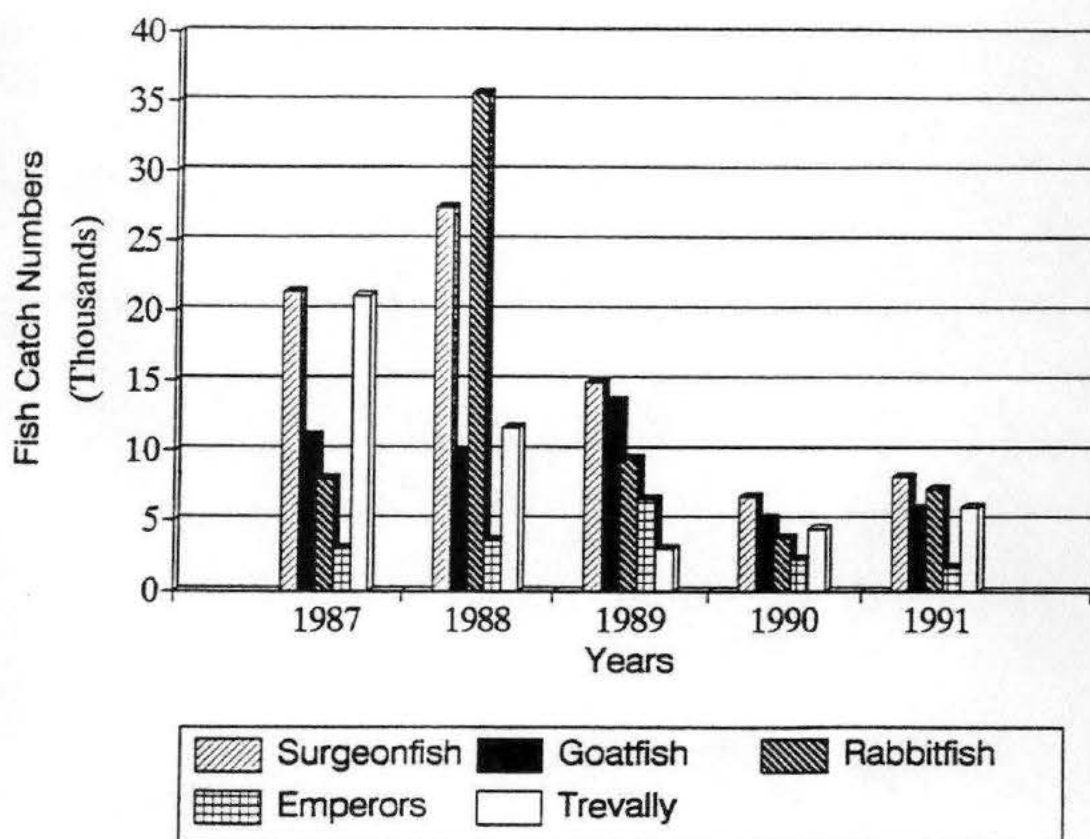


Figure 10. Declining populations of reef fish of Guam, 1987-1991 (Data from Davis, 1993a.)

compromised by tourism development. Development activities destroy watersheds and alter the permeability of recharge areas, thus altering water flow to underground aquifers and surface water supplies. In addition, tourists and their activities consume exceptionally high quantities of fresh water. Tourism development also reduces the quality of fresh water resources by its use of pesticides, fertilizers and other chemicals, and indirectly by inducing development over the aquifer.

Perhaps most damaged by tourism, however, is nearshore water quality. Tourism development increases stormwater runoff into nearshore waters and contributes to the decreased quality of that runoff. It generates underwater construction of marinas, swimming holes and other tourist attractions. It contributes significantly to the effluents from wastewater treatment and thermal power plants. It may increase the toxicity of wastewater. It encourages tourist activities such as snorkeling, diving, boating and souvenir hunting. All of these tourism-related activities, done frequently and in concentrated areas, degrade coastal water quality, thus threatening marine communities. In fact, a high percentage of Guam's reefs are no longer alive, and many fish species are declining.

The magnitude of these impacts relates directly to the scale and pace of tourism development on Guam. Tourism has grown very rapidly on Guam; it is very large-scale. It has already had an enormous impact on Guam's ecosystems. To consider tripling or quadrupling the size of tourism on Guam

is unthinkable. Yet that is what is planned.

CHAPTER VIII

ANALYSIS

Unquestionably, Guam's natural environment has been severely and, in some cases irreparably, damaged by tourism development. Environmental problems were recognized as early as 1973, five years after tourism began, and have continued to the present. Over the years, concerned government leaders and members of the public pointed to the problems and suggested remedies. Numerous plans were written that recommended control of tourism and regulations to mitigate or avoid damage to the natural systems, but all these failed to effectively protect Guam's environment. This chapter addresses itself to an analysis of why Guam was unable to control tourism and protect the environment.

The Role of Private Enterprise

Tourism is a private sector economic activity. While the Government of Guam has provided incentives for growth, it has basically allowed the industry to develop within a free market atmosphere. Since a healthy environment is vital to tourism's future on Guam, it would be logical to assume that normal market mechanisms would ensure that environmental

degradation did not take place. However this is not the case for several reasons.

The primary aim of resort developers is maximizing short-term profits. Typically, as soon as the economic incentives offered by governments end and profits begin to drop, many developers sell out (Pearce 1991, 89). They sell to locals or to a government that is anxious to preserve the industry. On Guam, economic incentives (Qualifying Certificates) were offered for up to 20 years. Within that time frame, investors could develop a property, exploit and pollute the natural resources, make a profit and sell before their profits were threatened by the slowly-developing environmental problems. The tourism industry concerns itself with the environment primarily when environmental problems impact short-term profits.

Exacerbating the industry's focus on short-term profits is the fact that tourism on Guam is dominated by foreign investors. Off-islanders hold controlling interest in all major hotel developments (Sablan 1994). Investors who live off island are not as concerned about the long-term prospects of the island and its people as locals might be. They do not have a love for the "homeland" that most Chamorros do.

Finally, the *Tragedy of the Commons*, first described in 1968 by biologist Garrett Hardin, applies to the tourism industry on Guam. In Hardin's example, English villagers try to maximize their own gain by grazing more sheep on the commons, until overgrazing destroys the commons for all. In

the tourism industry on Guam, developers try to maximize their own gain by building more resorts on the commons--the beaches, ocean, rivers and natural settings of Guam. They will do this until these natural resources are ruined for themselves and everyone else. In the meantime, they will have made their profit. There are no market-driven safeguards for common-property resources, which are owned by none and used by all (Miller 1994, 14).

Thus it is evident that in the case of tourism development on Guam, the market system does not protect the environment and, in the case of common-property resources, actually contributes to its degradation. Recognizing the failure of the market system to protect the environment where tourism is concerned, the Organization for Economic Co-operation and Development (OECD) concludes that it is the responsibility of governments to ensure that the natural environment is maintained (OECD 1980, 20).

