

RITUAL IN THE ECOLOGY OF A NEW GUINEA PEOPLE
An Anthropological Study of the Tsembaga Maring
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DISSERTATION ABSTRACT

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Roy A. Rappaport

This dissertation is concerned with the role of ritual in the ecology of the Tsembaga Maring, a local population of two hundred recently contacted shifting horticulturalists occupying a territory of three square miles of primary and secondary forest between altitudes of two thousand and seven thousand feet in the Simbai Valley, in the Madang District of the Australian administered Territory of New Guinea. It is based upon fourteen months of field work conducted between October 1962 and December 1963 under grants from the National Science Foundation and National Institutes of Health.

Ritual is defined for the purposes of this study as the prescribed performance of conventionalized acts directed toward the involvement of non-empirical or supernatural agencies in the affairs of the actors. Some Tsembaga rituals, however, although they are explicitly undertaken by the Tsembaga to maintain or transmute their relations with ancestral or other spirits do, in fact, maintain or transmute in measurable ways their relations with empirical components of both their "immediate" and "non-immediate" environments.

The immediate, or territorial, environment of the Tsembaga includes the non-human entities with which the Tsembaga share their territory. These flora, fauna and soils are regarded as an ecosystem in which the Tsembaga participate as an ecological population. The non-immediate, or extra-territorial environment of the Tsembaga includes, most importantly, other human groups similar to the Tsembaga.

The description of Tsembaga participation in the ecosystem which is their immediate environment is reduced, for the most part, to metrical terms. Values, based upon measurements undertaken in the field, are assigned to the trophic requirements of the Tsembaga and their livestock on the one hand and to aspects of those components of the ecosystem from which they fulfill these requirements on the other. Yields per acre, areas under various vegetation associations, protein intake, caloric intake, energy expenditure of various age-sex categories in various tasks, human population size, size and rate of growth of the pig population and other factors are treated as variables in a system for which rituals, arranged in a protracted cycle, provide regulation. The rituals which constitute the ritual cycle are not only performed as responses to "system-endangering" changes in the values of the variables, but their performance also operates to return these values to "safe" levels. The Tsembaga ritual cycle is thus interpreted as a

servo-mechanism in a complex system.

The regulatory operation of the Tsembaga ritual cycle is not confined to relationships among the variables derived from components of the immediate environment of the Tsembaga. The frequency of warfare, the distribution of people over land and land among local populations is also regulated through the ritual cycle.

It is argued, in sum, that through the ritual cycle of the Tsembaga the following are effected:

1. Relationships between people, pigs and gardens are regulated. This regulation operates directly to protect people from the parasitism and competition of their pigs and indirectly to protect the environment by helping to maintain extensive areas in virgin forest and assuring adequate cultivation-fallow ratios in secondary forest.
2. The slaughter, distribution and consumption of pork is regulated in a way which maximizes its value in the diet.
3. The consumption of non-domesticated animals is regulated in a way which tends to maximize their value to the population as a whole.

4. The marsupial fauna may be conserved.
5. The redispersal of people over land and the redistribution of land among territorial groups are effected.
6. The frequency of warfare is regulated.
7. The severity of intergroup fighting is mitigated.
8. The exchange of goods and personnel between local groups is facilitated.

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PREFACE

The field work which forms the basis of this study took place between October 1962 and December 1963 under a grant from the National Science Foundation to Columbia University. Professor Andrew P. Vayda of the Department of Anthropology, Columbia University, was principal investigator. I also received before, during and after the period of field work, personal support from the National Institutes of Health in the form of a pre-doctoral fellowship. I am further indebted to the Agricultural Development Council for a travel grant which permitted me to visit specialists whose advice and suggestions have been important to my understanding of some of the phenomena described in this dissertation.

The expedition, of which this dissertation comprises one of the results, consisted initially of Professor Vayda, Mrs. Cherry Vayda, my wife Ann and I, all of whom proceeded to Australia together. Professor Vayda and I arrived in Australian New Guinea in July of 1962 to investigate various possible field sites. Mrs. Vayda and my wife followed us from Australia in August. In January of 1963 the expedition was enlarged by the arrival of Allison Jablonko, of the Columbia University Department of Anthropology and her husband, Marek Jablonko.

It was our intention to study the adaptations of swidden horticulturalists living in tropical forest under conditions that had changed only slightly from those which prevailed previous to contact. It was also our wish to add to the ethnographic record information concerning peoples living in the middle altitudes between the central highlands and the lower coastal and riverine regions. To find suitable groups required several weeks of reconnaissance. Professor Vayda and I investigated the Adelbert Mountains in August, and in September my wife and I walked into the Schrader Mountains from Aiome while the Vaydas surveyed the area between the Tabibuga Patrol Post in the Jimi Valley and the Simbai Patrol Post at the headwaters of the Simbai River. A subsequent visit made by Professor Vayda and me to the Maring speakers occupying the middle Simbai Valley brought us to the decision to live among these recently contacted people. In October 1962 my wife and I settled down with the Tsembaga, who are surrounded by other groups more or less similar to themselves while the Vaydas moved in with the Fungai-Korama, a one day walk to the east, whose territory borders a vast stretch of unoccupied forest. When they arrived, the Jablonkos joined the Vaydas at their location.

Although our meetings with the Vaydas and Jablonkos were infrequent, we were in contact through weekly carrier

borne letters, and we exchanged those field notes which had bearing upon each other's independent inquiries. In some areas cooperation was close. My chief interest lay in ritual and ecology, and in matters of belief particularly I worked closely with Cherry Vayda, whose main concerns were with Maring perception and conceptualization. Cooperation with my wife whose interests lay mainly in Maring semantics was also very close in problems of Maring ideology.

Professor Vayda's interests and mine coincided in the area of ecology, but while I confined myself to the study of a single local population he took a more inclusive unit, the entire Maring speaking community, as his object of study. He was concerned particularly with the elucidation of patterns underlying marriage, warfare and population movements, and to this end conducted censuses and interviews among almost every local group in the Maring speaking area. In our frequent communications I provided Professor Vayda with information concerning Tsembaga practice and questioned him concerning their prevalence. He, in turn, provided me with information concerning widely distributed phenomena, and asked concerning their incidence among the Tsembaga.

The Jablonkos directed their efforts while in the field to filming, with a view to producing a fine grained analysis of personal interaction. They visited us several

times during our stay among the Tsembaga, and it was through their efforts that many Tsembaga horticultural procedures, and a number of the ritual events to be described in these pages were committed to film.

My wife and I remained in the field until late December 1963. The Vaydas departed slightly before we did, and the Jablonkos followed us out of the field in February, 1964. Research among the Maring resumed under a related National Science Foundation grant in June 1964 with the arrival of two geographers, William Clarke of the University of California, and John Street of the University of Hawaii. John Street remained in the field until January 1965 and William Clarke until August 1965.

The language which I relied upon most heavily was pidgin English (hereafter referred to as "p.e."). It was only in the last months of field work that my command of Maring was sufficient to serve as an effective ethnographic tool. The use of pidgin required interpreters, since no Tsembaga could speak that language. Two interpreters were used alternately, and in matters in which ambiguity was present or error or misunderstanding suspected, the information obtained through one was checked by employment of the other.

The list of those who have offered help and encouragement before, during, and after the period of field work is

long. On the way to the field, E. H. Hipsley of the Commonwealth Department of Health, Ross Robbins of the Australian National University and Jacques Barrau, then of the South Pacific Commission, offered invaluable advice and suggestions. John Womersley, director of the Department of Forest herbarium at Lae identified all plant specimens, and Joseph Szent-Ivany, Government entomologist, Port Moresby, took responsibility for the identification of insects. Hugh Popenoe, director, Department of Soils, University of Florida, analyzed those of the soil specimens which survived the year long trip to his laboratory. To these specialists, I wish to express, not only for myself but for the others as well, our deepest appreciation.

Our life and work in the field was made immeasurably easier by the assistance of many people. Particularly helpful was R. McCormac, District Agricultural Officer, Mandang, who provided us with personnel and items of equipment, and assisted in some of our logistic problems. The personnel of both the Lutheran Mission Hospital at Yagaum and the Government Hospital at Madang acquainted us with prevalent local diseases and initiated us into such mysteries as the use of the hypodermic needle. The government hospital also provided us with medical supplies.

To the staff of the Anglican Mission at Simbai,

Reverend and Mrs. Peter Robin, James Sansom, and Robin Hide, we are deeply grateful not only for their assistance in overseeing our supplies and arranging for them and our mail to be sent out to us, but also for their warm hospitality on our visits to Simbai. We also wish to acknowledge with gratitude the cooperation and hospitality of Alan Johnson and Gavin Carter, the officers in charge, Simbai Patrol Post, during our stay in their area. Gavin Carter, Patrol Officer during the major portion of our stay, was constantly helpful in every way possible.

Several people, during visits to our field location, opened our eyes to phenomena previously unnoticed or not assigned their proper significance. The visit of Douglas Yen, was a turning point in my study of agriculture, and Ralph Bulmer made tentative identifications of a large part of the avifauna. Visits from Nancy Bowers and Andrew Pawley were also very helpful to us. Edwin and Nancy Cook, when we visited them at their field location among the neighboring Narak people in the Jimi Valley, provided us with many stimulating ideas and good advice.

Many members of the Department of Anthropology of Columbia University, both students and faculty, have listened to me patiently while this dissertation was being written, and have offered valuable comments. I am particularly

indebted to the members of my Dissertation Committee, Morton Fried, Marvin Harris, Margaret Mead, and its chairman, Andrew P. Vayda.

Others who have offered valuable help and suggestions include Alexander Alland, Jacques Barrau, William Clarke, Paul Collins, Harold Conklin, Fred Dunn, C. G. King, W. V. Macfarland, M. J. Meggitt, Ernest Nagel, John Sabine, Marshall Sahlins, John Street, Marjorie Whiting, and Aram Yengoyan. It is to Collins that I owe many of the notions concerning functional systems which are explicit or implicit in this study. Barrau, Clarke, Street and Whiting have been particularly generous with comments, assistance, and suggestions, all of which have been appreciated although not all have been accepted. I personally must accept full responsibility for the shortcomings of this study.

I also wish to acknowledge a debt to "The Maring Simulation Group", which includes Marshall Childs, Gregory Dexter, David Osborn and Santo Pratico of the IBM Corporation, and George Morren, Arnold Perey and A. P. Vayda of the Columbia University Department of Anthropology, as well as myself. For some months this group has been attempting to develop a computer model of the Maring ecosystem from data collected by those of us who worked in the field. The meetings have been extremely stimulating, and have exposed interrelationships

among the phenomena described in this dissertation which had previously gone unnoticed by me.

I would like finally to express my deepest gratitude to Meñ and Kavali, my friends and interpreters, and to those Maring, particularly Akis, Avoi, Babi, Baḡgaimp, Mer, Muk, Pinj and Yemp, whose friendship, kindness and patience made this study possible.

NOTE ON MARING ORTHOGRAPHY

Since it is assumed that the reader's primary interest is not linguistic, the orthography employed in this study is not phonemic. It is, rather, a "broad transcription" of Maring speech, and signs representing specific sounds have been selected as much for their familiarity to the English speaker as for their phonetic accuracy. The letters used in the Maring terms have English values with the following exceptions and limitations:

a	as in <u>f</u> ather
i	as in <u>m</u> iss or <u>m</u> ee <u>t</u>
e	as in <u>e</u> rror or <u>m</u> ay
o	as in <u>b</u> one
u	as in <u>B</u> uddha
oe	as in French <u>oe</u> uf
ü	as in German <u>ü</u> ber
ñ	as in Spanish ma <u>ñ</u> ana
ŋ	as in <u>s</u> ing
č	as in <u>ch</u> urch
r	is pronounced with a quick flap of the tongue tip similar to the Spanish r.
initial b, d, and g have slight prenasalization (^m b, ⁿ d, ^ŋ g)	

Although the area occupied by the Maring speakers is

not large there are differences among the local groups in both the rendition of some phonemes and in some items of vocabulary. The pronunciation and terms included in this study should be understood to represent the speech of the people among whom we lived, principally the Tsembaga, and not necessarily the speech of the entire Maring population.

CHAPTER I

INTRODUCTION

Many functional studies of religious behavior have had as an analytic goal the elucidation of events, processes, or relationships occurring within a social group of some sort. Works of Chapple and Coon (1942:507), Durkheim (1912), Gluckman (1952), Malinowski (1948), and Radcliffe-Brown (1952), may be cited as examples.

While the scope of this social unit is frequently not made explicit, it would seem that in some studies it is what Durkheim called a "church," that is, "a society whose members are united by the fact that they think in the same way in regard to the sacred world and its relations with the profane world, and by the fact that they translate these common ideas into common practices" (1961:59). Frequently, however, it is a smaller and more bounded group which provides the context within which the role of ritual in relation to other aspects of culture is studied. Such units, composed of aggregates of individuals who regard their collective well-being to be dependent upon a common body of ritual performances, might be called "congregations". In many small scale societies the congregation is coterminous with the local group. Such is the case in this study of the Tsembaga, a group of

shifting horticulturalists living in the Bismarck Mountains of New Guinea.

This study differs, however, from those mentioned above, in that its main concern is not with the part that ritual plays in relationships occurring within a congregation. It is concerned, rather, with the part that ritual plays in the relationships of a congregation to entities external to itself.

Ritual may be defined for the purposes of this study as the prescribed performance of conventionalized acts directed toward the involvement of non-empirical (supernatural) agencies in human affairs. Although suggestions have been made by a number of writers¹ concerning the possible role of ritual in the adjustment of social groups to their environments, this problem has not engaged the attention of many students of either religion or human ecology. Some writers, interpreting what appear to be economically wasteful practices, have taken the view that ritual frequently interferes with the efficient exploitation of the environment.² Others have tacitly assumed that the empirical relations of the congregation to its environment remain unaffected by ritual performances. Indeed, one of the important functionalist theories of religion is based upon such an assumption of empirical independence between ritual and the world external to the

congregation. It is asserted that since men are unable to control many of the events and processes in their environments which are of crucial importance to them, they experience a feeling of helplessness. This helplessness produces anxiety, fear, and insecurity. The performance of rituals suppresses anxiety, dispels fear, and provides a sense of security. A statement by George Homans summarizes this line of thought nicely:

Ritual actions do not produce a practical result on the external world - that is one of the reasons why we call them ritual. But to make this statement is not to say that ritual has no function. Its function is not related to the world external to the society, but to the internal constitution of the society. It gives the members confidence, it dispels their anxieties, it disciplines their social organization. (1941:172)

No arguments will be raised here against the psychological or sociological functions which have been imputed to ritual by Homans and others. But it will be argued that in some instances ritual actions do produce a "practical result on the external world." In some instances the "function" of ritual is related to the "world external to the society." It will be demonstrated that among the Tsembaga ritual not only expresses symbolically the relationships of a congregation to components of its environment, but also enters into these relationships in empirically measurable ways.

To state simply that ritual actions may measurably affect components of the environment external to the congregation is, of course, to state the obvious, if not the trivial. If, to perform a ritual, a tree be cut down, the environment is affected. If ritual requires that large numbers of visitors be entertained at prolonged and lavish feasts, extra large gardens will be planted, or more wild animals than usual will be killed, or particularly large quantities of wild vegetables will be collected. All of these are actions which by any definition of environment affect the environment.

But it is not the obvious effects of isolated ritual requirements which form the central concern here. The interest, rather, is in the ways in which ritual mediates critical relationships between a congregation and entities external to it. Among the Tsembaga, and other Maring-speaking groups in New Guinea, through ritual the following are effected:

1. Relationships between people, pigs and gardens are regulated. This regulation operates directly to protect people from the possible parasitism and competition of their pigs and indirectly to protect the environment by helping to maintain extensive areas in virgin forest and assuring adequate cultivation-fallow ratios in secondary forest.
2. The slaughter, distribution and consumption of pork is regulated in a way which maximizes its value in the diet.

3. The consumption of non-domesticated animals is regulated in a way which tends to maximize their value to the population as a whole.
4. The marsupial fauna may be conserved.
5. The redispersal of people over land and the redistribution of land among territorial groups is effected.
6. The frequency of warfare is regulated.
7. The severity of inter-group fighting is mitigated.
8. The exchange of goods and personnel between local groups is facilitated.

Ritual will be regarded here as a mechanism, or set of mechanisms, which regulates some of the relationships of the Tsembaga with components of their environment. This statement requires some elucidation. The terms "regulate" or "regulation" imply a system. A system is any set of specified variables in which a change in the value of one of the variables will result in a change in the value of at least one other variable. A regulating mechanism is one which maintains the values of one or more variables within a range or ranges which permit the continued existence of the system.

It should be emphasized that neither the Tsembaga nor any of the actual components of their environment are themselves variables. As Hagen (1962:506) has put it, "A variable is a single dimension of an entity, not the entity itself." The

size of the Tsembaga population, for instance, but not the Tsembaga themselves might be regarded as a variable. The amount of land in cultivation, expressed in acres, might be designated a variable, but the gardens themselves could not be.

The systemic relationships described in this study are more than regulated. They are self regulated. The term "self regulation" may be applied to systems in which a change in the value of a variable itself initiates a process which either limits further change or returns the value to a former level. This process, sometimes referred to as "negative feedback," may involve special mechanisms which change the values of some variables in response to changes in the values of others. Thermostats, for instance, may be regarded as mechanical regulating mechanisms in systems in which measurable quantities of heat emanating intermittently from a controlled source and the temperature of a surrounding medium are variables. It will be argued here that Tsembaga ritual, particularly in the context of a ritual cycle, operates as a regulating mechanism in a system, or set of interlocking systems, in which such variables as the area of available land, necessary lengths of fallow, size and composition of both human and pig populations, trophic requirements of pigs and people, energy expended in various activities and the frequency of

misfortunes are included. There are numerous additional variables to be considered as well. While it has not been possible in all cases, numerical values have been assigned to most of the variables on the basis of measurements performed in the field.

As Collins (1965:281) has pointed out, "functional analysis makes no prescription concerning the nature of the variables...constituting the system." The selection of variables is a product of hypotheses concerning possible interrelations among the phenomena under investigation, and these, in turn, flow from the interests and theoretical conceptions of the analyst. The hypotheses which have led to the selection of variables in this study have already been stated in the form of a number of propositions concerning the role of ritual in the adjustment of the Tsembaga to their environment. Underlying these hypotheses is the belief that much is to be gained by regarding culture, in some of its aspects, as part of the means by which animals of the human species maintain themselves in their environments. There should be no conceptual difficulty in treating culture much as one would the behavior of other animals. As the sociologist Hawley pointed out over twenty years ago:

Culture is nothing more than a way of referring to the prevailing techniques by which a [human] population

maintains itself in its habitat. The component parts of human culture are therefore identical in principle with the appetency of the bee for honey, the nest-building activities of birds, and the hunting habits of carnivora. To argue that the latter are instinctive while the former are not is to beg the question. Ecology is concerned less now with how habits are acquired, than with the functions they serve and the relationships they involve (1944:404).

Hawley's statement has important methodological and theoretical implications for cultural anthropology, and Vayda and I (Vayda and Rappaport, in press) have noted some of these as follows:

Consistent with usage in [general] ecology, the focus of anthropologists engaged in ecological studies can be upon human populations and upon ecosystems and biotic communities in which human populations are included. To have units fitting into the ecologists' frame of reference is a procedure with clear advantages. Human populations as units are commensurable with the other units with which they interact to form food webs, biotic communities and ecosystems. Their capture of energy from and exchanges of material with these other units can be measured and then described in quantitative terms. No such advantage of commensurability obtains if cultures are made the units, for cultures, unlike human populations, are not fed upon by predators, limited by food supplies, or debilitated by disease.

The adoption of populations and ecosystems as units of analysis, it should be stressed, does not require any

sacrifice of anthropology's primary goal of elucidating cultural phenomena. Quite to the contrary, such a procedure can make important contributions to the attainment of that goal. A population may be defined as an aggregate of organisms that have in common certain distinctive means for maintaining a set of material relations with the other components of the ecosystem in which they are included. The cultures of human populations, like the behavior characteristic of populations of other species, can be regarded, in some of their aspects, at least, as part of the "distinctive means" employed by the populations in their struggles for survival. It has been suggested by the biologist G. G. Simpson (1962:106), that the study of cultural phenomena within such a general ecological framework may provide additional insights into culture, "for instance, in its adaptive aspects and consequent interaction with natural selection."