Government's Role in Protecting the Environment

The Government of Guam has taken some responsibility for protecting the environment. Over the past two decades especially, its various agencies (Guam Environmental Protection Agency, Division of Aquatic and Wildlife Resources, Guam Soil and Conservation Service, University of Guam, Guam Coastal Management Program and others) have developed data and adequately identified environmental problems. These same agencies have

made very appropriate recommendations for conserving resources, mitigating environmental damage and controlling development. Other government agencies have incorporated the data and suggestions in land use and economic development plans at various junctures. As a result, various environmental regulations and laws have been enacted. Yet tourism remains out of control, and the environment has progressively deteriorated. Why have the government's efforts failed?

Over the years, Government of Guam employees have reflected on this very question. In various documents they have concluded that regulations on tourism development have failed because of certain organizational problems. They point to Guam's political status (which does not give the Territory full control of its resources), a lack of coordination among agencies, understaffing, a lack of technical training for staff, insufficient data, inconsistent laws and regulations, and lack of time to review project proposals. While these and other "organizational" problems probably do contribute to Guam's inability to gain control of tourism and protect the natural environment, they alone provide an inadequate explanation.

There are deeper problems. First, since the beginning of tourism development, Guam has followed a development strategy of economic growth that puts environmental (and social, for that matter) concerns in second place. This is evident in the wording and implementation of government plans and in government actions. Second, there is a lack of political will

among elected leaders to protect the environment for future generations. Several reasons exist for this situation. Third, in contrast to people in the continental United States, the citizens of Guam do not have a tradition of public action regarding issues of concern. Thus they do not monitor industrial impacts on the environment nor do they force the government to uphold its laws. Each of these ideas need further elaboration.

Preoccupation with Growth

Initially Guam focused on economic growth as a development strategy. This was natural because Guam's drive for development emerged in the sixties, a time heavily influenced by the writings of Walt W. Rostow, particularly his *Stages of Economic Growth* (1960). Rostow and his followers believed nations could develop--defined as gaining material wealth--by imitating the economic growth process of industrial societies. Nations could gauge how well they were doing by measuring the annual increase in per capita Gross National Product (GNP)--the sum of the values of all the goods and services produced during the year.

This approach to development seemed to work for Guam. Tourism took off like a rocket, and annual increases in per capita Gross Island Product were impressive.

In the decades following the sixties, however, serious questions arose in development literature about the focus on economic growth and material

well-being (Sachs 1992, 12-16). An exclusive focus on economic growth seemed to accentuate the disparity between rich and poor; it discounted the environment; it failed to consider development of humans.

Moreover, the economic growth development strategy required continual growth. Limits to growth were not considered. This is a particularly significant omission where small islands are concerned. While economic development on a continent can proceed for some time until resource limits are reached, growth on a small island cannot.

The measures of Rostow's concept of development as economic growth were also brought into question. They often masked environmental and social problems. For example, the building of a hotel would increase a nation's GNP, meaning that it was a wealthier nation. But there was no way to account for the loss to the nation in natural vegetation, species or the functions they performed (such as flood control) that such a development entailed. If a nation polluted its sole aquifer pursuing some economic development project, and had to build a desalinization plant, that catastrophe would be reflected by an increased GNP. The desalinization plant would be counted as a positive on the balance sheet; the loss of the fresh water resource would not be considered.

Over the next two decades in response to these concerns, development literature explored broader concepts of development. In 1970, the UN called for full integration of economic and social components in

development planning (Sachs 1992, 14). The Club of Rome in 1972 introduced the concept that there were limits to the growth that mankind could attain in a finite world. In 1974 the Declaration of Cocoyoc proposed that the purpose of development was developing man, not things (Sachs 1992, 14). New measures of development appeared that stressed improvement in a population's health and education status, the distribution of income among the people and the health of the environment.

Most recently, the concept of sustainable economic development made its appearance in development literature. While there are many definitions of sustainable development, for the purposes of this paper, it is defined as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987, 8).

As the concept of development gradually evolved in the world arena, the Government of Guam failed to adjust its thinking and policies accordingly. It did incorporate into plans some of the new language of the development field. But the government's primary focus continued to be on economic growth, growth that in the long-run has been destructive to the environment and is not sustainable.

Thus, over the 28 years of tourism development, the government consistently stood for economic growth when faced with a decision between growth and environmental protection. While land use and economic development plans repeatedly spoke of limited resources, an infrastructure

overwhelmed by growth, and the need to protect unique ecosystems, the growth mentality prevailed. The basic thrust of each plan was to accommodate the growth, to stretch the resources, to use the environment optimally (as opposed to allowing it to remain in its natural state), and to grow.

For example, growth prevailed over the environment in 1985 when the Tumon Bay Master Plan proposed "environmental design guidelines" for development, but hastened to add that the guidelines were not intended to be restrictive (Guam 1985, 1). Indeed they were not. The plan mentions that "unique ecological areas and significant stands of tropical vegetation should be preserved," yet today one would be hard pressed to find any "significant stand of tropical vegetation" in the Tumon area.

The 1988-1993 Overall Economic Development Plan acknowledged that "Guam...has limited resources" and that it should no longer focus on expansion of the economy just for the "sake of growth" (Guam Department of Commerce 1988, 198). But it went on to recommend the implementation of a tourism development plan for the as yet undeveloped southern part of Guam (Guam Department of Commerce 1988, 1, 23).

Similar inconsistencies appear more recently. The 1993 Land Use Plan points to "economic growth without adequate planning controls" and seeks to ensure that the "people of Guam are not subjected to unbridled and unmanageable growth" (Guam Territorial Planning Commission 1993b, 1-2).

It points to citizen concerns about contamination of the aquifer, polluted beaches, dying reefs and erosion (Guam Territorial Planning Commission 1993b, 5). Yet, the entire plan is focused on planning for the expected tripling in numbers of tourists and doubling of the resident population by 2015. The plan does not include mechanisms for halting the inflow of immigrants or tourists or slowing the growth of hotel construction because that would likely slow the economy.

The dominance of economic growth concerns over environmental concerns is evident in other government actions. Economic growth prevailed when the Guam Legislature took it upon itself to rezone property over the aquifer from agricultural use to light industrial use. Other pieces of special interest legislation were passed favoring development-oriented activities which did not meet standards imposed on activities reviewed through proper channels (U.S. Department of Commerce 1979, 52).

Growth was the dominant concern when, according to a GEPA staff person, the Territorial Land Use Commission approved a certain development, ignoring the comments of the Guam Environmental Protection Agency and other government agencies concerning the negative impacts. It prevailed when fines for environmental damage were established that were inconsequential to developers. Economic growth was the top priority when politicians opposed a refuge that would protect the struggling remnants of Guam's wildlife, so that new resorts can be built.