The lead suggested by Hawley and Simpson has been followed in this study. The Tsembaga are regarded here as an ecological population in an ecosystem which also includes the other living organisms and the non-living substances found within the boundaries of Tsembaga territory. The rituals upon which this study focuses are interpreted as part of the distinctive means by which a population, the Tsembaga, relates to the other components of its ecosystem and to other local

human populations which occupy areas outside the boundaries of Tsembaga territory.

It should, perhaps, be made explicit that the operation of ritual as a regulating mechanism is not necessarily understood by the Tsembaga. In the language of sociology, regulation is a "latent function" (Merton 1949:19ff) of Tsembaga ritual. The Tsembaga themselves see the purposes of the rituals as having to do, rather, with the relations of people to various spirits--for the most part, those of deceased ancestors. The rituals with which this study is concerned are conceived by the Tsembaga to maintain or transmute their relationships with these non-empirical entities. It would be possible to elucidate the regulatory functions of Tsembaga ritual without reference to Tsembaga conceptions, but it is reasonable to regard the conceptions of a people as part of the mechanism which induces their behavior. Native views of the ritual which they perform will therefore be included in this study. The inclusion of native views in a description of ecological relations, moreover, permits us to ask some important questions concerning ideology. We may, for example, ask whether or not actions undertaken in reference to understandings which are not empirically valid are, nevertheless, appropriate to the operational situation in which the actors find themselves.

The plan of this study is as follows:

Chapter II will introduce the Tsembaga. Necessary demographic information will be presented, and social organization, particularly as it affects the dispersal of people over the land, will be discussed briefly. Ways in which Tsembaga reach decisions affecting the activities of the entire group will also be described.

The Tsembaga participate in relationships with what may conveniently be seen as two sets of entities. The first of these sets includes the non-human components of their immediate, or territorial, environment, that portion of the earth's surface from which their subsistence is derived. The second includes those human groups who occupy areas external to Tsembaga territory, and those items which are obtained from them. Chapters III and IV will deal with these two sets of relationships.

Chapter III will first describe briefly some of the characteristics of the immediate environment of the Tsembaga. The description of the environment will include an introduction to several categories of spirits, whom the Tsembaga regard to be important components of their environment and in reference to whom many of the rituals to be described later in the study are undertaken. Attention will then be turned to the productive and extractive procedures of the Tsembaga. The results, or yields, of these subsistence procedures, and the

extent to which they fulfill Tsembaga trophic requirements will be assessed. Finally, estimates will be made of the maximum population sizes which would permit the described subsistence procedures to be practiced on Tsembaga territory without environmental degradation.

It will not be the purpose of Chapter III to explicate the role of ritual in the relations of the Tsembaga with their immediate environment. Chapter III will, rather, describe these relations and specify, where possible, variables to which numerical values will be assigned. It will be the purpose of a later chapter to demonstrate the regulatory functions of ritual in respect to these relationships.

Chapter IV will be concerned with the relations of the Tsembaga to human groups external to themselves. The exchange of women and goods will be discussed briefly. The larger part of the chapter will be concerned with warfare and the rituals associated with it. Latent functions will be suggested for some of the specific rituals undertaken during the course of hostilities, but Chapter IV, like Chapter III, will be directed toward the description of relationships rather than toward an exposition of ritual's role in mediating them. This will be reserved for Chapter V, in which the ritual cycle of the Tsembaga will be described. The role of this ritual cycle in regulating both the relations of the Tsembaga to the

non-human components of their immediate environment and to the human components of the less immediate environment, particularly in regard to fighting, will be discussed. Chapter VI will present general conclusions.

FOOTNOTES TO CHAPTER I

1. Among those who have made such suggestions are Brown and Brookfield (1958, 1963), Cook (1946), Freeman (1955), Izikowitz (1951), Moore (1957), Stott (1962), and Vayda, Leeds and Smith (1961).

Concern here is with ritual, rather than tabu, which may be defined as the supernaturally supported proscription of physically feasible behavior. It may be mentioned, however, that a number of writers have noted the possible role of tabus in the conservation of resources, and a recent paper by Harris (1965) has elucidated the critical role of the tabu against the consumption of beef in the human ecology of India.

2. See, for example, Luzbetak (1954:113) concerning waste at a New Guinea pig festival.

CHAPTER II

THE TSEMBAGA

1.0 The people, their location, and their linguistic relationships

The Tsembaga are a group of recently contacted people living in the Madang District of the Australian administered Territory of New Guinea. They occupy an area of slightly more than three square miles at approximately 5° south latitude, 145° east longitude on the south wall of the Simbai Valley, which separates, in this region, the Bismarck Range to the south and a spur of the Schrader Range to the north. The land is very mountainous, rising within the confines of the small Tsembaga territory, from 2200' at the river to 7200' at the top of the Bismarck ridge, and is, for the most part, heavily forested. Most of the area above 5000' shows no signs of ever having been cut, while at lower altitudes, secondary forest prevails, although some small remnants of primary forest and a few patches of grassland are to be found.

The Tsembaga, comprising during the field work period some 200 persons, are organized into five putatively patrilineal descent groups among which no common ancestry is acknowledged. Three of these five patrilineal clans form a

single exogamous unit, while the remaining two clans form separate exogamous units. In 1962-63, forty-four per cent of the living wives and widows of Tsembaga men were of Tsembaga origin; the remaining came from other local groups. Monogamy is the most common form of marriage; only four of the thirty-two Tsembaga married men had two wives at any time during the field work period.

Vayda and Cook (1964:798ff), following Ryan's (1959) usage for the Mendi people of the southern New Guinea highlands, have referred to the territorial groups, such as the Tsembaga, found among Narak and Maring peoples as "clan clusters". This usage is convenient for some purposes, but it will not be followed here. The Tsembaga and other similar groups will be termed "local populations" in this study.

The Tsembaga are one of more than twenty similar groups of Maring speaking people occupying territories in the middle Simbai and Jimi Valleys. In all, there are about 7000 Maring (or, as the language is occasionally and somewhat mysteriously labeled on linguistic maps, Yoadabe-Watoare) speakers. Wurm (1964:79) classifies Maring as a member of the Jimi sub-family of the Central Family of the East New Guinea Highlands Stock, which includes most of the languages of the East New Guinea Highlands (Micro) Phylum. The area of Maring speakers is the most northerly of those occupied by speakers

of Central Family languages; the land to the north and west of the Maring is held by speakers of Karam and Gants, languages only distantly related to the East New Guinea Highland Stock.

The Central Family, which includes at least fourteen languages with a total of 286,000 speakers (Wurm, 1964:79), occupies a large area in the Eastern, Western and Southern Highlands districts. This geographical distribution suggests that the ancestors of the Tsembaga and other Maring entered the general area which they presently occupy from the south. The presence of extensive tracts of unoccupied virgin forest to the north and east of the easternmost Maring groups supports this view. Tsembaga tradition, moreover, places the origins of four of the five clans in the Jimi Valley in the third or fourth generation ascending from men who were middle-aged in 1962 and 1963. Tsembaga tradition is unreliable as history, but recency of arrival is supported by such negative evidence as the lack of any clear signs of environmental degradation, and such positive evidence as the large size of the trees composing the secondary forest in which gardens are cut, and the reports of many older informants, who state that extensive tracts of primary forest existed in the lower altitudes until forty or fifty years prior to field work.

Details of Tsembaga subsistence procedures will be discussed in the next chapter, and in later chapters the

relationship of ritual to subsistence practices and other aspects of the Tsembaga adaptation will be analyzed. It may be well to orient the reader at this point, however, by mentioning that the Tsembaga and other Maring are bush fallowing, or swidden, horticulturalists, planting their gardens in secondary forest. Their starch staples include taro, yam, sweet potato and manioc, but they also enjoy a very large number of other crops, including sugar cane, many greens, and the fruit of the Pandanus conoideus (p.e.: "marita"). Pig husbandry is also important. Hunting, trapping and gathering also play a part in Tsembaga subsistence, feral pig, cassowary and birds being the most important quarry taken in hunting, and marsupials the animals most frequently caught in traps. The yields of gathering include not only some vegetable foods, notably edible ferns, but also timber, animal and vegetable fibres used for clothing, vines used as rope, and leaves, fruits and earths used as dyes.

The technology of the Tsembaga is simple. Only the digging stick, the steel ax, and the bushknife (the latter two arriving in the area over trade routes in the late nineteen thirties or early nineteen forties, but becoming common only in the nineteen fifties) are used in gardening. Bows and unfledged arrows are used in hunting, and also form, along with spears, axes and wooden shields, the technology of warfare.

Traps include snares, deadfalls, and pits. Gourds and bamboo tubes are used as containers. The latter occasionally also serve as cooking vessels; aside from these there are no others, most food being prepared directly on the fire or in an earth oven. Net bags, loin cloths, caps, and string aprons are woven from a variety of fibres; intricately woven waist and arm bands are made from orchid stems, and some bark cloth is made. Prior to the establishment of the patrol posts in the Jimi and Simbai Valleys in 1956 and 1959 respectively, the Tsembaga manufactured salt by boiling water obtained from mineral springs. Much of their salt production in earlier times was traded south over the mountain in exchange for stone ax blades which were quarried, shaped and polished in the Jimi Valley.

Men and women are domiciled separately. During 1962 and 1963 the men's houses, which accommodate males above the age of seven or eight, ranged in number of occupants from two to fourteen. Each married woman and widow has a separate house, where she resides with her unmarried daughters, small sons, and pigs. Most cooking takes place at the women's houses. Although the interior arrangements of men's and women's houses are somewhat different, their size and construction is similar. Both are framed in light timber, with roofs and walls thatched with pandanus leaves. The dimensions of men's houses range from seven by twenty feet to ten by thirty-five feet, with a height

at the ridge pole of four and one half to six feet. Women's houses are of comparable length and breadth, but on the average lower than those of the men. A portion of the interior of a woman's house, however, is devoted to the shelter of pigs, each of which is accommodated in an individual stall with an individual exit to the outside.

2.0 Physique and Demography

In the next chapter both the subsistence procedures and trophic requirements of the Tsembaga will be assessed and an attempt will be made to estimate the maximum number of people who may pursue their subsistence activities on Tsembaga territory. Among the biological characteristics of the Tsembaga population which are germane to these and other assessments and estimates to be made later are: (1) the total number of individuals included in the population; (2) the age and sex composition of the population; (3) the average body sizes of the constituent individuals.

2.1 Population size

During the period October, 1962 to December, 1963, the local population resident upon Tsembaga territory varied in size from 196 to 204 persons. The latter figure will be used in later computations.

There is considerable evidence to indicate that

population size was considerably greater in previous times than during the period of field work. For one thing, about twenty-five Tsembaga were living sororilocally, uxori-locally or matrilocally with other local populations in 1963. These people, or their parents, had lived on Tsembaga territory until military defeat in 1953 forced the Tsembaga to flee. Most Tsembaga had returned to their own territory by 1963, but these twenty-five still remained elsewhere. Informants agree, further, that in earlier times there were many more people, and genealogies bear them out. Disease is blamed by them for much of the population decrease, although they admit that many were also killed in fighting. The early years of contact are especially dangerous to groups such as the Tsembaga, for they are exposed to new mortality factors, particularly disease, before old mortality factors, especially warfare, are suppressed.

Considering the number of Tsembaga presently residing elsewhere, and considering the consensus among informants and the support given to such consensus by genealogies, a population size of 250 to 300 persons in the 1920's and 30's is not unlikely.

2.2 Body size

The Tsembaga are very small in stature. The average

height of forty-nine adult females was 54.3", the range being 51.75" to 57.75". Their average weight was 84.4 pounds, with a range of seventy-five to 100 pounds.

The average weight of fifty-nine adult males was 102.6 pounds. Their weights ranged from eighty-seven to 140 pounds.

Since many young men wear their hair in massive coiffures hardened with grease extracted from the fruit of the *Marita pandanus*, it was necessary, in their cases, to guess at the location of the top of the skull. The average of the heights recorded for adult males, 58.1", must, therefore be regarded as an approximation. The extremes, however, 53.25" and 62.5", are represented by men whose hair was cut short.

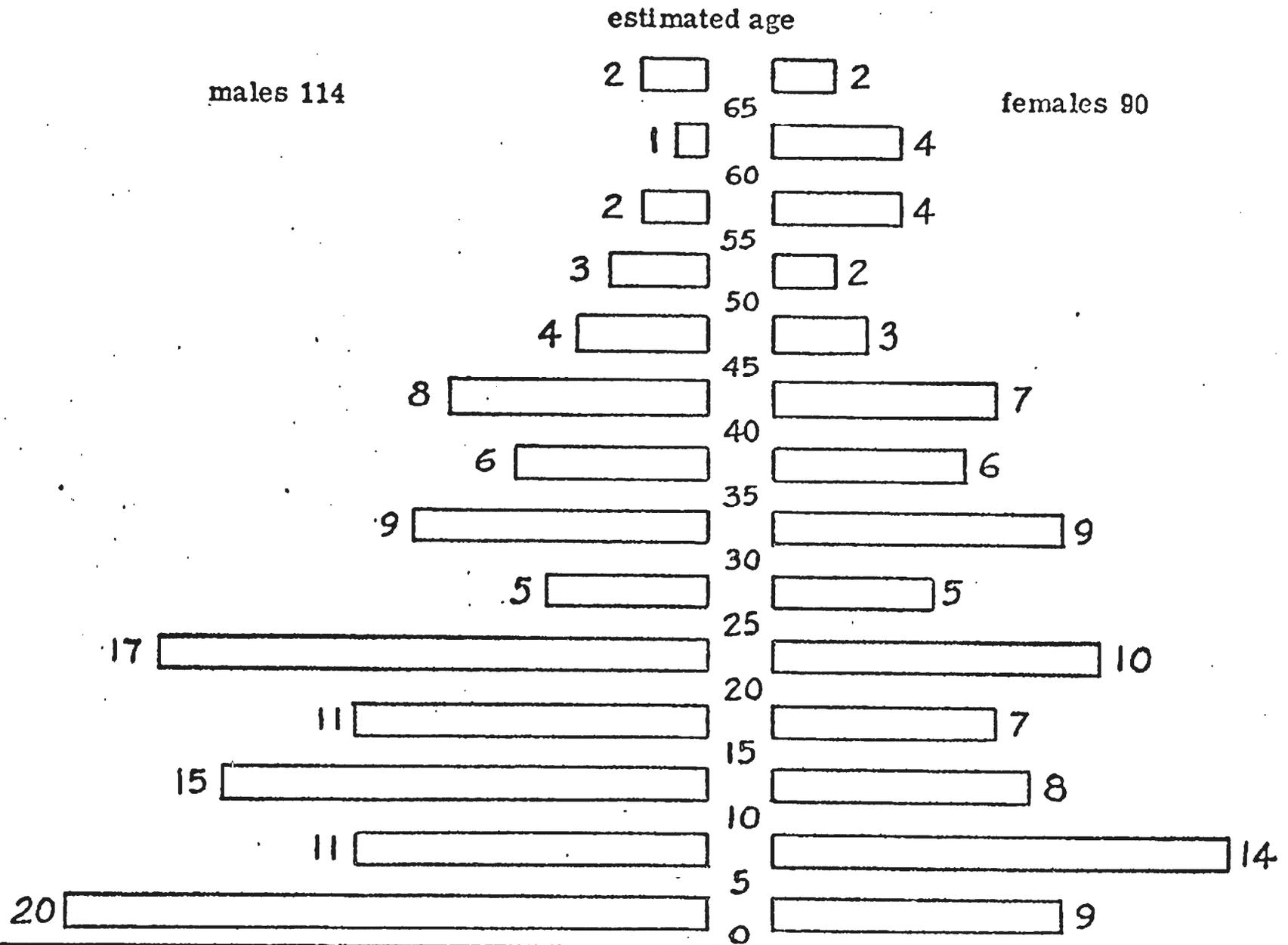
2.3 Population structure

The age-sex composition of the Tsembaga population is presented in Table 1.

Some of the characteristics of Tsembaga population structure, particularly the imbalance of males and females in the younger categories, and the change in the male-female ratio at estimated age twenty-five, require comment.

The Tsembaga, who are happy to admit that they kill one or both of a pair of twins, unanimously deny practicing female infanticide. They themselves point to the economic

Table I. The Structure of Tsembaga Population. November 1963. (Total 204)



importance of women, and suggest that the killing of female infants would be foolish. The reversal of the usual ratio in the estimated five to ten year old category lends support to their protestations.

It is not possible to arrive at any explanation here. Data are insufficient to say with any certainty whether the disparity is a result of differential frequencies in male and female births, or differences in the rate of survival of males and females, or both. Data are sufficient to indicate, however, that a deficiency of females, although especially marked among the Tsembaga, is not peculiar to them. A. P. Vayda's census figures indicate totals of 3722 males and 3420 females among the Maring, and in only one local group do females outnumber males. Nor is such a disparity peculiar to the Maring. An excess of males exists among the people of the Tor District in West Irian. As in the case among the Tsembaga, the imbalance between the sexes is most marked in the younger categories, and Oosterwal (1961:37f) attributes it to a greater frequency of male births.

It must be noted that the sex imbalance exists in the face of the fact that among the Tsembaga, at least, males suffered heavier losses in warfare than females. The change in the Tsembaga male-female ratio at estimated age twenty-five is quite clearly an effect of differences in casualty

rates. The estimated twenty-five to thirty age category is the youngest to have participated in the last round of warfare, which took place in 1953, in which the Tsembaga were one of the principal combatants. This series of engagements resulted in a serious defeat for them. Fourteen adult males were killed, and in the ensuing rout two male children, two adult females, and two female children were slain. Deaths of males, thus, were four times as high as those sustained by females, and even this was extraordinary. Women and children are generally exposed to enemy action only in the case of rout. In most armed encounters, only adult males are killed.

3.0 Dispersion and social organization

That a quantity of a necessary resource, such as arable land, sufficient to meet the trophic requirements of all the Tsembaga exists within the borders of their territory does not necessarily indicate that each Tsembaga has sufficient to meet his needs. Many societies are characterized by differentials in access to resources between individuals or between groups. In some societies this is a concomitant of social stratification. In others it may be the result of differences in the demographic fortunes of land-holding descent groups. The details of Tsembaga social organization will be examined elsewhere. It will only be necessary here

to discuss briefly the social means by which the Tsembaga are dispersed over their territory in subsistence activities.

From the point of view of defense and certain subsistence activities--those of hunting, trapping, and gathering--the Tsembaga form a single territorial unit. Any Tsembaga may extract non-domesticated resources from any part of the combined lands claimed by the five putatively patrilineal clans which together comprise the total local population. This right is exclusive to Tsembaga. Members of other groups may not extract non-domesticated resources from Tsembaga territory, nor may the Tsembaga engage in such activities on the territories of other groups.

While the Tsembaga form a single territorial unit as far as hunting and gathering is concerned, certain portions of the territory are claimed by less inclusive groups. The main portion of Tsembaga territory, the area lying between the Simbai River and the top of the mountain, consists of three adjacent vertical strips. Two of these are said to be the lands of two of the clans. The third is claimed jointly by the three remaining clans. These land-holding groups of one or more clans form exogamous units.

Individual males hold rights to parcels of garden land by virtue of membership in one of the clans. While a man inherits parcels from his father, adjustments of inequities in

holdings are readily made between clan brothers. In the case of the land-holding cluster of three clans, land adjustments are also made between members of the separate clans. The members of these three clans are, or believe themselves to be, related by connections through females in ascending generations when intermarriage among them is either known, or believed by the informants to have taken place.

Members of the three separate clans regard each other, that is, as cognates even though actual connections frequently cannot be traced. It is a matter of some interest that the kinship terminological system, which is Iroquois on ego's generational level and bifurcate merging in the first ascending generation, is Hawaiian for both the first descending and the second ascending generations. Distinctions between agnatic and uterine relations are thus masked in two generations. People thus use for members of the other clans within the "cognatic cluster" the same set of kin terms which they apply to members of their own clan.

This formation of three clans may be regarded as a de facto corporate non-unilineal descent group, for it shares an estate in land. It remains de jure a cluster of three separate agnatic groups, however, for the principle of filiation remains one of patrilineal connection to one of the three constituent clans.