Given the rapid pace of tourism development on Guam, it is hard to understand why growth is such an obsession. Yet, whenever a slight decline in tourist arrivals occurred, providing breathing room from the too-rapid increases normally experienced, it caused alarm and led directly to more aggressive efforts to attract tourists.

For instance, visitor numbers dropped in 1975 and again in 1976 offering an opportunity to gain control of the industry and its impacts on the environment. In 1973, the Managing Director of the Guam Visitors Bureau himself spoke of the environmental and social problems which already existed:

Of late, the burgeoning growth of tourism threatens to drown Guam in its own success. There are some stark realities in respect to tourism which must be faced or the dream of promise will become a nightmare. Partly as a result of tourism, Guam has a higher standard of living than previously, but as the rural life-style of yesterday becomes more urban there are disabilities. The cost of living is increasing apace with higher wages; local control of land is being wrested from Guamanians; and sensitivity to the loss of cultural and natural heritage is lacking...Prosperity need not be purchased with the loss of human dignity and the despoliation of nature (Unpingco 1975, 107).

Yet, concerned that the industry was declining--that the Gross Island Product might fall, the Guam Visitors Bureau commissioned a study to determine how the industry might be bolstered and launched an aggressive new campaign in the late 1970s (Warner 1978, 163).

This situation repeated itself when visitor numbers declined again in 1991 and in 1993. Despite the fact that visitor numbers already approached one million and that evidence of serious environmental damage existed, the

Government of Guam, the Guam Visitors Bureau and even the federal government continued to fuel tourism by funding aggressive marketing campaigns in Korea and Taiwan, and by proposing reactivation of the Qualifying Certificate program (which had been discontinued for hotel development in 1989) (Sablan 1994).

Tourism development on Guam is being pursued without consideration of the physical (or social) limits to growth. For instance, the 1993 Land Use Plan acknowledges that there will be insufficient fresh water resources if the proposed resort developments are completed, and the resident and tourist populations increase as expected (Guam Territorial Planning Commission 1993c, 88). Yet little if any thought is given to reducing development activity, tourist numbers and immigration to a level that can be sustained comfortably by the fresh water resources. Instead, efforts are directed at accommodating the estimated increases. Viewed from another perspective, when will there be enough hotels? When will there be enough golf courses? How many other underwater attractions will it take to satisfy the tourists? What is the objective of all this growth?

It seems the market system will decide when there has been sufficient growth in tourism. As if foreseeing the future, John D. Gilliam, Director of Planning for the Government of Guam in 1973 made the following statement:

(T)he market would determine when a situation of overbuilding had occurred. It would not be determined by those who issue building permits, or by those in the government who might be able to influence the issuance of building permits....(I)t would

be...developers who would decide when the point of saturation was reached, and that it would be the developers who would solve the problem by pulling out their investments and investing elsewhere the risk capital they had accumulated in order to earn a high rate of return (Gilliam 1975, 128).

Unfortunately, that may be when tourists no longer want to visit Guam because of the degraded environment, and when there is little left on which the people of Guam might base an economy.

As the OECD determined in 1980, the market system cannot be relied upon to control the impacts of tourism on the environment (OECD 1980, 20). It is the government's responsibility. On Guam, that responsibility has not been fully accepted.

Certainly no one would suggest that tourism development on Guam can continue forever given the island's small size and limited resources. If it cannot, where is the stopping point? The leaders of Guam have never addressed this issue. The planners of Guam do not address this issue. No one seems to. There is no collective vision on an "end point," a place where Guam wants to be. Despite the warnings of planners in 1987, "expansion for the sake of growth" seems to be the priority on Guam (Guam Department of Commerce 1988, 4).

The obsession with economic growth, then, is one significant reason why government plans and efforts to protect the environment were never effectively implemented. The leaders of Guam take full responsibility for the economic development of the island; they do not take full responsibility for

protecting the environment.

The Lack of Political Will Among Leaders

The effectiveness of environmental protection on Guam hinges on leaders who are knowledgeable about ecosystems, committed to the long-term economic and physical health of the island, and willing to place the interests of the island as a whole over the interests of their family and friends. This is a tall order for any government, but it is especially difficult for Guam.

As is true on the U.S. continent, many of Guam's elected and appointed officials do not have adequate knowledge of environmental issues. They do not understand the functions and roles of various parts of the island ecosystems; they do not fully grasp the interconnections between the flora, fauna and physical components of the ecosystems. This is evident in many decisions: rezoning for industrial use over the aquifer; approving the underwater observatory at Piti; opposing the proposed wildlife refuge. Were they to understand the full environmental ramifications of these decisions, they would probably prefer to err on the side of caution and not on the side of economic growth.

Long-range thinking is also difficult for Guam's leaders, as it is for all of us. Environmental damage happens in slow motion. It is insidious, incremental and synergistic. Each environmental insult is not seen as

materially harming the ecosystem. But over time and collectively, many insults can be catastrophic. Thus when a government official is asked to approve one variance or overlook one law, it doesn't seem like much damage will be done to the environment. However, this happens over and over. The focus on short-term economic growth combined with a slow motion change in the environment make it difficult for officials to oppose individual projects.

Finally, among Chamorros there is a cultural obligation to care for one's family and friends which transcends one's obligation to the island as a whole. This tradition is one which has served Pacific island people well throughout their history. However, practiced within the imposed western-style governmental system, it poses problems. It creates policy problems that have been recognized by others:

On small island, most people are either closely related or know each other well...It is much more difficult to formulate and apply policies on their own merits, and decisions are inevitably highly influenced by personal and kinship considerations (Beller, d'Ayala and Hein 1990, 5).

Thus, Guam's at-large legislators may find it especially difficult to make decisions that adversely affect family and friends, but benefit the island people as a whole. The importance of this problem for Guam's leaders should not be underestimated.

For all of these reasons, then, it has been difficult for Guam's leaders to take a strong stand for the environment if it means opposing economic growth.

The Lack of Public Pressure

In the continental United States, public pressure groups force political leaders to uphold environmental laws, to follow land use plans and to regulate industries. Most renowned, perhaps, is the case of Love Canal where citizens organized to pressure government to close the school and evacuate the community because of hazardous chemicals oozing from the ground. In other cases in the U.S. and around the world, citizen groups monitor the activities of industry, fight for endangered species and even block logging operations with their bodies. These groups are a powerful force for the environment.

It is clear that the people of Guam are concerned about the environment. In many respects, the Chamorros are more openly passionate about their land and its wildlife than are those of us on the continent. Evidence of this lies in the speeches made at the 1973 Pacific Science Association meeting (parts of which have been quoted throughout this paper). More evidence surfaced at a series of public hearings held in August 1989 about tourism development in southern Guam. The following comments were received from various speakers (Workman 1989, 4):

The value of wildlife is priceless.

This area is worth more to humanity in its present state.

When I hear luxury hotel, I think that from the sound of it there is not going to be many taotaos living in it.

Think how much natural land must be cleared just so some affluent people can play golf.

In some cases, however, the instinctual concern for the land is not supported by specific knowledge, and therefore succumbs to economic arguments. Many people on Guam, for instance, are unaware of the complex interactions within and among ecosystems. They do not understand that removal of vegetation hastens soil erosion, and that this may have repercussions in coral reef communities. Over 20 years ago, a Chamorro leader commented

Without knowledge, understanding, and respect for natural resources, the ordinary citizen tends to disregard, despoil, or overexploit the very ecosystem of which he is an integral part (Perez 1975, 92).

This remains true today.

Even with a knowledge of the environment, there is a weak tradition of citizen action on Guam. In fact, it is culturally unacceptable for Chamorros to form protests groups--for example, to monitor the tourism industry, or to speak out collectively on the Territorial Land Use Commission's frequent issuance of variances. There is not a confrontational society. As a result, only a few environmentally-oriented nonprofit organizations exist on Guam, and those are not dominated by Chamorros. This sometimes has negative impacts for the environment. For instance, recently the local and national Audubon Societies initiated a push for the establishment of a federal wildlife refuge on Guam. Its actions were quickly dubbed as those of a "narrow

interest group" that did not trust the Chamorro people to protect their own environment (Eastly 1994b, 42).

Summary

This chapter opened with the question, why has Guam been unable to protect its environment from the impacts of tourism? We have seen that private enterprise on Guam does not protect the environment. Nor do citizens groups take responsibility for this task. The government is the sole entity positioned to control tourism development and protect the environment of Guam. But it considers economic growth a higher priority. It has not yet recognized the interrelationships among long-term economic well-being, a healthy environment and a healthy society. Moreover, many of Guam's elected and appointed leaders lack the political will to protect the environment and to consider the long-term quality of life of all the residents. Often protecting the environment means going against cultural obligations to family and friends, or going against the short-term interests of some constituents.

Thus, tourism remains uncontrolled, programmed for another phase of exponential growth, and the environment suffers. In the end, so too will the people of Guam.

CHAPTER IX

CONCLUSION

Recommendations

The path of economic growth Guam has chosen to follow since 1967 is leading to environmental and economic disaster. If tourism development and population growth continue at the pace that is projected, natural resources will be depleted further and the ability of the environment to absorb wastes will be totally overwhelmed until such time as tourists no longer want to come to Guam.

This will mean a severe economic downturn because of Guam's heavy dependence on the tourism industry. Environmental deterioration may be so great that other economic alternatives, such as farming or fishing, are no longer viable. This picture of Guam's future does not have to become reality. A decision can be made today to turn away from the path of economic growth to one of sustainable development. Choosing this new path requires enlightened leadership, political courage and a willingness on the part of the people of Guam to accept difficult economic times in the short-term in order to achieve human development and economic stability in the long-term.

The first step along the path to sustainable development is for

government leaders to acknowledge and accept the fact that there are limits to the growth of tourism (or any other industry) on Guam. Most fundamentally, that limit is set by the limits of Guam's natural resource base and its waste assimilation capacity--by its environment. There are sufficient scientific data already gathered to establish rough estimates of these environmental limits. Due to a variety of uncertainties, it is critical that a conservative limit be set, and that all future planning should be bound by those limits.

The second step toward sustainable development is environmental education for all. Due to the urgency of the situation on Guam, immediate attention must be directed to educating adults. There is not enough time to develop educational programs in the public schools and to wait until today's children become tomorrow's leaders. The existing public environmental education efforts of government agencies must be integrated in a new easy-to-understand format to inform Government of Guam elected leaders and staff, the public, business leaders and tourists of the interdependence of Guam's ecosystems and human activities. An intensive environmental education program must also be integrated into the public and private schools on Guam. It is critical that people of Guam understand the relationships between living things and their environments:

It is the only real basis for control, for predicting consequences of any use or alteration, and for rational sustained program for permanent habitation of any area by man (Fosberg 1992, 9).

Finally, once an understanding of environmental interrelationships is achieved, a new vision of the future must be created by the people of Guam, based on environmental realities, concerns for future generations and the needs of the people today. The people must come to terms with the trade offs related to economic development. What level of environmental amenities would they like to retain as they struggle to obtain a higher standard of living? Considering the standard of living that exists on Guam today, is a higher standard of living what is needed? Or is it that some specific areas need further development?

For instance, a vision might include greater attention to providing dependable utilities to all residents, improved education (content and facilities) to the children, and greater attention to healthy lifestyle, all of which are in dire need of improvement on Guam. Future planning must be aimed at achieving a vision that is sustainable within the physical constraints of the island. "The challenge is to strike a balance that preserves the island's natural web of life, while satisfying the legitimate need to develop" (Tolba 1987, 89).

Specifically, the Governor of Guam should create a position of Environmental Adviser with rank equal to that of the other advisers to the Governor. (This could be the head of GEPA, however GEPA is largely U.S. funded and also focuses primarily on environmental harm to humans, rather than on preserving ecological integrity.) The Environmental Adviser would be

responsible for 1) establishing an island-wide environmental education program; 2) aggregating scientific data about the environment from the various agencies on Guam (perhaps through a forum of an Environmental Council on which all such agencies are represented), and presenting it to the public and to government leaders on a regular basis (minimally, an Annual State of the Environment Address and quarterly reports); 3) working with citizen's groups to encourage the monitoring and evaluation of impacts to the environment in local areas; 4) advising the Governor, legislators, mayors and commissioners of environmental consequences of various decisions. The Environmental Adviser might also oversee special projects, such as the development of an interpretive center to teach residents and visitors alike about the value of the various biomes on Guam. The creation of this position would raise public awareness of the environment and help to raise it to a higher priority.

Second, the Governor must call for an immediate moratorium on tourism development, including all projects currently awaiting approval. The moratorium would stay in effect until such time as it is determined that present development has not exceeded the natural resource base, that present growth has been assimilated and a new vision has been developed for where tourism is going. This would undoubtedly entail village meetings as well as island-wide conferences. Qualifying certificates should be permanently discontinued for the tourism industry. The Governor would also

convene a team of government officials (including resource managers) to establish strict controls and requirements for any future tourism development, as well as the tools to implement those guidelines. Requirements might include the use of solar power for heating hot water in the hotels; installation of water saving devices; use of gray water systems for landscaping and other new technological means for conserving resources. Another might be that developers be required to contribute a percentage of the cost of their development to the preservation of land for public parks and wildlife refuges.