Claims to the three strips of land are ratified ritually by periodically planting small trees or bushes called yu min rumbim (rumbim: Cordyline fruticosa (L.) A. Chev; Cordyline terminalis, Kunth; yu min: men's souls). Every adult male participates in this ritual by placing his hand on the bush as it is planted, so symbolizing his connection to the land. Each of the three land-holding groups plants a separate yu min rumbim.

The ritual plantings of these three groups, and these three groups only, are synchronized. Their rumbim go into the ground on the same day and are uprooted on the same day. It is on the basis of the coordination of these and other rituals, and their joint participation in yet others that the Tsembaga may be regarded as a single congregation distinct from all others.

Despite these claims by constituent groups to specific areas, all Tsembaga have access in fact to garden land throughout the entire territory. This comes about through transfers in land, either usufructory or as grants in perpetuity, which are readily and frequently made between the members of separate land-holding groups. Most of the grants in perpetuity are made on the basis of affinal connections, while most of the usufructory grants rest upon cognatic ties; that is, they are made on the basis of connections through females

in ascending generations. In a sample of 381 gardens made in the years 1961, 1962, and 1963, the gardener had received permission to garden on land claimed by a land-holding group of which he was not a member in 108 cases, twenty-eight per cent of the total. Thus, the use of land for gardening is not exclusive to the agnatic or cognatic group which claims the land. To put it in the converse, a man frequently makes gardens on lands to which the agnatic or cognatic land-holding group of which he is a member has no claim. While title to three distinct areas are recognized by the Tsembaga to be vested in three discrete groups, their gardens are very much intermingled.

Because of the easy access of all males to garden land all over the territory, it is reasonable to assume that population density figures, which will be presented in the next chapter, reflect a condition obtaining throughout Tsembaga territory and not averages of what might be a number of very different densities in different areas. To put it differently, for purposes of exploitation an even distribution of the population over the available land may be assumed.

That all of the Tsembaga, and the Tsembaga alone, enjoy common and almost exclusive access to the resources existing within a jointly defended territory has a further theoretical and methodological implication. They, separate

from neighboring groups, constitute a unit in a set of material exchanges with the populations of other species which also inhabit their territory. They may be regarded, that is, as a population in the ecological sense of the term.

It should perhaps be made clear that the pattern of residence is largely independent of land use. Distances are not great, and a man may, and usually does, maintain patrilocal residence while making gardens on land received from his wife's, father's, or sister's husband's natal group if they too are Tsembaga. The actual residence pattern might be termed "pulsating." It will be shown later in this study that at a certain point in the ritual cycle there is a high degree of nucleation. Tsembaga subsistence procedures, however, particularly those connected with pig husbandry, militate against nucleation, and much smaller clusters of houses are the rule at most times. This will be discussed in some detail later. Three of the five clans are divided into sub-clans, which range in size from seven to thirty-eight persons, and units of this or clan magnitude usually form the residential clusters. Tsembaga clans range in size from fifteen to seventy-four persons. Residential clusters generally include one or more communal men's houses and several women's houses.

4.0 Political structure

Some of the events which will be discussed later in this study depend upon the coordination of the activities of many persons. The means by which such coordination is achieved requires brief discussion.

There are no hereditary or formally elected chiefs among the Tsembaga, nor are there any named, explicitly political offices. Neither is there to be found a pattern, such as that described by Oliver (1955), in which certain individuals, having achieved the status of "big men," command or coerce the activities of subordinates and vie with each other in feast giving. Among the Maring, to be sure, some men are recognized as yu maiwai, ("big," or "important" men) and are especially influential in public affairs. They do not, however, compete in feast giving and do not command the obedience of others. The ability of such a man to effect compliance with his wishes depends upon his persuasiveness, and not upon his exclusive occupancy of a particular position in the social or political structure. Indeed, there is no limitation upon the number of big men that may be present in any sub-clan or clan: the Tsembaga are truly egalitarian in that there are as many big men as there are men whose capabilities permit them to be big men. Moreover, there is not on the part of men in general any abdication, either expressed or tacit, of decision-making in

favor of big men. Everyone has voice in decision-making, if he cares to raise it, and anyone may attempt to initiate action by himself proceeding to act and thereby instigating others to follow. If the term "authority" is taken to refer to loci in communications networks from which flow messages instigating actions, then it may be said that among the Tsembaga authority is shifting. Big men may perhaps be defined statistically: they are those who more frequently than other men effect the courses of action to which a group commits itself. A man, that is, is not involved frequently in decision-making because he is a big man. He is a big man because he is frequently involved in decision-making. It should be made clear, however, that a big man is seldom under an obligation to participate in the making of any decision. He may, and frequently does, leave decisions to others. His motive for refraining from participation in a decision may be lack of interest, inability to arrive at an opinion, or the desire to avoid a thorny issue. But his right to silence is unquestioned, and its invocation, if not too frequent, does not diminish his status.

Whether or not a man is a big man depends upon his personal attributes. Big men, it is said, have "talk" (čep). They have "talk" concerning fighting, women, rituals, and gardens. They have opinions, that is, about things concerning the group which they can express articulately and which their

auditors respect. They are, in short, intelligent men of forceful personality. They are usually men of considerable physical strength and vigor as well.

Big men tend to be wealthy, tend to be shamans, and tend to be in possession of knowledge of the rituals concerned with fighting. Wealth and esoteric knowledge and ability are primarily the fruits of the same abilities--intelligence, vigor, forcefulness--which make a man a frequent decision-maker. While the possession of wealth and esoteric knowledge tends to support the status of a big man, it does not per se confer decision-making prerogatives. It does not, moreover, provide a particularly powerful set of tools which a man may use to bend others to his will, as may be the case in societies in which the difference in amounts held by the wealthy and the non-wealthy is great, or where esoteric knowledge surrounds the person of its possessor with great sanctity. The "spheres of influence" of even the most respected big men are very limited. The ability of any such man to effect compliance with his wishes diminishes with structural distance: it is greatest within his own sub-clan and among the residents of his own men's house, less among other sub-clans within his clan and among residents of other men's houses, and even less (although perhaps still considerable) among members of other clans within the local population. The renown of such men usually

transcends the local population, but their influence outside their own local group is restricted to affines, cognates, and non-kin trading partners.

The processes of decision-making are as amorphous as the structure within which they take place. Meetings are sometimes called to discuss an issue, but these are rare. At meetings which I attended, furthermore, there was little attempt to reach decisions in any formal way. There was no one to frame propositions in the form of anything like motions which could be put to a vote, for one thing, and besides, the idea of voting itself is unknown. It may be suggested that formal decision-making is actually avoided at meetings, for the framing of issues in terms which would allow a decision to be made could lead to confrontations between those holding opposing views. Such confrontations would be difficult to resolve.

Meetings are simply events at which there is much discussion about a particular subject going on at the same place and time among an assemblage which is larger than usual. Meetings have a strange appearance. Small knots of men-- three or four or five in a group--stand or sit on the ground talking among themselves. There may be many such groups within a restricted area. A few men move from group to group. Occasionally someone will address the entire assemblage in a

loud voice. Some men drift away, others come by. Eventually everyone drifts away. No decision has been reached and no action initiated, but there has been much talk. Concerning most action there is no meeting, but there is discussion in the men's houses and on the paths and in the gardens. A meeting crystallizes sentiment more quickly, but its purpose is limited to consensus formation and not decision-making or action instigation per se. Its purpose is "to make the talk one" more quickly than is usually the case. When he thinks the consensus has been reached, or when he thinks that there has been enough discussion, some man, without further discussion, initiates the course of action which the consensus suggests: he puts his eel traps at a traditionally designated place in one of the streams, thus initiating preparations for the final stage of the kaiko or pig festival; he begins to collect materials required for the construction of visitors' houses on the dance ground; he personally visits another local group and, through a kinsman, extends an invitation to the kaiko.

5.0 Contact

The amount of contact with agents of the west to which the Tsembaga had been exposed at the time of field work was slight. The first patrol of the Australian government to

enter the area crossed their territory in 1954, but a second did not appear for several years. The Simbai Valley was pacified in 1958,¹ but the government did not officially regard the area as controlled until 1962. A luluai and a tultul were appointed by the Australian government in 1959, and a second tultul was appointed in 1961. The prerogatives of these government headmanships, however, are restricted to dealings with the government. Both those who hold the titles and the people at large regard these offices as irrelevant to internal affairs. At the time of field work, October, 1962 to December, 1963, only two young Tsembaga men had gone out of the valley as indentured labor, and had not yet returned.² Although the Anglican mission had maintained stations with two other Simbai Valley groups for some years, the Tsembaga remained unmissionized. No Tsembaga spoke pidgin english, and only a few of the younger men had ever visited the government patrol post, established in 1959, at the headwaters of the Simbai River about twenty-five miles away by trail.

Indirect contact began, of course, much earlier. The first steel tools came to the Tsembaga in the late 1940's, and by the early 1950's stone implements had been completely replaced. Epidemics, probably of European origin, also entered the area long before white men. A dysentery epidemic, bearing the pidgin name sikman carried away a large number of

people in the early 1940's, and there is evidence of measles several years later.

Cargo cult also came to the Tsembaga long before white men. In the early 1940's, news of impending flood, earthquake and ancestral return came to them from the north, along with accounts of unfamiliar treasures that they might receive. Although they followed instructions, building special houses and so on, the ancestors did not return bearing gifts amidst flood and earthquake, and the disillusioned Tsembaga have remained more or less impervious to cargo cult talk ever since.

In sum, while the arrival of Europeans and European commodities have effected important changes, particularly through the introduction of steel tools and the suppression of warfare, the degree to which the adaptation of the Tsembaga to their immediate environment has been affected is limited. Steel tools and a few new crops, such as maize and certain varieties of sweet potatoes, have without doubt affected agricultural procedures, but the Tsembaga remain subsistence gardeners, slashing and burning swiddens in the secondary forest each year in accordance with patterns which prevailed when there was no maize and when they had only stone tools with which to work. Religious beliefs and ritual practices, moreover, include no apparently European elements.

6.0 Summary

In this chapter the Tsembaga were introduced. Some demographic information which will provide a basis for calculations to be made in later chapters was presented. Decision-making among the Tsembaga was discussed briefly, and it was observed that the Tsembaga, because of their joint or coordinated performance of rituals, may be regarded as a single congregation.

The social means by which the Tsembaga are dispersed and redispersed over the ground were discussed briefly. As far as hunting and gathering is concerned, all Tsembaga have access to all parts of the territory, while less inclusive agnatic or cognatic groups claim garden land. Transfers of land, either usufructory or in perpetuity, give all Tsembaga easy access to garden land in all parts of the combined territory, however. This has two implications. First, any man-land ratios which may be derived may be assumed to refer to conditions prevailing throughout the territory. Second, the Tsembaga may, because of their common and almost exclusive access to the resources of a jointly held territory, be regarded as a "local population", that is, a population in the ecological sense. They, separate from other Maring local populations, form a unit in a web of material exchanges with

populations of other species which also inhabit their territory. The relations of the Tsembaga with other entities which exist, or are conceived by them to exist, within the borders of their territory will be the concern of the next chapter.

NOTES TO CHAPTER II

1. Since our departure from the field in December 1963 some small scale short-lived armed altercations are reported to have occurred among Simbai Valley Maring.
2. Fifteen young Tsembaga men are reported to have been recruited on two year labor contracts early in 1965.

CHAPTER III

RELATIONS WITH THE IMMEDIATE ENVIRONMENT

1.0 Introduction

In this chapter the territory of the Tsembaga will be described briefly. Productive and extractive procedures will then be discussed, although descriptions of operations will be avoided as much as possible. An attempt will be made, rather, to reduce descriptions to quantitative terms based upon measurements taken in the field. Information concerning Tsembaga food intake will also be presented and the adequacy of the diet will be assessed. Calculations will be made of the amount of land needed to meet the trophic requirements of the Tsembaga through application of the subsistence procedures described in the earlier part of the chapter, and the carrying capacity of Tsembaga territory will be estimated.

2.0 The environment

Some important aspects of the immediate or territorial environment of the Tsembaga will be summarized here.

It should be noted that not all of the metrical material presented here will enter the later analysis as variables. Information concerning temperature and rainfall is not presented here because these quantities themselves will be regarded as variables but because they represent conditions

which may possibly affect the presence or absence of the various biotic components of the Tsembaga ecosystem. The cultivation of particular plants, for instance, is limited by temperature, rainfall, insolation and soil conditions. (Brookfield 1964:20ff; Kroeber 1939). Information, thus, concerning climate, soils, and vegetation may constitute an important empirical basis for comparison between areas.

2.1 Climate

During the period December, 1962, to November 30, 1963, 153.89 inches of rainfall were recorded at 4750 foot altitude on Tsembaga territory. No figures from any earlier period are available. While there was a drier and a wetter season, recognized terminologically by the Tsembaga, in no month did less than 6.76 inches of rain fall. Moreover, three of the months which, according to informants, were supposed to be part of the dry season, August, September, and October, were very wet.

Rain generally fell gently, although on several occasions over 100 points fell in less than a half hour. The highest daily recording was 4.01 inches, and there were forty-three days when over one inch of rain fell.

Most rainfall occurred at night, and on most days sunshine was prolonged, although cloud was seldom absent from

some part of the sky. From August through November, however, much of the rainfall occurred during the daylight hours, and days of prolonged sunshine were few. Evaporation, consequently, was impeded and the ground remained wet.

Fog, technically cloud, is common, particularly above 4000 feet. Most usual between 4 and 7 p.m., it would occasionally persist through the day.

During the year there was sunshine on more than 243 days and rainfall on 253 days. Monthly rainfall figures for Tsembaga, and a summary of five years of rainfall statistics for Tabibuga in the Jimi Valley, are included in appendix I.

Seasonal variation in temperature is slight. The diurnal variation ranges from seven to sixteen degrees Fahrenheit, with daily maxima almost always falling in the mid to high seventies and the daily minima in the low sixties.

No winds of a force sufficient to break small twigs off trees were noted during the year, although Clarke reports that he experienced somewhat stronger winds in 1964. Informants say that they have never known wind to reach a force sufficient to damage houses, groves or gardens.

2.2 Land

The territory of the Tsembaga measured orthographically includes 2033 acres, or 3.2 square miles, of which 1690

acres or approximately 2.5 miles, are in the Simbai Valley, while the remaining 343 acres, are in the Jimi Valley. Population density reckoned against total orthographic area is, thus, about sixty-four persons per square mile.

The terrain is rugged, rising from an altitude of 2200 feet at the Simbai River to 7200 feet at the Bismarck Ridge. Slope is about 20° up to 5000 feet, then rises more steeply to the mountain top. The surface is further complicated by spurs projecting at approximate right angles to the line of the ridge, and by frequent watercourses.

Information concerning soils, which seem generally to be poor, is summarized in appendix II.

2.3 Vegetation

Hundreds or even thousands of species of plants are to be found within the limited area circumscribed by the borders of Tsembaga territory. Native nomenclature is elaborate. In the case of most non-domesticated plants, the native taxon usually corresponds to a species designation, while among the cultivated plants elaborate distinctions are made at a sub-species level.

This rich flora is distributed over Tsembaga territory in several different plant associations, among which the Tsembaga make clear terminological distinctions which may form

the basis for our discussion here. These associations include:

1. geni: forest which is said never to have been cut
2. korndo: grassy areas devoid, or almost devoid, of trees, and dominated by Imperata cylindrica
3. ringop: associations of domesticated plants, i.e., gardens in production
4. ringopwai: secondary growth, of which there are two sub-types
 - (a) kikia: secondary associations dominated by herbaceous species
 - (b) dukmi: secondary associations dominated by woody species

Only geni and korndo will be discussed here. Ringop and ringopwai will be discussed later in the context of subsistence activities.

2.3.1 Geni

Of the 1690 acres held by the Tsembaga within the Simbai Valley, 602 by planimetric measurement are in virgin forest, which lies unbroken above a line varying in altitude from 5000 to 5400 feet. An additional twenty-eight acres of virgin forest have survived as remnants at lower altitudes, and in the Jimi Valley the entire Tsembaga holding of 343 acres is either in primary forest or very advanced secondary

growth. Of the total area of 2033 acres included by orthographic measurement in Tsembaga territory, 973, or forty-eight per cent, are in virgin forest or in secondary growth resembling virgin forest.

This virgin forest may, on structural grounds, be divided into two associations. These are not terminologically distinguished by the Tsembaga.

1) High forest: This survives only in remnants between 2000 and 5000 feet, but it is unbroken from approximately 5000 to 6000 feet. Throughout the high forest range three fairly distinct arboreal strata support an abundance of epiphytes, lianes, stranglers, and small climbers. While there are two lower strata, one of shrubs and young trees, the other composed of low herbaceous forms, the forest floor has an open aspect, and it is only in scattered locations that visibility at the ground is less than 100 feet.

There are some floristic differences between the upper and lower portions of the high forest range, with the transition occurring between 3500 and 4500 feet. The lower zone is referred to by the Tsembaga as the wora. The entire area above it is called the kamunga. Information concerning floristic composition will be found in an appendix. Suffice it here to say that all structural components of both the kamunga and wora high forest are extremely mixed. In a strip

200 x 17 feet, the "A", or highest, tree stratum was found to include nine named tree types, the "B" stratum four, and the "C" stratum ten. Details concerning the forest census taken on this strip will be found in appendix III.

The most striking aspect of the high forest is the size of the trees which compose it. The crowns of "A" stratum trees achieve an estimated average height of close to 125 feet, with occasional individuals, particularly nonomba, a species of Eugenia, reaching 150 feet or more. Girths are frequently massive, ten foot circumferences three feet above the ground, or above the buttresses, which are a common feature, are not unusual. Trees of even greater girth are present.

Three-storied forests composed of trees of such size do not seem to be common at altitudes of 5000 to 6000 feet in most parts of the world (Richards 1964). The forest observed at such altitudes on Tsembaga territory resembles lowland formations more closely than it does montane or sub-montane associations. The presence of such a formation at such an altitude may be regarded as an example of "Massenerhebung Effect," the upward displacement of the altitudinal ranges of plant associations in inland regions as compared to coastal areas, and in the interior of mountain ranges as compared to foothills. Richards (1964:347) states that protection from wind is at least partially responsible for the Massenerhebung Effect, but

Clarke in a personal communication suggests that patterns of cloud cover may also be important.

2) Moss forest: Above 6000 feet trees are smaller, both in girth and height. The forest ceiling in this range is usually well under 100 feet from the ground, and stratification is indistinct. Although scattered individuals reach heights of 100 feet or more, their crowns do not form an unbroken canopy. Herbacious epiphytes and climbers are less abundant than at lower ranges, but epiphytic mosses are much more luxuriant, completely covering the trunks of most trees to a depth of more than an inch.

Information concerning the composition of the moss forest will be found in appendix III.

2.3.2 Korndo

In several parts of Tsembaga territory apparently stable grassy associations occur. Only one of these, located between 2800 and 3600 feet, is of considerable size, covering forty-one acres. Kunai, (Imperata cylindrica), itself known as korndo, is the overwhelming dominant, although a few ground creepers are present, as are scattered tree ferns, most of which are Cyathea angiensis, and a few small thickets of a very large bamboo called waia. These thickets have been planted.

The oldest Tsembaga informants maintain that neither

they nor their ancestors ever made gardens in this area, and that it has always been, as it is now, under kunai.

There is reason to believe that occupation of the Simbai Valley by the Tsembaga and other Maring is relatively recent, perhaps having begun within the last 200 years. It may be that this association, if it is anthropogenic (Robbins 1963), is the result of the activities of an earlier population for whose presence there is archaeological evidence in the form of the stone mortars and pestles which are occasionally found in the ground.

The sort of exploitation which would turn the cover over limited areas into kunai while surrounding areas remained in high forest is hard to visualize. It is certainly the case, however, that the frequent fires to which such associations are subjected encourage this grass, the rhizomes of which are undamaged by fire, and discourage most other plants.

2.4 Fauna

The non-domesticated fauna inhabiting Tsembaga territory is abundant. Placental mammals include only feral pigs, bats and rats, of which there are ten named varieties. At least thirty named varieties of marsupials are present, and there are at least fourteen named snake types. Lizards and frogs are also represented by many named types, and the avifauna is very rich. At least eighty-four named types are said

by the Tsembaga to be present on their territory. These include cassowary, several birds of paradise, many species of parrot and "bush turkeys." Most of the carnivores are to be found among the avifauna, with many owls, several species of hawk, and at least one eagle being present. In the streams both eels and catfish are to be found, although the latter is rare. Arthropoda are very varied, and their nomenclature is elaborate.