The Guam Visitors Bureau, now dedicated primarily to marketing and promoting tourism in Pacific Rim countries, should rededicate itself to managing existing tourism as a sustainable industry. The Environmental Adviser and other resource managers can assist in this effort. Any marketing efforts should be aimed at maintaining the quality rather than expanding the size (making it better, not bigger) of the tourism industry until such time that it is determined that some expansion is sustainable.

Implementation of these recommendations would be an enormous step in the direction of attaining a sustainable level of development on Guam. For the most part, they are not new suggestions; many of them were made by Government of Guam officials over 20 years ago. However at that time, as well as now, the recommendations presuppose that the long-term health of the environment and society as a whole takes priority over all other considerations, and that the goals of tourism development be reevaluated in

terms of human development. Moreover, implementation presupposes a commitment of Guam's elected government officials to the long-term prosperity of the island people as a whole rather than the short-term prosperity of a few. If the political will exists, it can be done.

Unfortunately, the prospects of this happening on Guam are not good. Given the failure of efforts during the past 28 years on Guam, it is unlikely that Guam's leaders will suddenly "see the light" and take the steps necessary to redress the environmental problems. Moreover, the level of environmental awareness is insufficient to allow the necessary political will to be generated. Even more disconcerting is the fact that worldwide, there are very few successes in controlling tourism or its effects of the environment (Butler 1991, 205). As one author commented, "...it is very difficult to have a 'little tourism.' It is like being a little bit pregnant; it has a habit of growing and changing" (Butler 1991, 206).

Those Pacific island nations just now considering tourism as a development strategy would do well to consider at the outset the seemingly uncontrollable nature of the industry. Understanding this, small island states with few other alternatives might establish in advance the goals that tourism is expected to achieve. They might identify in advance the carrying capacity (environmental, social, cultural) of the islands. They might acquire and set aside in advance unique and fragile natural areas that will be available for present and future generations to enjoy. They might launch an

environmental education campaign. They might define a scale and pace of tourism development that is well within the estimated carrying capacity, and appropriate to the small size of the islands. In general, they must give a high priority to environmental concerns. It is far easier to plan for sustainable tourism development at the outset than to introduce it once mass tourism is established and environmental deterioration has begun.

Conclusion

This study has described how tourism developed on the island of Guam and how it impacts the environment. It also examined efforts by the Government of Guam to control the growth of tourism, efforts that were largely ineffectual. Finally, the study analyzed the obstacles to effective control of tourism and protection of the environment. It has not been an optimistic overview.

If Guam is to avoid the environmental and economic problems faced by many other tourist destinations, it must veer sharply away from its current path of economic growth and follow a more sustainable route to development, one that gives a higher priority to the environment. As more than 1,600 leading scientists from over 70 countries agreed in 1992:

Human beings and the natural world are on a collision course. Human activities inflict harsh and often irreversible damage on the environment and on critical resources. If not checked, many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life

in the manner that we know. Fundamental changes are urgent if we are to avoid the collision our present course will bring about. (Committee for the National Institute for the Environment 1994, 105).

Guam is on that collision course.

APPENDIX A

SUBJECTS INTERVIEWED

JULY - SEPTEMBER 1993

Government Employees

Anonymous (individual asked not to be identified)
Guam Environmental Protection Agency

Robert Beck, Wildlife Supervisor
Guam Division of Aquatic and Wildlife Resources

Gerald Davis, Fisheries Supervisor
Guam Division of Aquatic and Wildlife Resources

Charles Crisostomo, Administrator
Guam Economic Development Authority

Joan Perry, Administrator
U.S. Department of Agriculture, Soil Conservation Service

Lynn Raulerson, Professor of Botany
University of Guam

Robert Richmond, Professor of Marine Biology
University of Guam

Linda Sablan, Planner III
Guam Department of Commerce

Randall Workman, Professor of Sociology
University of Guam

SUBJECTS INTERVIEWED

JULY - SEPTEMBER 1993

Others

Lee Carter, Member of the Board of Directors
Guam Environmental Protection Agency

Phil Giles, Executive Director
Marianas Resource Conservation and Development Council

Chris Koffend, Operations Manager
Commercial Sanitation Systems, Inc.

Kenneth Orcutt, President
Marianas Audubon Society

Paul Tobiason, President
Recycling Association of Guam

Nancy Weare, Secretary
Recycling Association of Guam

APPENDIX B

DETERMINATION OF TOURISM-INDUCED POPULATION

There is no way to determine precisely the population growth induced by tourism or its impact. However, for the purposes of this paper it was important to quantify tourism-induced population. Only by knowing its approximate size could some idea of its impact and significance be acquired.

I approached the task in the following manner. First, I looked at the percentage of foreign-born population on Guam prior to the introduction of tourism. This, I assumed to be a baseline of what the foreign-born population on Guam would be today had no tourism development occurred. According to the U.S. Census of 1960, foreign-born represented 14% of Guam's population. Foreign-born were those people living on Guam who were not U.S. citizens. (The remaining 86% of the population, therefore, were born on Guam or came from the continental U.S. or one of its territories.)

Second, I assumed that had Guam's economy remained a mix of subsistence agriculture/fishing and civilian employment with the military and Government of Guam as it was in 1960, there would have been little incentive for higher percentages of foreigners to immigrate to Guam. Other Pacific islands with subsistence economies and a military presence, such as Wake and Midway, did not attract large numbers of foreigners.

Third, I looked at the foreign-born population on Guam today. According to the U.S. Census of 1990, it represents 31% of the population. I reason that the difference between the 31% foreign-born on island today and the 14% foreign-born on island in 1960 (that is, 17%) is due to the economic boom caused by tourism development.

Therefore, I use a figure of 17% for the tourism-induced population on Guam today. Without doubt, this figure is a conservative one. It does not include, for instance, substantial tourism-induced immigration from the continental United States as those numbers could not be separated from the military presence.