It may be mentioned here that the fauna includes few forms which imperil human beings. Five of the fourteen snakes are venomous. Only one of them, however, the raraua (unident), is sufficiently poisonous, according to informants, to kill a human being, and the only instance of snake bite death that anyone remembers occurred many years ago, when an old woman succumbed. Wild pigs and cassowaries are capable of injuring seriously or even killing human beings, and gorings by pigs are not infrequent. Informants say, however, that neither wild pigs nor wild cassowaries are ever guilty of unprovoked attacks, and injuries are inflicted by them only when they are hunted.

Of greater danger to the welfare of the Tsembaga than any large animal are anopholes mosquitoes. Most of the Tsembaga suffer what are probably mild malarial attacks from time to time. Data are insufficient concerning intestinal

parasites. Stools of only two persons, in addition to the Tsembaga field workers, were subjected to laboratory analysis. No parasites were found.

2.5 Spirits

The Tsembaga regard spirits (raua) to be significant components of their environment, and the reasons which they offer for performing many of the rituals which will be discussed later in this study concern their relations with these spirits. To make the rituals comprehensible a brief introduction to these spirits is necessary.

2.5.1 The spirits of the low ground

In the wora, the lower part of the territory, a class of spirits called the raua mai are said to dwell. The term mai appears in a number of other contexts which illuminate both the usage here and the role which the Tsembaga impute to these spirits.

A taro corm out of which rhizomes have started to grow is a mai. A woman who has had a child is an ambra mai, and adult females of animals are mai. But femaleness is not necessarily implied by the term, for old men are yu mai. A meaning which seems common to all of these contexts is "that which is larger or earlier out of which has come that which is smaller or later."

The spirits of the low ground are concerned with growth and fertility. It is they who look after the increase and growth of people and pigs and the productivity of gardens and groves. They are concerned, too, with that portion of the fauna which inhabits the area below the unbroken high forest which covers the land above 5000 feet. Feral pigs are theirs, and when one is shot thanks must be given to them. Of particular importance to them are eels, which are said to be their pigs. As the raua mai are concerned with the lower portion of the territory, so are they concerned with the lower portion of the body--the belly, the genitals and the legs. Fecundity and strength in the legs derive from them; so do afflictions of the belly and the groin.

The category "raua mai" includes two sub-categories of related spirits. There are, first, those called koipa mangian. When informants are questioned they say that the koipa mangian of each clan is distinct, and that it dwells in a wide place in one of the streams on the clan's territory. Other contexts, however, suggest a single koipa mangian for all Tsembaga or even all Maring. A notion of separate manifestations of a single supernatural entity perhaps reconciles such inconsistencies.

Koipa mangian were never human, but near koipa mangian in A stratum trees in virgin forest remnants live the

spirits of those Tsembaga who died of illness or accident. They are referred to as raua tukump. Tukump, in other contexts, designates the mold which develops on such articles as orchid fibre belts and the bark rope bindings of stone axes. These spirits, the "spirits of rot", are conceived as intermediaries between the living and koipa mangian.

Spirits of the low ground are said to be kinim, which in many contexts means simply "cold." Here, as in some other contexts, it carries an implication of wetness as well. The juice of sugar cane is kinim, as is water, and women are said to be so because of their vaginal secretions. Coldness and wetness are said by the Tsembaga to be conditions which together cause softness and rot, and softness and rot, in contrast to hardness and dessication, are thought to be the necessary surrounding conditions for growing things. This is recognized in certain important rituals which will be discussed later. For now it is sufficient to say that the Tsembaga conceive the spirits of the low ground to be implicated in the cycle of fertility, growth, and decay, to which all animate things are subject.

But in the Tsembaga view while decay is necessary to life it also implies death, and the spirits of the low ground are dangerous. The spirits of rot, particularly when newly deceased, may spread a kind of supernatural corruption, called

simply tukump, which causes illness and hurt to those exposed to it. Koipa mangian himself is particularly fearful. He alone among the spirits of local origin actually kills. Other of the local spirits may bring illness, but it is only koipa mangian who brings death, even when it is another spirit whose displeasure is responsible for such punishment. In sum, the notions of fertility and growth on the one hand and death and dissolution through decay on the other are linked in the persons of the spirits of rot and koipa mangian. The spirits of the low ground seem to be more than spirits of fertility. They are, rather, the spirits of a cycle in which life both terminates in and arises out of death.

2.5.2 Raula mugi - red spirits

In the kumunga, the upper part of the territory, a class of spirits called the raula mugi (red spirits) reside. These are the spirits of Tsembaga who have been killed in warfare, and Tsembaga say that they derive their name from the fact that their deaths were bloody. Much of the moss forest and high forest near the top of the mountain is considered to be their home, and it is said that they have forbidden the felling of trees, except for certain ritual purposes, in this sacred area. The category of mammals termed ma (marsupials and perhaps some giant rats) which live in the entire kamunga

geni, the virgin forest above 5000 feet, are, moreover, considered to be their pigs, and when one is obtained in a trap or through hunting, thanks must be offered to the red spirits. This is also the case when cassowary or other large birds are taken in the high altitude virgin forest.

Aside from hunting and trapping in the kamunga geni, however, the red spirits are hardly concerned with the subsistence activities of the living. They are concerned, rather, with the relations of the Tsembaga to other local groups, particularly in the context of warfare. It is from the red spirits that the rituals associated with warfare are said to have been received by ancestors, and it is to them that they are mainly addressed. It is the red spirits, furthermore, who enforce the taboos concerning relations with the enemy during periods when hostilities are quiescent.

In contrast to the spirits of the low ground, who are said to be kinim, or "cold," the red spirits are romba-nda, or "hot." But as kinim in reference to the spirits of the low ground denotes wetness and softness, romba-nda in reference to the red spirits denotes dryness and hardness. While the cold, wet and soft imply fertility, the hot, dry and hard imply strength.

While both the hot and the cold, strength and fertility, are recognized to be necessary to their survival and

well-being, the Tsembaga regard them as opposing principles which are inimical to each other. Certain activities, therefore, must be segregated from each other in time and space, and certain objects or persons must be prohibited from contact with other objects or persons. Men who have knowledge of rituals for propitiating the red spirits, for instance, are forbidden to eat snakes, because the "coldness" of these reptiles will damage the "hotness" of their rituals.

In further contrast to the spirits of the low ground, the red spirits are concerned with the upper, non-sexual, part of the body: the chest, the head, and the arms, and afflictions of these parts may result from their displeasure.

2.5.3 The smoke woman

Residing at komba ku, a limestone cliff at the highest point on Tsembaga territory, is a female spirit, or set of spirits, called the kun kaze ambra. Yur kun kaze is the term for the technique through which shamanistic ecstasy is produced. It involves smoking native tobacco over which spells have been said, and singing ritual songs. Yur is the Maring term for tobacco. The meaning of kun kaze is obscure and is probably not Maring. It is the kun kaze ambra (ambra: woman) with whom a shaman holds concourse when he wishes to learn the will of the deceased.

In many contexts it would seem that there is a single kun kaze ambra, or "smoke woman, not only for all the Tsembaga but for all Maring speakers. In other contexts, however, it appears that there are many: as in the case of koipa mangian, the problem can perhaps be resolved in terms of a concept of local or even personal manifestations of a single supernatural entity.

While the smoke woman, who is said never to have been human, is conceived as female, this conception does not seem to carry any implication of fertility. While she is not thought to be antagonistic or dangerous to women, sexual activities must be segregated temporally from activities having to do with the smoke woman.

Although she resides in the upper portion of the territory, the smoke woman is not associated with any animals or plants living on the high ground or any other part of the territory, nor is she responsible for any portion of the human body. She is concerned, rather, with relationships among the spirits themselves and between the spirits and the Tsembaga. She must be contacted when a change from activities implicating the spirits of the low ground to activities implicating the red spirits are contemplated, and again when a change back is projected. Through her comes the consensus of the spirit world, approving, disapproving, advising delay. The smoke woman, in

short, articulates the activities of the living and the dead.

2.5.4 Other people's spirits

Only one other class of spirits needs to be mentioned here. These are raua tukump ragai (ra: other; gai or kai: clan). These are the deceased of other clans. Unlike the Tsembaga's own raua tukump, the term raua tukump ragai includes the deceased of other groups who have been killed in warfare as well as those who died of illness or accident. Particularly dangerous are the spirits of slain enemies, who are thought to lurk about the territory waiting for opportunities to avenge themselves by bringing illness or death to members of their slayer's group.

3.0 Subsistence

In this section information will be presented concerning Tsembaga subsistence activities with a view to deriving values for some of the variables designated in Chapter I. Descriptions of subsistence procedures are, to a large extent, avoided here. They will form the subject of a separate work.

3.1 Cultivation

Cultivation refers to the complex of behavior by which members of an animal species both propagate and care for the members of other species, either plant or animal, which, in

turn, provide them with useful material. Among the Tsembaga cultivation includes horticulture, silviculture, and animal husbandry.

3.1.1 Horticulture

The Tsembaga rely upon the products of horticulture for much the greatest part of their nutritional requirements.

Tsembaga horticulture is shifting. It is a set of interrelated activities directed toward (1) the establishment and maintenance, in a area previously dominated by other plants, of a temporary association in which edible plants are most prevalent, and (2) the succession of the temporary association of edible plants by an association similar to that which it replaced.

The great preponderance of the gardens are made in secondary forest between 3000 and 5000 feet. Three hundred eighty-one gardens made in 1961, 1962, and 1963 were surveyed or censused. Only one had been cut in virgin forest.¹

Gardens are planted only once. Cropping continues for periods varying from fourteen to twenty-four or more months, after which the abandoned garden is allowed to revert to secondary growth. The major gardens are cut, for the most part, in the latter part of what is said to be the wetter season (April, May, and early June). Most burning takes place in

the drier season (between June and September), and planting follows immediately. There is no calendar, the scheduling of gardening activities depending mostly on weather, although some attention is paid to a few indicator plants.

Men and women cooperate in making gardens. Both sexes cut underbrush. Men alone fell and pollard trees, make fences, and lay out logs on the ground as plot markers, planting guides, and soil retainers. Either men or women may burn the refuse on the plot for the first time, but women are usually responsible for the performance of a second burn, which disposes of materials uncombusted by the first. The heaviest burden in planting falls upon women. Men plant bananas, sugar cane and manap (Saccharum edule, p.e. pitpit); women plant the tubers and greens. Harvesting also falls largely to women, as does weeding, although men sometimes help their wives in these operations. Every major garden represents the cooperative efforts of a man and woman. The gardening pairs are overlapping. A woman may, and usually does, during the same year make gardens with more than one man. In addition to her husband, she will frequently make gardens with her own or her husband's unmarried brothers or a widowed father. Conversely, a man is likely to make gardens not only with his wife but also with his unmarried sisters or a widowed mother. It is not unusual, therefore, for a single individual to participate

in making several gardens in a single season. An important factor contributing to the pattern of personnel arrangements in gardens is, of course, the disparity between numbers of males and females in particular clans or sub-clans.

If a gardening pair has many pigs, two kinds of gardens are planted during the dry season. In the lower altitudes, between, that is, 3000 and 400-4500 feet, a dan-wan duk (taro-yam garden) will be planted, while in the upper altitudes, between 4200-5200 feet, a bo-nogai duk (sugar-sweet potato garden) is made. The native names for the two garden types indicate the crops which are most important in these gardens. Some sweet potatoes and sugar are found in almost all taro-yam gardens and vice versa. The differences in the composition of these gardens are mainly statistical, although some low altitude crops--certain yams and hibiscus especially--are absent from sweet potato gardens in the higher altitudes.

When the number of pigs is small, separate sweet potato gardens are not planted. Instead, mixed gardens (duk mai want), which bear closer resemblance in their composition to taro-yam gardens than to sugar-sweet potato gardens, are planted toward the middle of the altitudinal range.

In the wetter season, between November and April, most people plant additional gardens containing, for the most part, greens which come into maturity during the dry season. These gardens are always small and sometimes omitted.

3.1.1.1 Cropping

Information will be presented here concerning the crop inventory, the schedule of harvesting, yields per acre, and energy expenditure in gardening procedures.

3.1.1.1.1 Crop inventory

Information concerning the crop inventory is summarized in Table 2. Column 1 presents native categories, and Column 2 provides translations or meanings for these categories. In some instances English terms or Latin binomials serve adequately. In the case of some of the more inclusive categories (indicated by Roman numerals), this has not been possible, and notes on some of the entries are required.

Dan-wan, which translates "taro-yam," are designated "presentation tubers." Dan-wan figure in ceremonial food presentations, in contrast to ~nogai, which do not. ~Nogai are fed to pigs as well as people and are thus designated "pig tubers" here.

The plants included in Category IV, komba čem, are found in swiddens, and are thus included here. They are also found separately in pandanus groves (see silviculture below).

Information concerning the place of origin and time of introduction of the various crops is derived from informants' statements.

TABLE 2

Tsembaga Ringop

(Cultivated Species Planted in Swiddens)

Native Category	Identification Description, or Criterial Attributes	Popular Name	Number of Named Varieties	Origin or Introduction
I. Daŋ-wan	"Presentation Tubers"			
A. Daŋ	Taros			
1. Daŋ	<i>Colocasia esculenta</i>	taro	27	Present from time of ancestors, but new varieties appear, old disappear
2. Koŋ	<i>Xanthosoma sagittifolium</i>	taro kong	1	From karam people in 1957
B. Wan	Yams			
1. Wan	<i>Dioscōria alata</i> and <i>nummularia</i>	yam	32	Present from time of ancestors, but varieties change
2. Man	<i>D. bulbifera</i>	yam, mami	4	All varieties said to be present from time of the ancestors
3. Dinga	<i>D. pentaphylla</i>	yam	1	Said to be present from time of the ancestors
4. Ruka	<i>D. esculenta</i>	yam	1	" "
II. Nōgai	"Pig Tubers"			
A. Nōgai	<i>Ipomoea batatas</i>	sweet potato	24	Present from time of ancestors, but varieties change
B. Baundi	<i>Manihot dulcis</i>	manioc	1	Introduced from the Jimi Valley around 1920
III. Bep	Leafy greens not planted in pandanus groves			
A. Čeŋmba	<i>Rungia klossi</i>		5	All said to be present from time of ancestors
B. Rampmañe	<i>Commelina</i> sp.		1	" "
C. Gonebi	<i>Brassica juncea</i>		1	" "
D. Rumba	<i>Cucurbitaceae</i> sp.		1	" "
E. Kiñipo	<i>Hydrocotyle</i> sp.	parsley	1	" "
F. Nink	? <i>Nasturium officinale</i>	watercress	1	Introduced from Jimi Valley, 1957
IV. Komba-Čem	Crops planted in pandanus groves			
A. Komba	<i>Pandanus conoideus</i>	marita	34	Present from time of ancestors, but varieties said to change slowly
B. Čem	<i>Hibiscus manihot</i>	hibiscus	17	Present from time of ancestors, but varieties change

Table 2 continued:

Native Category	Identification Description or Criterial Attributes	Popular Name	Number of Named Varieties	Origin or Introduction
C. Bep	Cyathea spp.	fern	3	All present from time of the ancestors
V. Bar	Psophocarpus tetragonulobus and Dolichos lablab	peas, beans	4	(P. tet) present since time of the ancestors, D. lablab introduced from the Jimi Valley 1935-40
VI. Yobai	Musa sapientum	banana	28	Present from time of the ancestors, but varieties change
VII. Kornapa	Zea mays	corn, maize	2	Introduced from Jimi Valley, 1945-50
VIII. Manap	Saccharum edule	pitpit	16	Present since time of the ancestors, but varieties change
IX. Kwiai	Setaria palmaefolia	New Guinea asparagus	7	Present since time of the ancestors, but varieties change
X. Pika	cucumber	cucumber		
A. Pika	Cucumis sativus	cucumber	1	Said to be present from time of ancestors
B. Mop	?Cucumis sativus	cucumber	1	" "
XI. Ira	Cucurbita pepo	pumpkin	1	From Jimi Valley 1945-1950
XII. Yibona	Cucurbitaceae ?lagaenaria sp.	gourd	1	?
XIII. Rango	Zingiber c.p. zerumbet	ginger	1	Present from time of the ancestors
XIV. Bo	Saccharum officinarum	sugar cane	27	All said to be present from time of the ancestors
XV. Aramp	Succulents eaten raw with salt			
A. Kumerik	?Pollia sp.		2	Present from time of the ancestors
B. Kiñkiñmai	Hemigraphis sp.		2	" "
XVI. Punt	Ornamentals			
A. Amame	Coleus seutellaroides	green and yellow coleus	1	Present from time of the ancestors
B. Nimp	" "	purple coleus	1	" "
C. Korambe	Impatiens platypelia		1	" "

Table 2 continued:

Native Category	Identification Description or Criterial Attributes	Popular Name	Number of Named Varieties	Origin or Introduction
XVII. Kañpamp	Ficus wassa		1	Present from time of the ancestors
XVIII. Pai Pai	Carica papaya	paw paw	1	Introduced from Karam people around 1940
XIX. Rumbim	Cordyline fruticosa	tanket	10	All varieties said to be present from time of the ancestors
XX. Močam	Alocasia sp.	wild taro	1	Present from time of the ancestors
Totals:	Species: 36+		264+	

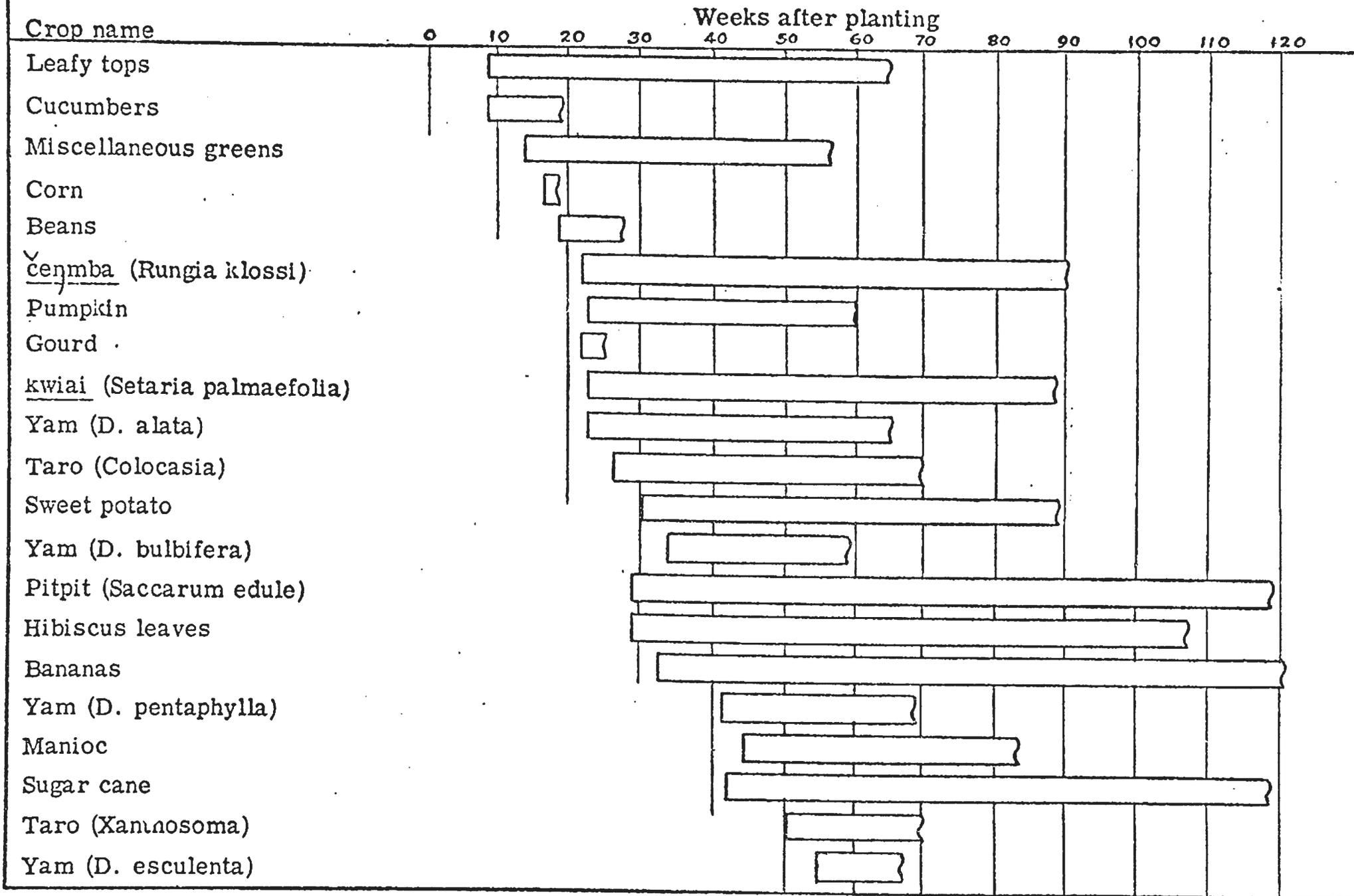
3.1.1.1.2 Harvesting schedule

Records of harvesting on over thirty gardens were kept between January 25, 1963, and December 14, 1963. On most gardens, however, the record is somewhat shorter, February 16 to December 14, 1963.