APPENDIX C

ENDANGERED AND THREATENED WILDLIFE OF GUAM

Common name	Scientific name	Official Federal status	Official Guam status	Comments on Guam population
NATIVE FOREST BIRDS:				
Nightingale reed-warbler	<u>Acrocephalus l. luscini</u>	Endangered	Endangered	May be extinct.
Micronesian starling	<u>Aplonis opaca guami</u>	-	Endangered	Uncommon.
Mariana crow	<u>Corvus kubaryi</u>	Endangered	Endangered	Fewer than 100 on Guam.
White-throated ground dove	<u>Gallicolumba x. xanthonura</u>	-	Endangered	Very rare in 1979. May be extinct on Guam.
Guam Micronesian kingfisher	<u>Halcyon c. cinnamomina</u>	Endangered	Endangered	Extirpated from the wild. Exist only in captive breeding populations.
Micronesian megapode	<u>Megapodius l. laperouse</u>	Endangered	Endangered	May be extinct on Guam.
Guam broadbill (=flycatcher)	<u>Myiagra freycineti</u>	Endangered	Endangered	May be extinct. Not seen since 1984.
Micronesian honeyeater	<u>Myzomela rubrata</u>	-	Endangered	May be extinct on Guam.
Mariana fruit dove	<u>Ptilinopus roseicapilla</u>	-	Endangered	Very rare on Guam in limestone forests.
Guam rail	<u>Rallus owstoni</u>	Endangered	Endangered	Extirpated from the wild. Exist only in captive breeding populations.
Rufous-fronted fantail	<u>Rhipidura rufifrons</u>	-	Endangered	May be extinct on Guam. Not seen since 1984.
Guam bridled white-eye	<u>Zosterops c. conspicillatus</u>	Endangered	Endangered	May be extinct. Not seen since 1983.
NATIVE CAVE SWIFTLETS:				
Vanikoro swiftlet	<u>Aerodramus vanikorensis bartschi</u>	Endangered	Endangered	Rare. One colony left on southern Guam.
NATIVE WATERFOWL:				
Mariana mallard	<u>Anas platyrhynchos oustaleti</u>	Endangered	Endangered	May be extinct on Guam.
Mariana common moorhen	<u>Gallinula chloropus guami</u>	Endangered	Endangered	Rare. Approximately 150 remain on Guam.
NATIVE MAMMALS:				
Pacific sheath-tailed bat	<u>Emballonura semicaudata</u>	-	Endangered	May be extinct on Guam.
Mariana fruit bat	<u>Pteropus mariannus mariannus</u>	Endangered	Endangered	One colony left on northern Guam. Less than 400 individuals on Guam.
Little Mariana fruit bat	<u>Pteropus tokudae</u>	Endangered	Endangered	May be extinct.
SEA TURTLES:				
Loggerhead sea turtle	<u>Caretta caretta</u>	Threatened	Threatened	
Green sea turtle	<u>Chelonia mydas</u>	Threatened	Threatened	Nest on northern Guam.
Leatherback sea turtle	<u>Dermochelys coriacea</u>	Endangered	Endangered	Accidental visitor.
Hawksbill sea turtle	<u>Eretmochelys imbricata</u>	Endangered	Endangered	
Olive (Pacific) ridley sea turtle	<u>Lepidochelys olivacea</u>	Threatened	Threatened	
NATIVE PLANTS:				
Tsatsa	<u>Cyathea lunulata</u>	-	Endangered	Rare.
Ufa	<u>Heritiera longipetiolata</u>	-	Endangered	Rare. Found on northern Guam.
Hayan or Tronkon (Pea family)	<u>Serianthes nelsonii</u>	Endangered	Endangered	One adult, 11 seedlings left in the wild.

Source: USFWS, 1993, Final Environmental Assessment for the Proposed Guam National Wildlife Refuge, Appendix A.

SOURCES CONSULTED

- Ahmad, Y.J., and G. K. Sammy. 1985. Guidelines to environmental impact assessment in developing countries. Toronto: Hodder and Stoughton.
- Amesbury, R. 1990. Guam's environment. Pacific Daily News (Guam). 9 September (Islander Section), 5.
- Anonymous, GEPA employee. 1993. Interview by author, 18-19 July, Guam. Handwritten notes in author's possession.
- Baines, G.B.K. 1982. South Pacific island tourism: Environmental costs and benefits of the Fijian example. In The impact of tourism development in the Pacific held by satellite, edited by F. Rajotte, 53-74. Canada: Environmental and Resource Studies Programme, Trent University.
- Bell, P.R.F., P.F. Greenfield, D. Hawker, and D. Connell. 1989. The impact of waste discharges on coral reef regions. Water, Science and Technology 21 (1): 121-130.
- Beller, W., P. d'Ayala, and P. Hein, eds. 1990. Sustainable development and environmental management on small islands, Man and the Biosphere Series, vol. 5. Paris, France: UNESCO and The Parthenon Publishing Group.
- Birkeland, C. 1984. Influence of topography of nearby land masses in combination with local water movement patterns on the nature of nearshore marine communities. In Productivity and processes in island marine ecosystems, 16-31. Paris, France: UNESCO.
- Bojo, J., K. Maler, and L. Unemo. 1992. Environmental development: An economics approach. The Netherlands: Kluwer Academic Publishers.
- Briassoulis, H., and J. van der Straaten, eds. 1992. Tourism and the environment: Regional, economic and policy issues. Boston: Kluwer Academic Publishers.

- Butler, R.W. 1991. Tourism, environment, and sustainable development. Environmental Conservation 18 (Autumn): 201-209.
- Carpenter, R.A., ed. 1983. Natural systems for development: What planners need to know. New York: MacMillan Publishing Company.
- Carpenter, R.A., and J.E. Maragos. 1989. How to assess environmental impacts on tropical islands and coastal areas. A training manual prepared for the South Pacific Regional Environment Programme (SPREP). Honolulu, Hawaii: East-West Center.
- Castro, F. 1990. Letter from GEPA to Ms. Elizabeth Sly, Manager of Agana Shopping Center, Agana, Guam. Copy in author's possession. Dated November 9.
- Cater, E., and B. Goodall. 1992. Must tourism destroy its base? In Environmental issues in the 1990s, ed. A.M. Mannion and S.R. Bowlby, 309-323. New York: John Wiley & Sons Ltd.
- Chiotis, G., and H. Coccossis. 1992. Tourist development and environmental protection in Greece. In Tourism and the environment, ed. H. Briassoulis and J. van der Straaten, 133-143. Boston: Kluwer Academic Publishers.
- Clark, J.R. 1991. Carrying capacity: Defining the limits to coastal tourism. In Proceedings of the 1990 congress on coastal and marine tourism: A symposium and workshop on balancing conservation and economic development held in Honolulu, Hawaii 25-31 May, 1990, ed. M.L. Miller and J. Auyong, 117-131. Newport, Oregon: National Coastal Resources Research and Development Institute.
- Cohen, E. 1978. Impact of tourism on the physical environment. Annals of Tourism Research 5 (2): 215-237.
- Committee for the National Institute for the Environment. 1994. A proposal to create a National Institute for the Environment: The environmental challenge. The Environmental Professional 16 (June):105-111.
- Convery, F.J., and S. Flanagan. 1992. Tourism and the environment--impacts and solutions. In Tourism and the environment, ed. H. Briassoulis and J. van der Straaten, 145-153. Boston: Kluwer Academic Publishers.