A schedule of harvesting by crop is reproduced below in Figure I. Until week twenty-four, this schedule represents a synthesis of observations on several gardens in which planting dates could be fixed within one week. After week twenty-four, however, planting dates could not be fixed with equal accuracy, for the plantings upon which this schedule is based took place previous to my arrival in the field. They may, thus, be inaccurate by as much as two weeks.

It should also be kept in mind that there is variation in speed of growth between gardens which differ in altitude and other respects. This table represents an approximation of events taking place around 4000 feet. At higher altitudes maturation is slower.

Diagram I. Harvesting Schedule of Tsembaga Garden Crops



3.1.1.1.3 Yields per acre

Quantities harvested per acre are presented below in Table 3 for taro-yam gardens and in Table 4 for sugar-sweet potato gardens. These estimations, which are critical preliminaries to an estimation of the amount of garden land required to support the Tsembaga, are based upon daily harvest records compiled in the field. The weights of major crop categories are presented individually, but caloric values for each, drawn from the literature (see appendix VIII), have been assigned so that a degree of commensurability will obtain both between the various crops and between the totals and total figures from other areas in which the crop inventory is different.

These figures, which represent an attempt at estimating the yields of two major types of gardens from first harvesting to abandonment, should be accepted with caution. Because the period of field work was considerably shorter than the period of harvesting, in both cases the figures represent a compilation of harvesting records kept upon three gardens of different ages. For these and other reasons an error of 10% is not unlikely. The methods employed in these estimations are outlined in appendix IV.

Yields Per Acre - Tsembaga Taro Yams Gardens

Crops	Yield (1) 0-23 wks.(2) Torpai x 3.89 lbs.	Yield 24-66 wks. Kakopai x 3.3 lbs.	Total 0-66 wks. Torpai & Kakopai lbs.	Factor for non-weighted harvest %	Adj. total per acre 0-66 wks. lbs.	Yield 67-120 wks. Tipema x 6.0 lbs.	Factor for non-weighted harvest %	Adj. total per acre 67-120 wks. lbs.	Total per acre 0-120 wks. lbs.	Edible portion %	Calories per lb.	Total calories per acre
Colocasia	-	2349.9	2349.9	5	2467.4	306.0	-	306.0	2773.4	85	658	1,551,169
Xanthosoma	-	971.2	971.2	5	1019.8	-	-	-	1019.8	80	658	536,796
Dioscoria alata & nummularia	2.14	806.9	828.3	5	869.7	81.0	-	81.0	950.7	85	486	576,104
D. bulbifera	-	188.9	188.9	5	198.3	18.0	-	18.0	216.3	85	486	
D. pentaphylla	-	159.3	159.3	5	167.3	4.0	-	4.0	171.3	85	486	
D. esculenta	-	53.6	53.6	5	56.3	-	-	-	56.3	85	486	
sweet potato	-	1356.3	1356.3	5	1424.1	390.0	-	390.0	1814.1	80	681	988,345
manioc	-	546.2	546.2	5	573.6	22.5	-	22.5	596.1	80	595	354,680
Rungia klossi	34.0	165.8	199.8	2	203.8	42.0	-	42.0	245.8	95	136	31,756
misc. greens	178.0	97.5	275.5	2	281.0	16.5	-	16.5	297.5	95	218	61,606
hibiscus leaves	-	636.9	636.9	2	649.6	120.0	-	120.0	769.6	95	136	99,430
beans	33.0	3.3	36.3	-	36.3	-	-	-	36.3	95	440	15,972
banana	-	534.9	534.9	20	641.9	822.0	20	986.4	1628.3	70	427	486,685
corn	236.3	-	236.3	5	248.1	-	-	-	248.1	29	463	33,336
pitpit	-	459.8	459.8	2	468.9	26.6	-	26.6	495.5	40	104	20,612
Setaria palm.	33.0	468.9	501.9	2	511.9	610.5	-	610.5	1122.4	17	65	12,402
cucumber	566.0	-	566.0	50	854.0	-	-	-	854.0	95	50	40,565
pumpkin	34.0	244.2	278.2	2	283.8	52.5	-	52.5	336.3	68	200	45,740
gourd	20.3	-	20.3	2	20.7	-	-	-	20.7	68	154	2,171
sugar	-	644.3	644.3	200	1932.9	1986.0	20	2383.2	4316.1	30	263	340,532
Totals									17968.6			5,197,901

1) Figures indicate weeks after planting. Thus entries in column 2, for example, indicate yields between 0 and 24 weeks after planting.

2) The names (e. g. Torpai) are those of the sample gardens, yields of which were weighed. The figures (e. g. 3.89) in association with the garden names are factors required to adjust the yields of the various sample gardens to yields per acre.

3) D. = Dioscoria

TABLE 4

Yields Per Acre - Tsembaga Sugar-Sweet Potato Gardens

Crops	Yield (1) 0-23 wks. Torpai x (2) 3.89 lbs.	Yield 24-66 wks. Timbikai x 4.2 lbs.	Total 0-66 wks. Torpai & Timbikai lbs.	Factor for non-weighed harvest %	Adj. total per acre 0-66 wks. lbs.	Yield 67-120 wks. Unai x 3.3 lbs.	Factor for non-weighed harvest %	Adj. total per acre 67-120 wks. lbs.	Total per acre 0-120 wks. lbs.	Edible portion %	Calories per lb.	Total calories per acre
Colocasia	-	445.2	445.2	5	467.5	13.2	-	13.2	480.7	85	658	268,858
Xanthosoma	-	769.6	769.6	5	808.1	16.5	-	16.5	824.6	80	658	434,280
Dioscoria alata & nummularia	-	59.5	59.5	5	62.9	-	-	62.9	62.9	85	486	86,994
D. bulbifera	-	38.8	38.8	5	40.7	1.6	-	42.3	42.3	85	486	
D. pentaphylla	-	70.3	70.3	5	73.8	-	-	73.8	73.8	85	486	
D. esculenta sweet potato	-	5055.0	5055.0	5	5307.7	477.7	-	477.7	5785.4	80	681	
manioc	-	110.2	110.2	5	115.7	16.5	-	16.5	132.2	80	595	62,475
Rungia klossi	17.0	53.5	70.5	2	71.9	12.4	-	12.4	94.3	95	136	12,186
misc. greens	84.0	37.8	126.8	2	129.2	-	-	129.2	129.2	95	218	26,748
hibiscus leaves	-	40.9	40.9	2	41.7	26.4	-	26.4	68.1	95	130	8,799
bananas	33.0	33.0	33.0	-	33.0	-	-	33.0	33.0	95	440	13,816
bananas	-	45.1	45.1	20	54.1	293.7	20	352.3	406.4	70	427	121,482
corn	236.3	-	236.3	5	248.1	-	-	248.1	248.1	29	463	33,336
pitpit	-	405.3	405.3	2	413.4	316.0	-	316.0	729.4	40	104	30,264
Setaria palm.	16.5	266.2	282.7	2	288.4	29.7	-	29.7	318.1	17	65	3,510
cucumber	566.0	-	566.0	50	854.0	-	-	854.0	854.0	95	50	40,565
pumpkin	17.0	106.0	123.0	2	125.4	-	-	125.4	125.4	68	200	16,864
gourd	10.0	-	10.0	2	10.2	-	-	10.2	10.2	68	154	1,063
sugar	-	386.4	386.4	200	1759.2	1372.8	20	1647.2	406.4	30	263	268,686
Totals								13824.5				4,581,594

1) Figures indicate weeks after planting. Thus entries in column 2, for example, indicate yields between 0 and 24 weeks after planting.

2) The names (e. g. Torpai) are those of the sample gardens, yields of which were weighed. The figures (e. g. 3.89) are factors required to adjust the yields of the sample gardens to per acre yields.

3) D. = Dioscoria

The per acre yields of Tsembaga gardens are not high. Massal and Barrau (1956) present a number of estimates of yields of other types of agriculture found in the South Pacific. They state that mounded sweet potatoes produce three million to six million calories within seven months, or a little more, after planting. If Okinawa variety sweet potatoes are planted, the yield might be as high as eight million calories (p. 25). Irrigated taro yields, they state, reach eight tons per acre within a year of planting (p. 8). At values equivalent to those used for the Tsembaga swiddens, this represents close to nine million calories. Higher yields are also reported from the New Guinea Highlands. Brown and Brookfield report for Chimbu "long fallow cultivation" of sweet potatoes "... comparatively high yields, certainly higher than the four tons per acre of sweet potatoes which Meggitt estimated in Mae Enga" (Brown and Brookfield 1959:26).

Tsembaga yields are not as high as these, but for purposes of comparison it should be emphasized that the great preponderance of the harvest of Tsembaga gardens is taken during the twelve month period following initial ripening of root crops. In the period between the twenty-fourth and the seventy-sixth weeks (approximately) after planting, Tsembaga taro-yam gardens yield crops containing 85.0% of their total of 5,197,900 calories. During the same period sugar-sweet potato gardens

yield 90.7% of their total. It may also be noted here that calories are not, of course, all that gardens produce. Tsembaga gardens almost certainly yield larger amounts of plant protein, for instance, than do the gardens of the Chimbu and Enga.

3.1.1.1.4 Energy expenditure in gardening

An attempt has been made to estimate the amount of energy expended in producing an acre of both taro-yam and sugar-sweet potato gardens. This estimation is germane to calculations which will be made later in this study, particularly in reference to pig keeping and the timing of the ritual cycle. It also provides an additional dimension for evaluating Tsembaga subsistence procedures and comparing them to those in other areas. The results of these estimations are presented in Table 5 below. A discussion of the methods employed in deriving the values will be found in appendix V.

Energy Expenditure Per Acre, Tsembaga Gardens

Operation	Expenditure Value (kcal.)	Derivation	Taro-yam Garden	Sugar, sweet potato Garden
1 Clearing underbrush	.65 cal/sq ft	Timing, H and K ¹	28,314	28,314
2 Clearing trees	.26 cal/sq ft	Timing, H and K	11,325	11,325
3 Fencing	46.17 cal/lin ft	Timing, H and K ²	17,082	17,082
4 Pre-burn weeding	.1 cal/sq ft	Timing, H and K, modified	4,356	4,356
5 First burn	.008 cal/sq ft	Timing, H and K	336	336
6 Second burn	.11 cal/sq ft	Timing, H and K	4,792	4,792
7 Laying soil retainers	.168 cal/sq ft	Timing, H and K	7,238	7,238
8 Planting	.19 cal/sq ft	Timing, H and K	16,553	16,553
9 First weeding	.69 cal/sq ft	Timing, H and K	30,056	30,056
10 Second weeding	.69 cal/sq ft	Timing, H and K	30,056	30,056
11 Third weeding	.69 cal/sq ft	Timing, H and K	30,056	30,056
12 Tying sugar clump	1.80-3.60/cal	Timing, H and K ³	4,500	4,500
13 Misc. maintenance		(footnote 4)	10,000	5,000
14 Acquiring supplied		Estimate for acquiring supplies, mainly lashing	8,500	5,000
15 Harvesting sweet potato	5.9 cal/lb	Timing, H and K	10,703	34,132
16 Harvesting taros	1.1 cal/lb	Timing, H and K	4,172	1,436
17 Harvesting manioc	3.0 cal/lb	Estimate, H and K	1,788	396
18 Harvesting yams	10.0 cal/lb	Estimate, H and K	13,930	1,770
19 Harvesting surface crops	1.0 cal/lb	Estimate, H and K	10,373	6,434
20 Walking to gardens	1.5 cal/min	H and K ⁵	12,000	9,000
21 Carrying from gardens	6.56 cal/min	H and K ⁶	58,606	40,876
Total			314,736	288,708

Technological efficiency: Ratio of caloric return to input

A - Taro-yam garden 16.8:1

B - Sugar-sweet potato garden 15.9:1

Carrying and walking reduced 80%:

C - Taro-yam garden: 20.6:1

D - Sugar-sweet potato garden: 18.4:1

Footnotes

1) Hipsley and Kirk, 1965

2) Assumption of 370 ft. fence per acre.

3) Assumption of 500 clumps per acre. First tie 1.8 cal/clump: second and third 3.6 cal/clump.

4) Estimate for fence mending, yam house building, propping plants, etc.

5) Allowance 20 minute walk down hill, to sugar-sweet potato garden, 400 trips to taro-yam garden.

6) 25 kg. load carried up slope for 30 minutes, 300 trips from taro-yam, 207 from sugar-sweet potato garden.

3.1.1.2 The fallow

The purpose of this section is to estimate lengths of fallow periods on Tsembaga garden sites, and to evaluate their adequacy for land recovery from the effects of gardening.

Estimations of the lengths of fallow on various gardens were difficult. The Tsembaga are not accustomed to reckoning in years, and in all cases it was necessary to arrive at dates of previous cultivation by reference to events that themselves could be fixed in time only approximately.

The length of the fallow varies between sites on the basis of a number of factors. These include local edaphic conditions and convenience to residences, but most important seems to be altitude. The full cultivation cycle measured from one planting to the next on sites between 3500 and 4200 feet is in some instances as short as ten years, although the average seems to fall around fifteen. At the higher altitudes fallows vary in length from an estimated twenty to forty-five years, with the average falling around twenty-five years. The figures of fifteen and twenty-five years, for lack of more precise estimations, will be used in later computations.

Estimation of the adequacy of these fallows presents problems of criteria. The soil samples which survived the voyage to the laboratory cannot form the basis of a judgement. They indicate merely that fallow periods are necessary if soil

depletion is to be avoided. The factors considered in estimating the adequacy of Tsembaga fallow periods may be summarized here.

(1) Several practices suggest the conservation of soil during the lives of gardens.

(a) The Tsembaga practice selective weeding.

From the time that weeding commences, five to eight weeks after planting, second growth tree seedlings are allowed to remain, while herbacious forms are uprooted. Not only does this avoid a definite grassy phase in the post-gardening succession, thereby minimizing the danger of a deflection toward a grassy disclimax, but also provides during the cropping period deep tree roots which penetrate further into the substrate than the roots of most crops, and are able to recover nutrients which otherwise might be lost through leaching. The development of trees over the garden also provides some protection for the exposed soil against tropical downpours and, furthermore, induces the gardeners to abandon the garden before the structure or content of the soil is severely damaged. People abandon gardens not because the crops are completely exhausted, but because the developing trees make the harvesting of the remaining root crops difficult.

(b) The practice of pollarding large trees may also serve to protect the exposed soil during the cropping

period. A fringe of leaves is left on the tops of many of the larger pollarded trees, and some of them survive their mutilation. Their roots may recover some of the soil nutrients which are leached to levels deeper than may be recovered by the roots of many crops.

(c) The practice of placing pigs in abandoned gardens for short periods (two-four weeks) may also contribute to the recovery of the sites. The pigs turn the ground, eliminating both herbacious growth which has developed since the last weeding and some of the smaller seedlings which, if allowed to develop, could provide root and light competition for already established saplings. The contribution of manure by pigs may also be considerable.

(2) Examination of the floristic composition of secondary growth at various stages of development also was relied upon as an indicator. The absence or rarity of Imperata cylindrica, the grass which dominates disclimax areas on Tsembaga territory, on almost all garden sites suggests that deflection toward stable grassy associations is uncommon. On the other hand, the fact that in a census of twenty to twenty-five year old secondary growth 54% of the trees were types also found in the virgin forest suggests that the secondary forest does not represent a serious deflection from the primary forest. Information concerning the floristic composition of secondary

growth is summarized in appendix VI.

(3) The structure of the secondary growth in which gardens were being cut was also taken into consideration. In almost all instances the forest had formed an unbroken canopy over the site, and trees were of substantial size. There were in most plots many trees over eighteen inches in circumference, and average heights were usually above thirty feet. The herbaceous species, while present, were for the most part limited to forms less than two feet in height.

(4) Information from other areas, while not directly applicable, at least suggests the adequacy of Tsembaga fallows. Newton (1960:83), in reporting upon experimental work on shifting cultivation in Africa, states that the total quantity of nutrients immobilized within five years of garden abandonment is half that in eighteen years, and leaf development is also rapid. He states that the accumulation of litter on the forest floor reaches a maximum in eight to twelve years, and its soil-restoring decomposition and mineralization is rapid in tropical areas due to high temperature, humidity and the prevalence of insects. There are, no doubt, differences between conditions in various areas, but if Tsembaga conditions are at all similar to those in which the experiments which Newton reports took place, Tsembaga fallows should be sufficient.

In consideration of these various factors, Tsembaga

fallows were judged to be adequate. It is even possible that they are longer than necessary. In later computations, however, the values of fifteen and twenty-five years will be used.

3.1.2 Silviculture

Tsembaga silviculture is a set of interrelated activities directed toward the establishment and maintenance of a permanent association of trees bearing edible materials in areas previously dominated by associations of other plants.

Many kinds of trees are planted on Tsembaga territory. A list will be found in appendix VII. Attention will be confined here to the two forms which are planted in groves. These are ambiam (Gnetum gnemon, p.e. tulip) and komba (Pandanus conoideus, p.e. marita).

Ambiam, which is planted in groves below 4000 feet, provides, most importantly, an edible green leaf. The fruit, which is known to the Tsembaga to be edible, is only infrequently consumed. This tree is less important in the diet of the Tsembaga than it is in those of many other Maring groups. This is at least in part a result of recent military defeat. After the Tsembaga were driven from their territory in 1953 their victorious enemies, the Kundagai, cut down most of their ambiam trees. The Tsembaga, however, are fortunate in having many other greens in their diet, many of which they prefer

to ambiam, and replanting has not been heavy.

The Kundagai also cut down much of the Tsembaga marita, but heavy replanting has taken place since the Tsembaga began their return to their territory in 1957, and some men have as many as 700 trees in the ground. Unlike ambiam, for which there are many alternative greens, there is no substitute for marita. This tree bears a large waxy red or yellow fruit from which a sauce rich in vegetable fats is produced. Most of these trees were not yet bearing during the period of field work, for marita planted on Tsembaga territory does not produce fruit until it is about five years of age.

No measurements were made of the amount of land under marita groves, of yields per unit area, or of the expenditure of energy involved in their planting or harvesting. The total amount of land under these groves is, however, small, probably under fifteen acres, and is located, for the most part, below 3000 feet. Some marita is also planted at higher altitudes, usually in gullies and ravines unfit for swiddening. Planting density is between 300 and 400 trees per acre.

The amount of work in planting and harvesting marita is slight, for the herbacious cover need not be removed from the site, nor is fencing necessary. Harvesting involves, simply, knocking down the fruit with a long pole. Both planting and harvesting are men's work.

While no estimates were made of per-acre yields, the contribution of marita to the diet is reflected in consumption records.

3.1.3 Animal husbandry

The Tsembaga keep four kinds of animals: pigs, dogs, chickens and cassowaries: dogs were reintroduced during the period of field work. All dogs previously owned by the Tsembaga had perished in an epidemic of a respiratory disease some years earlier. Dogs were kept mainly for their usefulness in hunting and, in earlier times, for their teeth. Previous to the arrival of shell valuables in the area, forty to seventy years ago, the incisors of dogs and marsupials served as valuables in bride prices and other transactions. Some Marings, furthermore, eat dog flesh. Others are enjoined from doing so by taboos which not only apply to certain descent groups but also to people who are cognatically connected to those descent groups. The members of two of the five Tsembaga clans suffered such a prohibition against the consumption of dog flesh.

Some Maring groups keep large numbers of cassowaries. The Tsembaga do not. During most of the period of field work, only one fully grown cassowary was being kept by the Tsembaga.

Cassowaries do not breed in captivity. All tame birds were captured as chicks, and the Tsembaga usually trade cassowary chicks shortly after their capture to Jimi Valley people

who, in turn, trade them in the direction of the Wahgi Divide, on the other side of which they are important in bride prices. Among Maring groups cassowaries not only provided flesh but also feathers which were used in headdresses worn during fighting. Since pacification, cassowary feathers are not as valuable as they were previously.

Chickens are few in number and hardly cared for.

Rats kill many of the chicks, and hawks and other carnivorous birds carry off many of the grown birds.

3.1.3.1 Pigs

In terms of their numbers, their contribution to the diet, and the effort required to keep them, pigs are by far the most important of the domestic animals. Tsembaga ritual, moreover, like the ritual of many other people in Melanesia, is closely bound up with pigs. Most ritual occasions are marked by the slaughter of pigs and the consumption of pork. Furthermore, the timing of the ritual cycle and the occurrence of the year-long pig festival, called the kaiko, which terminates the five to twenty year cycle, depend upon the size, composition, and rate of growth of the pig herd. A more detailed discussion of the place of pigs among the Tsembaga is therefore warranted.

3.1.3.1.1 The pig population

In June, 1962, at the beginning of the kaiko, or pig

festival, the Tsembaga herd numbered 169. At the termination of the kaiko in November, 1963, the herd was reduced to sixty juvenile and fifteen adult pigs. All of the surviving adults were scheduled for imminent killing, so that the herd was, in effect, reduced to sixty juveniles. This latter figure, moreover, is much higher than it would have been had I not been present. Wealth which I provided (by trading salt and beads for food, by paying young men in shillings for carrying supplies, etc.) was used for the purchase of a number of baby pigs which otherwise could not have been obtained. It is likely that in my absence the pig herd at the termination of the kaiko, the point at which it is smallest, would have consisted of no more than forty juveniles.

The average size of the animals constituting the herd also differed at the commencement and termination of the kaiko. The average live weight of animals in June, 1962, is estimated at 120-150 pounds. The average weight of animals surviving the kaiko is estimated at sixty to seventy pounds. The live weight of the herd was, if the surviving adults are discounted, about 5.6 times as great before the festival as after it. If a further adjustment is made to discount twenty of the juveniles present in November, 1963, as a result of my presence, the difference becomes even greater. After such an adjustment the ratio of the live weight of the herd before to live weight after the festival is 8.4:1.

3.1.3.1.2 The role of pigs in Tsembaga subsistence

In addition to providing their owners with meat, pigs make at least two other contributions to the subsistence and physical well-being of the Tsembaga. It has already been mentioned that the confinement of pigs in abandoned gardens not only utilizes root crops which cannot be efficiently harvested by human beings, but also benefits the secondary forest which is developing on the site by uprooting much of its herbaceous component, thinning the arboreal component, and contributing manure. Among Maring groups living in the Jimi Valley, although not among the Tsembaga, swiddens are sometimes planted twice. After the first crop is almost exhausted, pigs are penned in the gardens. Their rooting not only eliminates weeds and seedling trees, it also softens the ground, making the task of planting for a second time easier. The pigs, that is, are used by some Maring as cultivating machines.

Pigs make a further contribution to Tsembaga subsistence by eating garbage and human feces. Not only do they thus assist in keeping residential areas clean, but also convert wastes into materials which may be utilized by their masters.

3.1.3.1.3 Care and feeding of pigs

Small numbers of pigs are easy to keep. Very young pigs are taken to the gardens each day by their mistresses,

whom they quickly learn to follow in dog-like fashion. When they reach four or five months of age, however, pigs are considered old enough to take care of themselves. They are no longer taken to the gardens but are allowed to wander loose and spend their days rooting in the primary forest and secondary growth, returning home in the evening to receive their rations of garbage and sub-standard tubers, particularly sweet potatoes.

Supplying limited numbers of pigs with sub-standard (under four ounces each) sweet potatoes requires little extra work, for these tubers are taken from the ground in the course of harvesting the daily ration for humans. When the herd becomes large, however, the sub-standard tubers incidentally obtained in the course of harvesting for human needs become insufficient. It becomes necessary to harvest especially for pigs--that is, to work for the pigs and perhaps to give them food fit for human consumption.

Records were kept of rations set aside for pigs at the four households of the Tomegai clan for a period of a little over three months. These pig consumption figures were then extended to cover an additional five months for which harvesting and consumption figures were compiled for the Tomegai, and during which the pig and human populations were fairly constant. Information concerning the Tomegai pigs is summarized in Table 6.

TABLE 6

Roster of Pigs Owned by Members
of the Tomegai Clan, 1962-1963

Pig Name	March 1963 Size*	Date of Acquisition	Acquisition Size*	Month of Death (1963)	Surviving Size, Nov., 1963	Notes
Angane	5			Nov.		
Gerki	5			Nov.		
Parau	4			Nov.		
Kombom	5			Nov.		
Tereŋ	5			Nov.		Bi-local pig; resid- ing in Bank about 50% of time
Kikia	4			Nov.		
Koč Wai	3			Nov.		
Tambuŋ	2			Nov.		
Jokai	2			Nov.		
Bai	2				3	Scheduled for kill- ing soon
Gi	2				3	Scheduled for kill- ing soon
Grič	1				3	
Yuanepa	1				3	
Nameless		Aug.	1		2	
Prim		July	1	Sept.		Accidental death

*Pig Sizes:

- 1 - "wamba ñak" - "Soft Child" - under forty pounds
- 2 - "wamba anč" - "Hard Child" - forty to eighty pounds
- 3 - "baka" - "Short" - eighty to 120 pounds
- 4 - "yundoi" - "Large" - 120 to 160 pounds
- 5 - "yundoimai" - "Very Large" - 160 to 200 pounds

The thirteen to fifteen pigs received considerably more sweet potato and manioc than did the sixteen humans. Of 9944 pounds of sweet potatoes brought to the houses between March 11 and November 8, 1963, the pigs were given 5554 pounds, or 53.7% of the total. Of 1349 pounds of manioc brought home, the pigs received 1106 pounds, or 82.0%. The total of all root crops brought home during this period in the four households was 18,574 pounds. The ration set aside for pigs was 6674 pounds, or 35.9% of the total. An additional calculation enlarges the proportion of root crops carried home which eventually finds its way into the stomachs of the pigs. On the basis of both observations and on published figures on edible portion and wastage in root crops, 15% of the gross human ration of 11,900 pounds, or 1785 pounds, may be assumed to have been wasted, that is, it was not eaten by humans. If half of this waste was peeling, which was consumed by the pigs, the pig ration was 40.7% of the total root crops carried home. The humans received 54.4%, and 4.9% was wasted (burned in cooking, etc.)

It was not possible to weigh the size of the ration given to pigs of different sizes. Using as a basis figures of rations given to European pigs of different sizes under test conditions (FAO Agricultural Study #44:47), size 2 pigs receive about twice as much as size 1, and sizes 3, 4, and 5

receive three times as much. This calculation, which is very gross and probably underestimates their ration, yields a figure of 2.6 pounds per day of tubers set aside for the adult and adolescent pigs. If garbage from tuberous portions of the human ration is added, the daily ration of adult pigs approaches three pounds, and it should not be forgotten that they receive other food as well, both other kinds of garbage and morsels from the rations of their masters and mistresses.

3.1.3.1.4 Energy, protein, and pigs

To provide such a ration for pigs is expensive. An indication of how expensive may be derived from an examination of the differences in amount of land put in cultivation by the Tomegai in 1962, when they were supporting fourteen pigs averaging 100 to 130 pounds each, and in 1963, when they were looking forward to the reduction of the herd to three pigs averaging between eighty-five and 110 pounds. These figures are summarized in Table 7.

TABLE 7

Tomegai Gardens in Square Feet

Garden Type	1962	1963
Taro-yam gardens or mixed gardens	98,859	126,100
Sugar-sweet potato garden	111,375	8,225
Total	210,234	134,325

The reduction in land under cultivation immediately following the reduction of the pig herd by eleven animals was 75,909 square feet, or 36.1%. Since the difference is entirely in sweet potato gardens, and not in taro-yam gardens (out of which visitors to the pig festival are fed), it is reasonable to regard the reduction in garden area as a concomitant of the reduction in the number of pigs being fed. It would seem then, that 1.65 acres were put into cultivation for the provisioning of eleven adult and adolescent animals. It may be mentioned here that the figure of .15 acres in cultivation per pig falls within the range, computed later in this chapter, for acreage under cultivation per human capita.

Another computation is of interest here. Using figures derived earlier the energy cost of producing 76,000 square feet of sweet potato garden is approximately 495,000 calories. The reduction in the herd was estimated at a live weight of 1600 pounds at a maximum. This was estimated to dress at about 50%, yielding, therefore, about 800 pounds of uncooked flesh. At 1318 calories per pound (FAO Nutritional Study #11:1954), this converts to 1,054,400 calories. The protein value of thin pork carcasses is taken at 10.9% and fat 27% (FAO #11:1954), yielding for the ten pigs eighty-seven pounds of protein and 216 pounds of fat.

It may not be necessary to point out that the ratio

of energy derived from pork to energy expended in raising the pigs was not approximately 1,000,000:500,000, or 2:1. This would have been a poor enough figure from the point of view of energy efficiency. The actual ratio was even worse, for most of the pigs killed were two or more years of age when killed. The ratio could hardly have been better than 1:1 and may, indeed, have been even less favorable. More energy, that is, was expended upon raising food for pigs than was returned in the form of pork. Pig raising, furthermore, involves energy costs other than those connected with raising pig food: lost pigs must be searched for, and damage to houses and fences by pigs must be repaired. The destruction of crops in producing gardens by invading pigs must also be regarded as an energy loss to the human population and, thus, one of the costs of pig-keeping.

It is interesting to note that the energy ratio characteristic of the Tsembaga pig-husbandry is less favorable than that of Siriono hunting, estimated by Harris (unpublished paper) to be 1.4:1, but probably closer to 2.5:1. Even this latter figure is not very favorable, and probably no human population anywhere could survive with such a ratio characterizing the energy-capturing activities upon which it relies most heavily. In addition to subsistence activities, other activities and basal metabolism must be supported by captured energy, and so

must the activities and metabolisms of non-working dependents: children, old people, and the sick and injured. It is little more than a guess, but I believe that very few techniques employed by human groups primarily for the purpose of capturing energy would show energy ratios below 6:1. Less favorable ratios would barely cover the survival requirements of the population.

But it should not be assumed that energy-capturing activities are coterminous with subsistence activities. The survival and well being of the human organism depends upon a supply of minerals, vitamins and proteins as well as upon a supply of calories. In some cases, the behavior which yields these nutrients is the same as that which captures energy. Activities directed toward the production and harvesting of cereals, for instance, frequently fulfill at one and the same time both energy and protein requirements. But it need not be the case that energy-capturing activities also fulfill other nutritive requirements. Indeed, there is strong reason to doubt that the production and harvesting of root crops do so. It is not the purpose of this section to discuss the general adequacy of Tsembaga crops for the fulfillment of the protein as well as energy requirements of human beings. It is, however, important to emphasize here that while the details of energy transactions may illuminate some aspects of ecological

and, perhaps, economic relationships, explanations which are restricted to the consideration of energy inputs and outputs will in some cases fail. We could only be mystified by a prolonged and laborious procedure, such as Tsembaga pig raising, which resulted in the return to the human participants of somewhat less energy than they actually invested. We might, indeed, be tempted to construct theories which included among the advantages of the procedure only such empirically undemonstrable qualities as "mystic merit," or the prestige derived from conspicuous waste (Linton, 1955:98). On the other hand, if the frame is broadened so that not only energy input-energy output but also energy input-material output transactions are considered activities such as Tsembaga pig raising are more clearly understood. The Tsembaga make an investment of energy and get a return of protein and fat.

3.1.3.1.5 Pigs as storage of vegetal surplus

In light of the food and energy requirements of pig-keeping and of the energy yield of pork, the applicability to the Tsembaga a hypothesis recently advanced by Vayda, Leeds and Smith (1961) concerning Melanesian pig-keeping should be examined.

These writers suggest that pig-keeping may play an important part in the adjustment of Melanesian man to temporal

variations, due to meteorological vicissitudes, in the availability of foodstuffs.

A way in which Melanesian populations are able to adjust to such unpredictable variation is through the practice of trying to plant more crops every year than can be or need to be consumed by the planters in a year not appreciably disturbed by adverse weather. Planting what will be more than enough should the weather be good is a means of ensuring that there will be enough...should the weather be bad... If, then, the size of the human population is limited by the times of minimal yield, the vegetal surpluses of normal years become available for the feeding of livestock... The practice of feeding vegetal surpluses to the pigs in the years of normal and maximal crop yields is described as "banking" in Oliver's account (1955:470) of a Solomon Island culture, and the term seems appropriate, for the pigs are indeed food reserves on the hoof... In years of minimal yield when the garden produce has to be used entirely for the support of the local human population, attempts may be made to trade away or ceremonially to give away the pigs to distant and better-supplied communities or else to have the pigs agisted at such places. If these attempts are unsuccessful, the pigs must subsist on what they can forage for themselves... Moreover, in the years of minimal yield, not only can the mature pigs in most cases take care of their own subsistence but they can also be a vital source of food for human beings,...(1961:70,71)

The mechanism outlined here does not seem applicable to the Tsembaga case. Meteorological disturbances of sufficient magnitude to cause crop failures seem never to occur, according to informants. According to informants, indeed,

crop failures don't seem to occur for any reason. Anything less than a residence of many years standing does not, of course, permit definitive statements concerning the occurrence or non-occurrence of crop failures, but there is little reason, in this instance, to doubt informants' statements. These indicate that the most serious meteorological impedence to cultivation suffered by the Tsembaga and their neighbors is excessive rain during the "drier season", (June-September) when most gardens are burned. Heavy rain during this period, informants say, makes the task of burning more difficult, but does not reduce the acreage placed in cultivation and has no effect upon yields. Field observations tend to support the informants' statements. July, August and September 1963 were marked by unseasonably heavy rains, but I could detect nothing to suggest that the unfavorable weather resulted in less acreage in cultivation than would otherwise have been the case. No one, for instance, failed to burn gardens which had already been cleared of trees and underbrush. People simply worked harder at burning their gardens than would have been necessary if the weather had been drier. Informants say that comparably heavy rains had fallen during July, August and September 1962. Very wet "drier seasons" are not, apparently, uncommon in the Simbai Valley.

Although crop failure for meteorological reasons may not have occurred, it is possible that food shortages could

have developed out of the disruption attendant upon warfare. Informants denied this, however, generally agreeing that even during periods of active hostility garden work could be accomplished during frequent cease fires.

The mechanism suggested by Vayda, Leeds and Smith is inapplicable to the Tsembaga case in a second particular. It posits an adjustment in which the amount of land put into cultivation by a population of constant size will remain more or less constant from year to year. This amount of land will, in normal or good years, yield food in excess of human requirements, and the excess will be fed to pigs who may be regarded as "repositories for surplus vegetal produce (1961:71)." It has already been noted, however, that among the Tsembaga the amount of land put into production is not constant from year to year. The amount of land in production in any year is a function of the sizes of both the human and pig populations. As the pig population increases, so does the amount of land under cultivation. Pigs, that is, are not only fed from the surplus of gardens planted for humans: acreage is put into production for the pigs.

It might be well to make explicit that the Tsembaga case does not provide a general disconfirmation of the Vayda, Leeds and Smith hypothesis. Their larger point, that Melanesian pig keeping is not wasteful, and that, on the contrary, "pigs

are vitally important to the management of subsistence by Melanesian populations (1961:69)", is supported. Although their more particular formulation does not fit the Tsembaga case, it deserves to be tested by quantified observations of pig husbandry, cultivation practices, and dietary intakes among Melanesian people living under a variety of meteorological regimes. It need hardly be said that practices such as pig keeping should be expected, in different ecological settings, to play different roles in the adjustments of their practitioners to their environments. It would not be surprising to discover that the mechanism suggested by Vayda, Leeds and Smith corresponds closely to the facts in some areas subject to climatic catastrophe.

But in light of the discussion in the last section concerning the capture of protein and energy, some comment must be made on one further point in the Vayda, Leeds and Smith formulation: the characterization of pigs as repositories of vegetal surplus. The mere fact that pigs are fed domesticated plant foods not consumed by humans makes them, in a sense, repositories of vegetal surplus. The characterization suggests, however, whether or not it is the authors intention, that the ration fed to the pigs is material which is in excess of the physiological requirements of their keepers, and that it is merely stored in the animals for future use. The implication

is that the material recovered from the animals is of the same sort as, or equivalent to, that which was fed to them at earlier times. In fact, the material which is recovered from pigs is quantitatively and qualitatively different from that which was fed to them, and it is in these differences that the main significance of the place of pigs in the diet of their keepers lies.

The ration fed to pigs consists mainly of carbohydrates in the form of sweet potatoes and tubers. These are foods which are important as energy sources. Animals are poor storehouses of energy since most of what they consume is expended in metabolism and activity, and it is unlikely that the amount of calories which can be reclaimed from the flesh of pigs raised by Melanesian practices would exceed one fifth of the amount that they had received in rations.

It may also be recalled that pig husbandry is expensive in terms of the caloric expenditure demanded of its practitioners, and that the maintenance of pigs may also demand, as it does among the Tsembaga, the cultivation of acreage in excess of that required for the support of the human population. Where swiddening is practiced this could necessitate shortened fallow periods, which might be attended by changes in either soil structure or composition. These changes might well affect crop yields adversely. To put it in Oliver's terms, the "bank" could be destroying the "capital."

In view of the shortcomings of pigs as energy storehouses, and in view of the high cost of pig maintenance in both energy expenditure and land it might well be asked if pig husbandry could be regarded as adaptive if the storage of energy for use in periods of crisis were the main advantage that it conferred upon those who practice it. The indications are that in many situations people would serve themselves better by eschewing pig husbandry, letting surplus tubers rot in good years, and in years of shortage themselves consuming sub-standard tubers, which are edible even if undesirable. It may be suggested that only in environments in which even sub-standard tubers might become unavailable would the emergency energy supply provided by pork justify the high costs of maintaining pigs and even in such environments pigs alone are of questionable value as a famine food. It is not likely that a Melanesian population would have sufficient pigs on hand to use pork as a substitute for carbohydrates until a new crop of tubers came in. The Tsembaga pig herd, for instance, at the outset of the kaiko, probably represented about 13,000 pounds of pork. A minimum of 1,000 to 1,400 calories a day per average person would be required to permit people to carry out even minimal activities. If such a ration had to be provided to a population the size of the Tsembaga by pork alone, the Tsembaga herd would be exhausted in two to three months. It is, of course, unlikely that no other foods would be obtainable, but it is

also unlikely that such a quantity of pork would be available during a period of hardship to groups similar in size to the Tsembaga. This quantity reflects maximal herd size. Usually the herd is smaller.

Although the advantages of pigs as storehouses of energy are dubious, the animals do render another obvious service to their keepers. Reference to the qualitative differences between the composition of pig fodder, mainly sweet potatoes and manioc in the Tsembaga case, and pork make this apparent.

The edible portion of a lean pig yields 10.9% protein and 27% fat by weight (FAO Nutritional Studies #11:1954). The edible portion of sweet potatoes yields 0.9-1.7% protein and 0.3% fat by weight (Massal and Barrau, 1956). Manioc yields 0.7-1.2% protein and 0.3% fat (Massal and Barrau). While the amino acid ratios of sweet potatoes are quite good, those of manioc are extremely poor, and not all of the limited amount of protein which manioc contains can be metabolized by humans except in the presence of other foods rich in the specific proteins which manioc lacks. The disparity, thus, between the protein contents of manioc and sweet potato, on the one hand, and pork on the other, is even wider than indicated by the figures. The difference between the fat contents of the root crops and the pork is in the ratio of 89:1. It seems, therefore, that rather than being viewed as a means for storing

vegetables, pig husbandry might better be regarded as a means for converting carbohydrates into high quality protein and fat.

In a later section the role of pork consumption at times of crisis will be discussed. It is sufficient to note here that a ready supply of high quality protein is of considerable importance to the well being of the Tsembaga and no doubt other Melanesian populations as well. Melanesian pigs, as Vayda, Leeds and Smith point out, cannot be regarded as luxuries. They are a very expensive necessity. The lengths to which the Tsembaga go to maintain their animals is striking, but perhaps not extraordinary for horticultural people living on tuberous staples.