- Dasmann, R.F. 1982. The environmental impact of tourism. In The impact of tourism development in the Pacific held by satellite, edited by F. Rajotte, 48-52. Canada: Environmental and Resource Studies Programme, Trent University.
- Dasmann, R.F., J.P. Milton, and P.H. Freeman. 1973. Ecological principles for economic development. New York: John Wiley & Sons, Ltd.
- Davis, G. 1993a. Fish count survey, 1987-1991 (personal records).
- _____. 1993b. Guam turtle history (draft report).
- _____, DAWR fisheries supervisor. 1993c. Interview by author, 9 August, Guam. Handwritten notes in author's possession.
- Eastly, M. 1994a. Guam. Pacific Magazine (January/February): 39.
- Eastly, M. 1994b. Environment controversy picking up momentum. Pacific Magazine (January/February): 42-43.
- Economist, The. 1989. The business of going away. The Economist 311 (15 April): 73.
- Elliott, M. 1991. The pleasure principle. The Economist 318 (23 March): T3-T5.
- Fairbairn, T.I.J. 1990. The environment and development planning in small Pacific island countries. In Sustainable development and environmental management on small islands, Man and the Biosphere Series, vol. 5, ed. W. Beller, P. d'Ayala and P. Hein, 259-266. Paris, France: UNESCO and The Parthenon Publishing Group.
- Farrell, B.H., and D. Runyan. 1991. Ecology and tourism. Annals of Tourism Research 18 (1): 26-40.
- Fosberg, F.R. 1960. The vegetation of Micronesia. American Museum of Natural History 119 (February 22): 54-73.
- Fosberg, F.R., ed. 1963. Man's place in the island ecosystem: A symposium. Hawaii: Bishop Museum Press.

- Gilliam, J.D. 1975. Guam: Can the port be free when the economy is not? In The impact of urban centers in the Pacific: Papers from the theme symposium of the second inter-congress of the Pacific Science Association held at the University of Guam, Guam 20-25 May, 1973, edited by R.W. Force and B. Bishop, 123-129. Honolulu, Hawaii: Pacific Science Association.
- Guam. 1985. Tumon Bay master plan: Environmental design guidelines for development. Guam: Government of Guam.
- _____. Bureau of Outdoor Recreation. 1965. An outdoor recreation plan for Guam, by Paul Leach. Guam: Government of Guam.
- _____. Department of Commerce. 1988. The overall economic development plan for Guam, 1989-1993. Guam: Government of Guam.
- _____. Department of Commerce. 1991. 1991 Guam annual economic review. Guam: Government of Guam.
- _____. Territorial Planning Commission. 1993a. I tano'-ta: The land use plan for Guam (final draft). Guam: Government of Guam.
- _____. Territorial Planning Commission. 1993b. The land use plan: Technical report I (Inventory and analysis of existing conditions). Guam: Government of Guam.
- Guam Visitors Bureau. 1992a. 1992 accommodations and golf course inventory. Guam: Guam Visitors Bureau.
- _____. 1992b. Visitor industry summary. Guam: Guam Visitors Bureau.
- _____. 1977. Visitor statistics. Guam: Guam Visitors Bureau.
- _____. 1978. Visitor statistics. Guam: Guam Visitors Bureau.
- _____. 1979. Visitor statistics. Guam: Guam Visitors Bureau.
- _____. 1980. Visitor statistics. Guam: Guam Visitors Bureau.
- _____. 1981. Visitor statistics. Guam: Guam Visitors Bureau.
- _____. 1982. Visitor statistics. Guam: Guam Visitors Bureau.

- _____. 1983. Visitor statistics. Guam: Guam Visitors Bureau.
- Hamnett, M.P. 1990. Pacific islands resource development and environmental management. In Sustainable development and environmental management on small islands, Man and the Biosphere Series, vol. 5, ed. W. Beller, P. d'Ayala and P. Hein, 227-258. Paris, France: UNESCO and The Parthenon Publishing Group.
- Hawkins, J.P., and C.M. Roberts. 1993. Effects of scuba diving on coral reefs: Trampling on reef flat communities. Journal of Applied Ecology 30 (1): 25-30.
- Helu-Thamann, K. 1993. Beyond hula, hotels and handicrafts: A Pacific islander's perspective of tourism development. The Contemporary Pacific: A Journal of Island Affairs 5 (Spring): 104-111.
- Hendricks, S. 1986. The endangered forest birds of Guam. Guam Micronesia Glimpses 26 (1):20.
- Ikeda, G., and F. Collison. 1990. Pacific islands tourism case studies: Regional survey. Honolulu, Hawaii: University of Hawaii at Manoa.
- Inskeep, E. 1987. Environmental planning for tourism. Annals of Tourism Research 14 (1): 118-135.
- International Working Group on Indicators of Sustainable Tourism. 1993. Indicators for the sustainable management of tourism. Canada: World Tourism Organization and the International Institute for Sustainable Development.
- Keogh, B. 1990. Public participation in community tourism planning. Annals of Tourism Research 17 (3): 449-465.
- Krippendorf, J. 1982. Towards new tourism policies. Tourism Management 3 (September): 135-148.
- Lockhart, D.G., D. Drakakis-Smith, and J. Schembri. 1993. The development process in small island states. New York: Routledge.
- Lofdahl, K. 1993. Field trip to the limestone forest (Class handout). Mangilao, University of Guam.
- Manuel, J. 1994. Real-time analysis of incinerator emissions: The missing link. Environmental Health Perspectives 102 (November): 932-934.

- Mathieson, A., and G. Wall. 1982. Tourism: economic, physical and social impacts. New York: Longman Group Ltd.
- McEachern, J., and E.L. Towle. 1974. Ecological guidelines for island development, IUCN Publications New Series, no. 30. Switzerland: International Union for Conservation of Nature and Natural Resources.
- McKee, D.L., and C. Tisdell. 1990. Developmental issues in small island economies. New York: Praeger Publishing.
- Micronesian Investor. 1991. Investment seminar attracts global audience. Micronesian Investor 2 (1): 4.
- _____. 1992. Fishing base, resort proposed. Micronesian Investor 3 (3): 3.
- _____. 1993a. Marshalls launches tourism promotion. Micronesian Investor 4 (2): 3.
- _____. 1993b. Japanese plan Palau mega resort. Micronesian Investor 4 (3): 4.
- Miller, G.T., Jr. 1994. Living in the environment. Belmont, California: Wadsworth Publishing Company.
- Miller, M.L., and J. Auyong. 1991. Coastal zone tourism: A potent force affecting environment and society. Marine Policy 15 (March): 75-99.
- Minerbi, L. 1992. Impacts of tourism development in Pacific islands (Report prepared for Greenpeace Pacific Campaign, San Francisco, California). Honolulu, Hawaii: University of Hawaii at Manoa.
- Nelson, J.G., R. Butler, and G. Wall, eds. 1993. Tourism and sustainable development: Monitoring, planning and managing. Department of Geography Publication Series, no. 37. Waterloo, Ontario, Canada: University of Waterloo, Department of Geography.
- Organization of American States (OAS). 1985. Enhancing the positive impact of tourism on the built and natural environment, vol. 5. Washington, DC: Organization of American States.
- Organization for Economic Co-operation and Development (OECD). 1980. The environmental impact of tourism on the environment. Paris: Organization for Economic Co-operation and Development.