3.1.3.1.6 Disadvantages of a large number of pigs

It is not only in respect to the amount of work entailed in their care that large numbers of pigs may be, as Vayda, Leeds and Smith (1961:71) have pointed out, too much of a good thing. This is also true of the sanitary and cultivating services rendered by pigs. A small number of pigs is sufficient to keep residential areas clean and is also sufficient to suppress herbaceous growth and superfluous seedlings in abandoned gardens. A larger herd, on the other hand, may be troublesome--the greater the number of pigs, the greater

the number of pigs, the greater the possibility of their invasion of producing gardens, with concomitant damage not only to crops and young secondary growth, but also to the relations between the owners of guilty pigs and the owners of damaged gardens. Furthermore, while exposure to the action of a moderate number of pigs for a limited time directly after the abandonment of gardens may benefit the development of the arboreal component of the fallow by eliminating seedlings which might compete with established saplings, the prolonged exposure of a site to a large number of pigs is detrimental because many seedlings which, being at some distance from already established specimens, could grow to fill gaps in the canopy are being constantly eliminated. The establishment of quick-growing, sun-loving herbacious species, including kunai, is thus encouraged. The latter grass, when it becomes dominant, tends to form a stable disclimax, its rhizomatous subsurface structure making it difficult for other species, arboreal or herbacious, to gain a foothold.

The effects of concentrating the domiciles of a large number of pigs in a small area could be observed around the Tsembaga settlement. It has already been mentioned that Tsembaga settlement pattern has, in the past, been "pulsating," with residential units being of clan or sub-clan size most of the time. Not only people but also, and perhaps more

importantly, their pigs have usually been scattered over the countryside. The Tsembaga, however, upon returning to their territory in 1957 after a three year exile, out of fear of their enemies, built all of their houses in a single nucleated settlement, which they continued to occupy in 1963. For six years, two hundred, rather than the usual twenty to forty persons, thus resided within an area 200 to 400 feet wide and about 2000 feet long. Each day about half of their pigs passed through the grounds named Pra and Greki just west of the settlement, rooting on their way. These areas were gardened in 1957. Stumps bear our informants' statements that the sites were in secondary forest when they were gardened. Six years after these gardens were planted trees were only scattered: no canopy had formed, for the pigs had constantly rooted out the seedlings necessary to its development. Kunai seemed to be the most important component of the ground cover.

Usually such concentrations of pigs were not allowed to develop. In earlier times the extent to which settlement pattern was scattered was, it seems, directly correlated with the size of the pig herd. During and directly after the pig festival the degree of nucleation was high. As the pig herd grew, however, people would move away, establishing themselves in hamlets. Even these sometimes disintegrated into scattered homesteads as the number of pigs grew even larger.

Stimulus to residential removal involved factors other than pigs, of course. The Tsembaga and other Maring are likely to move their residences because of illness, which is thought frequently to be the result of the contamination of the ground either by supernatural tukump, corruption disseminated by a spirit, or by kum, a similar sort of areal infection sent by sorcery. But disease among pigs is frequently rationalized in precisely the same way and is probably as frequent a reason for moving as disease among people.

Arguments concerning pigs also result in removals to isolated locations. These frequently have to do with garden invasion. Residential isolation serves to increase the distance between one's pigs and the gardens of others and the pigs of other people and gardens of one's own, thus diminishing the possibility of damage to both gardens and social relations. This is explicitly stated by some Tsembaga in explaining the location of their residences. That residential removal, usually resulting in the scattering of house sites, is also stimulated by the desire to decrease house to garden distances has already been mentioned, and the meaning of this in terms of energy expenditure has been presented. The need to reduce house to garden distances obviously becomes increasingly compelling with an increased pig herd, for it is necessary to transport food for pigs as well as people from gardens to houses.

While the process of residential "denucleation" mitigates the problems which result from large concentrations of pigs in limited areas, it also undoubtedly results in a diminution in social interactions between members of different small residential groups. Further, the scattered residential pattern opens the group to greater danger from enemy action during periods of open hostility. In short, the Tsembaga pay for their pigs not only in land, food, and energy, but also in loss of sociability and increased vulnerability.

3.1.3.1.7 Pig breeding

In light of the difficulties inherent in keeping large numbers of pigs, certain breeding practices which appear uneconomic become comprehensible. All male pigs are castrated at approximately three months of age. Tsembaga say that this results in a larger more docile animal. It also means that pregnancies are always the result of unions of domestic sows with feral males. Since most of the sows are domiciled above 4000 feet, and since the feral males are inclined to stay below 3000 feet, meetings must be infrequent. During the period of field work, out of a potential of ninety-nine or more pregnancies only fourteen litters resulted.

Birth generally takes place in the forest and infants are sometimes lost. Some of those lost perhaps survive in a

feral state and may serve later to impregnate domestic sows or may be recovered through hunting, but it is likely that most of them perish.

Mortality among those infant pigs who do find their way home is also high. From the fourteen pregnancies only thirty-two of the offspring were alive at the termination of field work. If the seven born in early December, 1963, and still surviving at the termination of field work two weeks later are subtracted, average litters approximated only two surviving offspring.

3.2 Hunting and gathering

A wide variety of non-domesticated resources, obtained from all of the biotic associations found on the territory are utilized by the Tsembaga. Information concerning the use and site of occurrence of approximately 300 items is summarized in appendix VIII. One hundred thirty-four of these items are found in the primary forest, seventy-two are found in secondary forest, and seventy-six are common in both associations, and the lists are far from complete.

Reliance upon no single item is particularly heavy. While no quantitative data on the use of such materials were compiled, it is clear, however, that reliance upon the aggregate of non-domesticated resources is considerable. Of particular importance are game and building materials. The land,

therefore, under primary and secondary forest should not be considered to be merely a reserve which could be put into production should the need arise, or land out of production during the fallow period. Such lands constitute important resource areas in their own right. Increase in the amount of land under cultivation not only might damage the environment by shortening fallows or encouraging erosion in the steep higher zone covered by primary forest. It would also reduce the amount of non-domesticated materials available to the Tsembaga.

4.0 The diet

Estimation of the food intakes of the Tsembaga are necessary to calculations which will be made later. One of the goals of this study is to show how ritual operates to keep the trophic demands of the Tsembaga and their pigs within the carrying capacity of their territory. To do this, quantification of the trophic demands of the population are required. In most estimations of carrying capacity, this quantification is expressed in terms of acreage per capita per annum put into production. Such a figure does not indicate, however, whether a per capita daily intake of 1500 or 2500 or 3000 Calories is allowed for. Estimations of actual intake specify the level at which the individuals who constitute the population are

being supported, which quantification in terms of area under cultivation alone does not. Actual intakes, further, may be assessed against estimated requirements and a judgement can be made as to whether the population is being maintained in a state of well-being or at bare subsistence level.

Estimations of intakes, in addition to supplementing carrying capacity calculations, will form one of the bases for another estimation which will be of considerable importance in elucidating the homeostatic function of ritual: the amount of energy available for pig husbandry.

The ways in which the operation of ritual and taboo tend to optimize the utility of the limited amounts of animal protein available will also be discussed in this section.

4.1 Composition of the diet

The composition of the Tsembaga diet by percentage of constituent foods by weight is presented in Table 8, along with comparative information from other New Guinea groups.

The data from Busama, Kaiapit, Patep, and Kavataria were collected during the New Guinea Food Survey of 1947. The broad nature of this survey did not permit long observation of consumption in any location, and it is probable that some items included in the diets of these communities were not recorded. It may be, therefore, that the impression of greater variety

in the Tsembaga diet is to some extent misleading. It is worth noting, however, that among the Tsembaga there seems to be less heavy reliance upon any single starchy staple than is the case in other groups. Furthermore, a much larger proportion of the diet apparently consists of foods other than starchy staples. Slightly more than one-third of the Tsembaga diet by weight, 34.9%, is composed of leaves, stems, and fruits other than banana. Sugar cane (which will be included in later calculations of Tsembaga intake) has been excluded from this comparison since it is not included in the reports from some of the other communities in which it may be present. If it were included here, the proportion of items other than starchy staples in the Tsembaga diet would approach 50%. In the five other communities with which the Tsembaga are compared, the percentage of non-starchy items in the diet varies from 15.3% to 25.7%. In further contrast to the others, the Tsembaga diet includes an appreciable amount of marita pandanus, the edible portion of which contains, according to Hipsley and Kirk (1965:38), 14% fat. The nutritional consequences of the greater variety found in the Tsembaga diet will be discussed later.

4.2 Tsembaga intakes

Estimation of the Tsembaga diet must be based upon

TABLE 8

Tsembaga and Other New Guinea Communities

Composition of Diets, by Percentage Weight

	Busama	Kaiapit	Patep	Kavataria	Chimbu	Tsembaga
Taro	65.0	7.3	45.9	8.6	-	25.8
Yam	1.4	9.5	.2	55.2	5.0	9.3
Manioc	-	2.0	.2	1.4	-	1.2
Sweet potato	-	25.7	37.6	14.0	77.0	21.0
Sago	6.8	.28	-	-	-	-
Banana	1.1	31.6	.4	5.5	-	7.8
Fruits and stems	6.1	-	2.6	2.3	13.0	17.3
Leaves	14.0	9.2	8.0	-	2.5	9.9
Coconut	2.2	9.5	-	2.8	-	-
Marita pandanus	-	-	?	-	?	4.2
Grain	.36	-	3.0	-	1.5	-
Misc. Veg.	-	3.4	1.8	1.4	-	2.5
Animal	2.9	1.7	.2	9.7	1.0	1.0

Information for Busama, Kaiapit, Patep,
and Kavataria from Hipsley & Clements,
1947

Information for Chimbu from Venkatachalam,
1962

Busama is a coastal village on the Huon
Gulf

Kaiapit is six miles east of the Markham
River, about sixty miles northwest of Lea,
altitude about 1000 feet

Patep - Altitude 3550 feet about twenty-
five miles from the coast at the mouth of
the Buang River

Kavataria - Coastal village on Kirawina
in the Trobriand Islands

Chimbu - 5,000-7,000 feet in central
mountain range

(1) the quantity of food ingested and (2) the quality of the food ingested. Vegetable and animal foods will be treated separately.

4.2.1 Plant foods

Fruits and vegetables comprise approximately 99% by weight of the Tsembaga intake. All vegetables brought home to the four hearths of the Tomegai clan were weighed daily by named variety, from February 14 to December 14, 1963. For the purposes of estimating intake, the figures from March 11 to November 8, a period during which both the pig and human populations were relatively stable, formed the basis of the estimations. Details of the methods employed will be found in appendix IX, but may be summarized here briefly.

From the gross weights, two deductions were initially made. First, the harvester herself set aside the ration for pigs, which was subtracted from the gross weight available for human consumption. A further deduction, made on the basis of tests, was applied for waste in preparation, leaving a weight of edible portion for humans.

Factors for consumption away from home were added to the gross weights of foodstuffs recorded at the houses. These additional factors were estimated upon the basis of observations made without benefit of scales.

Sixteen individuals regularly dined at the four hearths of the Tomegai clan. However, not all were present every day, and on many occasions the Tomegai had visitors. It was, therefore, necessary to keep a roster of who was fed from each hearth each day, with the age and sex category of each visitor being recorded.

While it was possible to weigh all foodstuffs brought to the women's houses, Tsembaga eating habits precluded weighings of the amounts apportioned to individuals. A formula, therefore, had to be adopted for assigning proportions of the total quantity brought home to the four hearths to individuals in the various age-sex categories. It was decided to use for this formula the proportions in Langley's recommendations for caloric allowances for New Guinea natives (1947:134). These allowances, according to Langley (1947:106), were based upon those of the National Research Council, but were corrected by her for differences in stature and "mode of life and degree of activity" between New Guineans and North Americans. It may be noted that the proportions allotted to each age-sex category by Langley correspond closely to those published more recently by the Food and Agricultural Organization of the United Nations (FAO Nutritional Studies #15:1957). The proportions assigned individuals in each age-sex category appear as "trophic units" in column 4 of Table 9.

It may be objected the use of ratios derived from recommended allowances for the distribution of actual portions is a procedure beset with pitfalls. It is no doubt the case that the actual proportions of the total served to individuals in each age-sex category were at some variance with the ideal. The adoption of the procedure was forced by the difficulty, indeed the virtual impossibility, of making quantified observations of individual intakes. While there cannot be certainty, it is likely that attempts at quantified observations of individual intakes would have produced errors of greater magnitude than the method adopted here.

Nutritive values for the various foodstuffs were taken from the literature. Whenever possible, values derived from the analysis of crops grown in New Guinea were used. These values, with the sources from which they were obtained, will be found in appendix IX.

Estimated daily intakes of calories, protein and calcium for individuals in various age and sex categories are summarized in Table 9, where they are compared to recommendations of both the New Guinea food survey (Langley (1947:134, Venkatachalam 1962:10) and FAO/WHO (World Food Problems #5, 1964:6).

In comparison to the recommendations caloric intake for all categories is adequate. There is a failure to meet

TABLE 9

Nutritive value of the vegetable portion of the Tsembaga diet compared with FAO/WHO and New Guinea Food Standards

Consumers				Calories		Protein				Calcium	
Category	Number persons	Average weight kgm	Trophic Units per capita	Rec. daily intake Langley, corrected	Estimated actual daily intake	Rec. daily intake Langley, corrected	Rec. daily intake FAO/WHO, corrected	Estimated daily intake, grams		Rec. daily intake Langley, corrected mgms	Est. daily intake mgms
								min.	max.		
1	2	3	4	5	6	7	8	9	10	11	12
Adult males	6	43.0	25	2130	2575	32	37	43.2	58.2	640	1525
Adult females	4	38.0	21	1735	2163	32	33	36.3	48.9	640	1281
Adolescent females	1	27.3	20.5	1540	2112	56	27	35.4	47.3	750	1250
Children 5-10	2	18.6	13	1157	1334	44-53	21	22.5	30.3	890	793
Children 3-5	2	13.0	12	1000	1236	42	15	20.7	28.0	840	732
Children 0-3	1	7.7	8.5	800	875	33	10	14.7	19.8	940	519
Per capita average					2015						

1. "Langley, corrected" refers to Langley, 1947:134, corrected for Tsembaga stature.
2. "FAO/WHO, corrected" refers to FAO; World Food Problems, No. 5, 1964, corrected for the biological value of vegetable protein.
3. Minimum and maximum intakes are presented because of ranges in protein content attributed to various vegetables by various authorities. Authorities and values assigned by them appear in Appendix VIII.

the recommendations in the calcium portions of the younger categories. These possible deficiencies are moderate in the case of 3-5 year olds and 5-10 year olds, while that possibly suffered by 0-3 year olds is made up in whole or part by mother's milk, children being nursed, usually, for two years or more.

Two aspects of protein intake should be discussed. There is, first, the question of the quality of the protein. The contents of various foods vary in "biological value," that is, in the extent to which they may be utilized for maintenance and growth (Burton et al 1959:46). This is a function of the proportions in which the amino acids of which the protein is composed are present: some may not be utilized except in the presence of others, while excesses of some may inhibit the utilization of others (FAO #16, 1957:23).

It is generally the case that proteins of animal origin are "complete", that is, they contain appreciable amounts of all of the amino acids which are essential for growth and tissue repair. This is not the case with many vegetable proteins. Manioc, which contains almost as much protein as the other root crops, is very poor in certain of the essential amino acids, and is thus by itself of only limited value as a protein source.

It is not necessary, however, that all the essential

amino acids be contained within a particular food. The total requirement may be derived from the proteins found in the variety of foods which are ingested together (Albanese and Orto, 1964:143f). The variety of foods enjoyed by the Tsembaga, thus, not only spares them the gustatory boredom to which some other New Guinea populations must be subject, but also may improve utilization of the total intake. The amino acid contents of sweet potatoes, for instance, while substantial, are limited by rather low methionine and cystine contents (Peters 1958:40). Taros are good sources of methionine although poor in iso-leucine, in which sweet potatoes are well supplied (Peters 1958:35). The presence of both items in the diet enhances the value of each, since they are frequently ingested at the same meal. Analyses of amino acid contents of many other Tsembaga vegetables are not available. It may be suggested, however, that the "biological value" (Albanese and Orto 1964:140f) of the aggregate of protein in the Tsembaga diet, although perhaps remaining low, is higher than would be the case if the diet consisted of fewer items, since it is reasonable to assume that the proteins in the many different foods ingested daily would compliment each other to some extent.

There is, however, a further problem. It may be noted in Table 9 that the intakes of adults meet the recommendations of the New Guinea Food Survey for protein, but the

intakes of the younger categories do not. This may well be characteristic of people whose diets include root crop staples. To derive sufficient protein from root crops alone requires the ingestion of a greater quantity of tubers than children may be able to manage easily. While the caloric requirements of a 5 to 10 year old child may be fulfilled by two pounds of tubers, to meet the suggested protein allowances he would have to consume two to four times that quantity. The seriousness of this disparity is directly proportional to the extent to which root crops comprise the diet. Among the Chimbu, for instance, where roots comprise eighty-two percent of the total intake, 5 to 10 year olds are reported to ingest only 12.8 grams of protein a day (Venkatachalam 1962:10). This is about half of Tsembaga intake, while the caloric intakes of the two peoples show nowhere near such a disparity.

The comparative advantage of the Tsembaga diet lies in the fact that starchy staples comprise only sixty-five per cent of it. Furthermore, because the Tsembaga have available to them such protein rich greens as hibiscus leaves, they need derive only forty per cent of their protein from tubers (see appendix VIII). The Tsembaga child's problem is, thus, not as serious as that of the Chimbu child, but it still may be difficult for him to obtain protein in a form sufficiently compact to be easily ingested. Animal protein is especially

valuable to him not only because it is a more adequate protein but because it comes in a more concentrated form.

It must be borne in mind that the sample includes only five children and one adolescent, and the method used for apportioning the total weighed food sample among the various age and sex categories must have resulted in some error. A clinical assessment of the nutritive status of the children would have indicated more clearly than the comparison of estimated intakes to standard recommendations whether or not there was sufficient protein in their diets. It was not possible to arrange for such a clinical assessment but it may be noted that a number of the children had soft and discolored hair, frequently a sign of low or inadequate protein intake, and that the parotids of a few were slightly enlarged. No cases of either kwashiorkor or severe emaciation were seen, however, nor did any of the children seem especially dull. It may be that their growth is retarded, but data are insufficient to assess this matter. Compared to American children Tsembaga children seemed small for their estimated ages. While this is to be expected among the children of a population in which adults average less than five feet in height, it is likely that the small stature of the Tsembaga is at least partially attributable to low protein intake among children and, as will be discussed later, adolescents. It may be

significant that the adults of the Fungai-Korama, a Maring group which occupies a territory on the edge of a large expanse of virgin forest, seem to be taller and heavier than the Tsembaga. It is possible that their greater size is a function of larger amounts of game in their diet, but quantitative data are lacking.

That Tsembaga children do not seem to be suffering from severe symptoms of protein deficiency suggests that Langley's recommendations are unrealistically high. Langley herself suggests care in their application, pointing out that they were derived from experimental work on Caucasian peoples and in addition include a "wide margin of safety" (Langley 1947:106). Corrections were made by her for differences in stature and also on the basis of observations of "the mode of life and degree of activity of the New Guinea native," but they were made without "physiological studies which would give a picture of the metabolism of Melanesian people" (1947:106).

More recent studies indicate that a considerably smaller protein ration may be sufficient even for children, and in column 8 of Table 9 the requirements set forth by the Joint FAO/WHO Expert Group on Protein Requirements (World Food Problems #5 1964:6) are presented. The low incidence of severe pathology among Tsembaga children suggests that the FAO/WHO requirements may be more in accord with physiological facts

than are Langley's recommendations. The FAO/WHO allowances do not, however, include a wide "margin of safety," and the fact that there is some pathology suggests that the Tsembaga achieve nitrogen balance at a low level. In view of this, the contexts in which the Tsembaga consume the limited amounts of animal protein available to them may be of considerable significance.

4.2.2 Animal foods

A variety of domesticated and non-domesticated animal foods are available to the Tsembaga. Domesticated animals include pigs, cassowaries and chickens. Non-domesticated animals include, in addition to wild pigs and cassowaries, marsupials, rats, snakes, lizards, eels, catfish, frogs, birds, bird-eggs, bats, grubs, insects and spiders. It might be mentioned that the Tsembaga are not, and vehemently maintain their ancestors never were, cannibals.