- O'Grady, A., ed. 1990. The challenge of tourism. Bangkok: Ecumenical Coalition on Third World Tourism.
- Pearce, D.W., and J.J. Warford. 1993. World without end: Economics, environment, and sustainable development. New York: Oxford University Press.
- Pearce, D.P. 1991. Tourist development, 2d ed. England: Longman Group UK Ltd., 1989; reprint, New York: John Wiley & Sons Inc.
- Pearce, H. 1993. The spoils of holidays. New Statesman and Society (30 April): 35.
- Perez, G.S. 1975. Guam conservation priorities. In The impact of urban centers in the Pacific: Papers from the theme symposium of the second inter-congress of the Pacific Science Association held at the University of Guam, Guam 20-25 May, 1973, edited by R.W. Force and B. Bishop, 89-96. Honolulu, Hawaii: Pacific Science Association.
- Perry, J., administrator at GSCS. 1993. Telephone interview by author, 9 August, Guam. Handwritten notes in author's possession.
- Pollot, M.L., and M.J. Van Zandt. 1994. Joint Testimony of Owners and Claimants of Land in the Ritidian Point and Jinapsan Areas of Guam presented before the Guam Land Conference held in Guam on 19 January. San Francisco, California: Keck, Mahin and Cate Law Firm.
- Rajotte, F. 1978. A method for the evaluation of tourism impact in the Pacific. Santa Cruz, California: Center for South Pacific Studies, University of California.
- Raulerson, L., professor of botany at the University of Guam. 1993. Interview by author, 25 July, Mangilao. Handwritten notes in author's possession.
- Rostow, W.W. 1960. The stages of economic growth: A non-communist manifesto. England: Cambridge University Press.
- Runquist, P. 1993. Shipwreck project gets first OK. Pacific Daily News (Guam). 27 August (Islands Section), 7.
- Sablan, L., planner for the Guam Department of Commerce. 1994-95. E-mail communications with author. Printed copies of transmissions in author's possession.

- Sachs, W. 1992. The development dictionary: A guide to power as knowledge. New Jersey: Zed Books Ltd.
- Sanchez, G.C. 1975. Planning and its aftermath on Guam. In The impact of urban centers in the Pacific: Papers from the theme symposium of the second inter-congress of the Pacific Science Association held at the University of Guam, Guam 20-25 May, 1973, edited by R.W. Force and B. Bishop, 97-103. Honolulu, Hawaii: Pacific Science Association.
- Sanchez, P.C. 1975. The new Guam: A challenge to human values. In The impact of urban centers in the Pacific: Papers from the theme symposium of the second inter-congress of the Pacific Science Association held at the University of Guam, Guam 20-25 May, 1973, edited by R.W. Force and B. Bishop, 83-88. Honolulu, Hawaii: Pacific Science Association.
- Snow, J. 1991. Tourism and sustainable management of coral reefs: The Barbados marine reserve case. In Proceedings of the 1990 congress on coastal and marine tourism: A symposium and workshop on balancing conservation and economic development held in Honolulu, Hawaii 25-31 May, 1990, edited by M.L. Miller and J. Auyong, 280-285. Newport, Oregon: National Coastal Resources Research and Development Institute.
- Souder, L.M.T. 1992. Daughters of the island, 2d ed. New York: University Press of America.
- South Pacific Regional Environment Programme (SPREP). 1993. Not always a pretty face: Urban growth versus the environment in the Pacific islands. Environmental Case Studies, no. 6, by J.F. Dupon and C. Morhange. Western Samoa: South Pacific Regional Environment Programme.
- Stancliffe, A. 1992. Voyage of destruction. New Statesman and Society 5 (January 3): 17.
- Stone, B.C. 1970-71. The flora of Guam. Micronesica 6 (Annual Issue): 18-33.
- Taitano, Z. 1991. Inmates start sweeping beaches. Pacific Daily News (Guam). 9 August.
- Thompson, L. 1969. Guam and its people. New Jersey: Princeton University Press, 1947; reprint New York: Greenwood Press.

- Tolba, M.K. 1987. Sustainable development: Constraints and Opportunities. London: Butterworths.
- Underwood, J. 1973. Population history of Guam: Context of microevolution. Micronesica (July): 11 .
- Unpingco, N.R. 1975. The realities facing Guam today. In The impact of urban centers in the Pacific: Papers from the theme symposium of the second inter-congress of the Pacific Science Association held at the University of Guam, Guam 20-25 May, 1973, edited by R.W. Force and B. Bishop, 107-114. Honolulu, Hawaii: Pacific Science Association.
- U.S. Census, 1960. Characteristics of the population: Outlying areas (vol. 1, parts 54-57). Washington: Government Printing Office, 1963.
- U.S. Census, 1970. Characteristics of the population: Outlying areas (vol. 1, parts 54-58). Washington: Government Printing Office, 1973.
- U.S. Census, 1980. Census of population: Detailed social and economic characteristics - Guam (PC 80-1-C/D54). Washington: Government Printing Office, 1984.
- U.S. Census, 1990. Population and housing: Social, economic and housing characteristics - Guam (1990 CPH-6-G). Washington: Government Printing Office, 1992.
- U.S. Department of Commerce. 1979. Guam Coastal Management Program and Final Environmental Impact Statement vol. 1.
- U.S. Fish and Wildlife Service (USFWS). 1993. Final Environmental Assessment for the Proposed Guam National Wildlife Refuge. Portland, Oregon: Department of the Interior.
- Walker, T.A. 1991. Tourism development and environmental limitations at Heron Island, Great Barrier Reef. Journal of Environmental Management 33: 117-122.
- Walter, R.D. 1975. The impact of tourism on the environment. Australia: Australian Recreation Research Association.
- Warner, D. 1978. A decade of tourism: The socio-economic impact of Guam's visitor industry 1967-1977. Agana, Guam: American Business Consultants.

- Weare, N., member of Recycling Association of Guam (RAG). 1995. Telephone interview, 16 January.
- Wiles, G., and M. Ritter. 1993. Guam. In A directory of wetlands in Oceania, comp. D.A. Scott, 129-178. Slimbridge, UK: International Waterfowl and Wetlands Research Bureau, and Kuala Lumpur, Malaysia: Asian Wetland Bureau.
- Williams, J. 1990. Development strategies highlight Pacific islands conference. Guam and Micronesia Glimpses 4:39-40.
- Workman, R.L. 1989. Defining Guam's development policy issues: The community's values within the debate. Mangilao, Guam: Community Development Institute at the University of Guam.
- World Commission on Environment and Development (WCED). 1987. Our Common Future. New York: Oxford University Press.
- Zucker, W. 1984. Hazardous waste management on guam: A case study. Ambio 13 (5-6): 334-335.