4.2.2.1 Non-domesticated animals

No records were kept of the intake of non-domesticated animal foods, for a great part of the consumption, particularly of the smaller forms, takes place away from the houses.

It is clear, nevertheless, that for certain categories of the population, married women and pre-pubescent children, small items, such as rats, frogs, nestling birds and insects

form a part of daily diet. The amounts are small, however, and probably do not contribute more than a gram or two to the daily protein intake. The larger items, eels, snakes and marsupials, although less frequently taken, probably contribute more to the annual diet. Wild pigs, of which six were taken in 1963, contributed most of all non-domesticated animals to the diet in that year. Wild cassowaries are only infrequently obtained by the Tsembaga, none being either shot or trapped in 1963. These birds may be more important in the diet of other Maring groups.

The apportionment of animal foods throughout the population is not even. Taboos against the ingestion of certain animals burden various categories of persons. The most extensive of these are suffered by bamp kunda yu (fight magic men), those who perform the rituals associated with warfare. The taboos applicable to other men who have participated in fighting are slightly less extensive. For both of these categories the consumption of many kinds of marsupial, and all snakes, eels, catfish, lizards and frogs is proscribed. The ideological basis for the restriction upon marsupials is not clear. It may be mentioned, however, that all of the proscribed varieties live in the high altitude virgin forest and are associated with the red spirits, with whom the men suffering the proscription have a special relationship. The

reptiles, amphibia and fish are not eaten because their "coldness" is regarded to be inimical to the "hotness" of ritual knowledge and ritual experience. In addition to these supernaturally sanctioned taboos, men also simply avoid certain animal foods. Any man, other than fight magic men, may eat rats, but no man would. They are said to be small things fit only for women and children. The same is said of small birds, bats, and most insects.

Adolescent boys suffer a somewhat different set of taboos and avoidances. The ideological basis for many of them rests upon the effect that their ingestion might have on the massive coiffure, called a mamp ku, which a boy allows to grow shortly after secondary sexual characteristics appear. If a marsupial with loose fur is eaten, for instance, it is said that the hair will become loose. If wild pig is eaten, the hair will be filled with lice, like that of the wild pig.

The restrictions to which adolescent girls and women of child-bearing age who have not yet borne children are subject are more limited than those which apply to adolescent boys. They do, however, pertain to the two most important wild animal foods: wild pig, the consumption of which, they believe, will give them lice, and rats, which will impart a bad odor to the vagina, making them unacceptable to men.

Children, and women who have borne children are, as

categories, subject to no taboos whatsoever. Thus, when a man or adolescent boy kills a snake, lizard, small bird, rat or marsupial, he gives it to a woman or child.

The taboos operate, in short, to direct most of the subsidiary sources of animal protein to two categories very much in need of them: women and children. The deprivation of adult males, who are as an ontogenetic category least in need of protein, in favor of women and children is probably of some advantage to the population. On the other hand, the deprivation of adolescents in favor of woman and children is not as clearly advantageous. Protein requirements during adolescence are high, for this is a period of rapid growth and development. It may be observed that while some of the other possible effects of low protein intake during adolescence (particularly mental dullness, which was not observed among Tsembaga adolescents) are injurious, the inhibition of growth and the retardation of sexual development (Hipsley and Kirk 1965:14) may not be disadvantageous. The advantages conferred by an additional inch or two and an additional few pounds could not be great, and the delay of menarche for a year or two might even be advantageous to the population as a whole. At any rate, while deprivation of protein at this time may result in suppression of the individual's growth, this may not be a high price to pay for more adequate protein for mothers and small children.

4.2.2.2 Domestic animals

Since the Tsembaga, unlike some other Marings, keep almost no cassowaries and since chickens are few, attention will be confined here to pigs.

During the field work period a pig festival was in progress, and the usual patterns of pork consumption were overridden by the special demands of various ritual and ceremonial events. Quantitative data concerning pork consumption during non-festival years is, therefore, lacking. Cultural practices in this area are, however, clearly defined.

It should be mentioned first that religious prohibitions suffered by men are not restricted to wild animal foods. During the greater part of the ritual cycle they may not eat the flesh of animals killed in connection with the pig festivals of other places. Women, children and adolescents, however, may eat such pork and are, thus, the full nutritional beneficiaries of these presentations.

Preferences also play what might be a nutritionally significant role in the apportionment of pork. Men receive larger portions of the cuts which they deem most desirable. These are the fatter parts of the animal, with the belly being most appreciated. Women, children and adolescents on the other hand, receive larger portions of the lean. In short, the protein intakes of women and children are benefited by

taboo and preference in the matter of domestic pork.

Of much greater interest and significance here are the contexts in which pigs are ordinarily killed and the manner in which the slain animals are apportioned. Pigs are killed during non-festival years only in connection with misfortune, emergency or obligation. The obligations are those associated with marriage. Prestations of valuables are made to affines from time to time in connection with the marriage itself, with the birth of children, and with the deaths of either of the marriage partners or their children. These prestations are almost always accompanied by pork.

Not all such prestations follow immediately upon the assumption of the obligation. Those in connection with the birth of children are usually deferred until the next pig festival, and this is sometimes the case even with prestations in connection with the marriage itself. Ritual demands arising from misfortune and emergency result in the greatest amount of pig slaughter and consumption during years unmarked by pig festivals.

During the period of field work, the Tsembaga, being involved in a pig festival, did not slaughter pigs at the time of illness or injury. Instead they promised that they would give the ancestors the animals at the termination of the kaiko, when they were planning to kill them anyhow. All informants

agree, however, and information from other local populations indicate that in non-festival years the pigs are sacrificed at the time of the misfortune or emergency. If an illness is protracted a number of pigs may be killed. C. Vayda reports that among the Fungai-Korama three pigs were killed in connection with the illness of one man during the course of a week.

Death also demands the slaughter of pigs. If the deceased was a married woman, the slaughter is likely to be of greater magnitude than for other categories of persons. Instances are reported in which men killed all of their deceased wife's pigs, for there were no other women to look after them. As with illness, the Tsembaga in 1963 killed no pigs at times of death. They merely promised animals at the termination of the pig festival.

Some misfortunes befall pigs directly. There are frequent deaths from arrow wounds, since pigs are often shot invading gardens. None were killed for this reason in Tsembaga in 1963, but among the neighboring Tuguma during the same year the toll among porcine culprits was six. Pigs also occasionally sicken and die. They are, nevertheless, eaten unless their corpses putrefy before being found.

The slaughter of pigs is also demanded by the rituals associated with warfare. The number of pigs killed is directly related to the duration and severity of the fighting. This

matter will be treated in more detail in the next chapter.

The contexts which define when a pig is to be killed also designate who is to eat it. When pigs are killed in connection with illness the portion served to the sick person is liver. The remainder of the pig may be consumed only by the agnates of the sick person, or in the case of a married woman, her husband's agnates as well. If any other persons partake of the flesh of the sacrificial animal, it is thought that the sick person will die and that the non-agnatic consumer will sicken. Rules concerning who may eat pig killed in funerary contexts are similar. Punishment for violation of consumption rules concerning funerary pig is visited upon both the non-agnatic consumer and the man who presented him with the pork by the spirit of the man to whom the sacrifice was addressed. Pigs killed for the rituals associated with warfare are eaten only by the men participating in the fighting.

Pigs are frequently killed by the owners of gardens which they have invaded and damaged. Feelings run high after such events. Not infrequently the owner of the slain pig makes an attempt upon the life of the garden owner or one of his pigs. If a peaceful settlement can be reached, however, the pig owner and the garden owner and their respective agnates share the flesh of the slain pig.

In sum, pigs killed in the context of misfortune or emergency tend to be consumed by those who are either victims of or participants in the event or those closest to them.

It is interesting to note that there is a tendency to distribute widely the meat which results from the killing of pigs in contexts which do not have to do with misfortune or emergency. Pork which is received in bride or child payments, for instance, is consumed not only by members of the recipient exogamous group. Some of it is invariably redistributed by them to co-residents and affines. Pork resulting from the death of pigs from accident or natural causes is also widely distributed. It may be mentioned that the consumption of the flesh of feral pigs is also not restricted to the agnatic group of the slayer. There seems to be, indeed, an attempt to distribute the flesh of these animals as widely as possible. At least all of those who participate in the hunt share in the flesh, which is apportioned by the slayer. If the animal is large, others do, too. In the case of the two largest wild pigs killed in 1963 every Tsembaga received a portion.

That most pork consumption in years in which pig festivals do not occur takes place in contexts of misfortune or emergency, and that the distribution of the flesh in these instances is restricted are matters of some physiological

interest. It is reasonable to assume that misfortune and emergency induce in those experiencing them a "stress reaction", a complex of physiological changes that result directly from or in response to the emergency with which the organisms are confronted. In the case of the sick and injured, this is obvious. It is also the case, however, that stress reactions occur among people who are experiencing rage or fear (Houssay 1955:1096) or even prolonged anxiety (NRC #1100, 1963:53).

One aspect of stress reactions is "negative nitrogen balance" (Houssay 1955:440), that is, a net loss of nitrogen from the body. This may not, if the stress period is not unduly prolonged, be a serious matter for organisms which have previously achieved nitrogen balance at a high level. Negative nitrogen balance, according to Moore (1959:439), will not, for instance, impair wound healing in a normally well nourished patient.

Organisms, however, which are in nitrogen balance at a low level previous to their exposure to stress may experience difficulties. As long ago as 1919 it was reported that the healing of experimental wounds in animals on low protein intakes was slower than healing in animals on high protein diets (Large and Johnston 1948:352). In a more recent discussion Moore also notes differences in healing between well and poorly nourished animals and surgical patients,

and states that "It is appealing to explain this...in the labilization or translocation theory; the well nourished animal has more body protein available for labilization or translocation [from undamaged tissues to damaged structures] (1959:102)." Zintel (1964:1043) has also recently pointed out that "Hypoproteinemia predisposes to poor wound healing or disruption of wounds, delayed healing of fractures, including anemia, failure of gastro-intestinal stomas to function, embarrassment of pulmonary and cardiac function and reduced resistance to infection." Lund and Levinson in a discussion of surgical patients, noted yet other ill effects of protein depletion upon the injured some years ago. These included decreased resistance to shock, hypotension, lower basal metabolism rates, polyuria, lack of appetite, weakness, and mental changes including confusion, lethargy, and depression (1948:349). Lund and Levinson suggest a "great increase" in the protein intake of individuals traumatized by surgery (1948:350). Their view is shared by Elman (1951:85,100). The more recent writers do not necessarily suggest such a course for individuals, who were, previous to traumatization well nourished, but Zintel (1964:1043ff) underlines the necessity to alleviate protein deficiency, should it be present or should it develop in surgical patients, preferably by feeding a generous supply of protein.

It is not only victims of trauma who may be put at a disadvantage by poor protein nutrition. In febrile diseases "the underfed febrile patient is thrown into a negative nitrogen balance, which is far from desirable since it predisposes to hypoproteinemia and anemia, interferes with the body's anabolic defense mechanisms, and delays convalescence (Burton, 1959:230)." A protein allowance somewhat in excess of usual requirements may therefore be indicated for fever patients (Burton 1959:231).

It may be the case that protein intake not only affects the prognosis for ill or injured organisms. It may be that protein intake also has a bearing upon susceptibility to some diseases. While the subject is not well known, Berg (1948:309ff) has remarked that "numerous incidental observations have indicated the possibility that proteins play an important part in immunity," and relates this to their role in the production of antibodies and the part they probably play in phagocytosis as well. It may be of importance here that the status of a protein depleted organism may be significantly affected by the intake of high quality proteins for relatively short periods of time. Berg (1948:311) states that experiments indicate that repletion of depleted animals "by feeding a high quality protein for as little as two days before antigenic stimulation leads to a detectable increase in

antibody production; in only seven days the capacity [of the previously depleted animals] approximates that of the control animals [which had previously been fed on "adequate diet"] . In a more recent discussion Axelrod (1964:654) states that "The detrimental effects of specific dietary deficiencies upon the development of acquired immunity in experimental animals have been amply documented. In particular, the requirements for amino acids...are recognized." He warns, however, that "the significance of animal experimentation must...be evaluated critically, and remarks that "the relationship of nutritional state to acquired immunity in man remains indeterminate (1964:655)." Zucker and Zucker in a recent discussion of the relationship between nutrition and the resistance of uninfected animals to infection, make a similar observation concerning the role of proteins: "the available data are largely inconclusive or uncertain as to interpretation." (1964:643)

It appears then, that illness and injury are marked by negative nitrogen balance which can have dangerous implications for protein depleted organisms. The effects of negative nitrogen balance, however, may be offset by the ingestion of large amounts of protein. It also may be, although this is far less certain, that the ingestion of high quality protein for relatively short periods of time may significantly improve the ability of uninfected organisms to withstand infection.

I suggest that given the adequacy of the protein derived from vegetables and non-domesticated animals for maintaining the Tsembaga in nitrogen balance at low levels in the absence of stress, it would be difficult to imagine a more effective way for them to utilize their scarce pigs than to consume them in situations of misfortune and emergency. Individuals who are already traumatized or diseased are provided with high quality protein which may go far to offset the nitrogen losses they are already experiencing as a direct result of the injuries their bodies are sustaining, and which also assist them in producing sufficient antibodies to resist infection. Those close to the victims receive protein which not only may offset the nitrogen loss resulting from the anxiety which they may be experiencing, but also might possibly prepare their bodies better to withstand the injuries or infections likely to be forthcoming if the victim is suffering from a contagious disease, for example, or was wounded in warfare which must be continued.

In sum, while the protein content of the everyday diet of the Tsembaga is probably adequate for everyday activities, it may be less than adequate in stress situations. The practice of killing and consuming pigs in connection with emergency and misfortune tends to provide physiological reinforcement when it is needed to those who need it. The contribution of

pork to the Tsembaga diet thus seems to be of much greater importance than is indicated by the amounts actually consumed. That this suggestion has implications for future anthropological analyses of animal sacrifice is clear, and appropriate physiological tests should be undertaken wherever possible. Until they are this formulation must remain hypothetical only. It may, nevertheless, be said that there are strong reasons to believe that the ritual regulation of pork consumption by the Tsembaga makes an important contribution to a diet which maintains the population in relatively good health at a high level of activity.

5.0 The limits of the system

In previous sections of this chapter an attempt has been made to specify the trophic requirements of the Tsembaga, the procedures by which they fill them, and the effects which these procedures have upon the environment in which they take place. Where possible, descriptions of relevant items and procedures have been reduced to quantitative terms to facilitate the elucidation of their inter-relationships. In this section an attempt will be made to compute the maximum numbers of people and pigs which could be supported on Tsembaga territory, through the procedures described in previous sections, without changes in the trophic requirements of individual

Tsembaga and without degradation of the environment. These estimates are a preliminary to the examination of the role of the ritual cycle in the regulation of the relations of the Tsembaga with the non-human components of their immediate, or territorial, environment.

Precise calculation of "carrying capacity" for people such as the Tsembaga, who depend in part upon wild foodstuffs, is extremely difficult. A simplifying assumption is generally made in calculations of carrying capacity for horticultural peoples, however. It is assumed that the factor which limits the size of the population is the amount of domesticated food (and therefore arable land) available to it. A further assumption, that it is the caloric value of the food which is limiting, is also made. This latter may, in some cases, be dubious. It might be, for instance, that the amount of protein available is limiting. Among the Tsembaga it has been noted that children who would have a difficult time in ingesting sufficient quantities of root crops and bulky greens to satisfy their protein requirements consume quite regularly many small animals and insects. It could conceivably be the case that with greater population the amount of forest would be reduced, lowering the amount of protein available in the form of small animals. This could result directly in a higher incidence of protein deficiency pathology and indirectly in a higher rate

of mortality among children. That protein rather than calories may be limiting to some populations is suggested by Venkatachalam's (1962) assessment of Chimbu children, among whom he reports some severe cases of kwashiorkor.

This point has been made in qualification of the estimates which will follow, rather than as an introduction to the procedures employed. Data are deficient concerning protein and other nutrients. Some estimations will, however, be made on the basis of calories available from domesticated sources.

Although simplicity has been gained by assuming calories from domestic sources to be the factor which limits the size of both human and pig populations, further difficulties surround the question of caloric intake. First, it is being assumed here, as it almost always is in carrying capacity estimations, that the diet of the Tsembaga is sufficient in calories. Supporting evidence is strong but not conclusive. Conversely, it might be that the Tsembaga could maintain their present level of health and activity on a shortened ration. If this were the case carrying capacity would be greater than the estimates will indicate. Data are insufficient for the assessment of this possibility, and Tsembaga intake as estimated will form the basis of calculations undertaken here.

The difficulties associated with assumptions concerning intake underlying carrying capacity computations are not

exhausted. Local populations of human beings, except in rare cases, are made up of individuals in a number of age-sex categories, each of which has different trophic requirements. Estimations of carrying capacity are based upon the assumption that the age-sex composition of the population will remain constant. This assumption underlies the computations which will follow. It is well to point out, however, as a qualification of these and almost all other estimates of carrying capacity, that the assumption no doubt departs to some extent from reality. Among all human populations, and especially among small groups living under primitive conditions, the proportions of individuals in the various categories is constantly shifting.

There are yet further problems in the computation of carrying capacity. Estimates, including those to follow, assume not only that the inventory of crops will remain constant but that the proportions in which these crops are planted will also remain constant. People practicing mixed crop shifting horticulture (and the Tsembaga are no exception) accept readily new crops and new varieties of old crops, as Street has pointed out in an unpublished paper (1965). To the extent that new introductions or changes in planting proportions will effect changes in yields per unit area, the assumptions of a constant inventory of crops and constant

planting proportions will deflect an estimate of carrying capacity from the actual situation of a population.

Shifting cultivation presents other peculiar problems in estimating carrying capacity: that of assessing the length of fallow periods and that of judging their adequacy for land recovery after cropping. In most estimates to be found in the literature the practice of the people is regarded as adequate and is used as the basis of calculations. The estimated length of Tsembaga fallow periods will serve as one of the bases for computations here. These fallow periods were judged to be adequate for land recovery for reasons which have already been presented, but the evidence falls short of empirical demonstration. As Street has underlined in the paper cited above, it is virtually impossible, in many instances, to assess environmental degradation, particularly in the structure and content of the soil: "Deterioration of the land is a cumulative process, and short term processes may be so slight as to be exceeded by errors in measurement." It should also be pointed out, and this may be true of Tsembaga practice, that fallow periods may be longer than they need be. In either class of cases, in those in which degradation of the environment is undetected or in those in which fallow periods are unnecessarily long, estimations of carrying capacity, if they are based upon native practice, will be inaccurate. There is

the further problem too of discovering precisely how long the fallow periods are. Shifting horticulture is frequently practiced by peoples who do not keep careful track of the years, and fallow periods vary from site to site. It becomes necessary to estimate lengths of fallow through involved means which may frequently produce inaccurate results.

The advantage conferred by the concept of carrying capacity is obvious. It permits us to establish limiting values for phenomena which can be described as systemic variables, and for that reason carrying capacity will be estimated here. But the advantages of the concept should not blind us to the difficulties, metrical and otherwise, hidden beneath its simplicity.

5.1 Carrying capacity formulae

A number of formulae have been proposed for applying the concept of carrying capacity to human populations. Those of Allen (1949:74), Brookfield and Brown (1963:108f), Carneiro (1960:230-231), Freeman (1955:133), and Loeffler (1960:41) are addressed particularly to the problems inherent in arriving at carrying capacity for groups practicing shifting cultivation. Among the variables considered are amounts of land put into cultivation, duration of harvesting, length of fallow, and total area of arable land. Brookfield has

further categorized garden land into various types and further takes into consideration grazing land.

The formulae proposed are generally simple ones.

Carneiro's, which follows, has been used here:

$$P = \frac{\frac{T}{(R + y)} \times y}{A}$$

Where:

P = The population which may be supported.

T = Total arable land.

R = Length of fallow in years.

Y = Length of cropping period in years.

A = The area of cultivated land required to provide an "average individual" with the amount of food that he ordinarily derives from cultivated plants per year.

Through the application of this formula and subsidiary procedures outlined in appendix X a number of carrying capacity estimates have been derived.

Two values have been used for variable T, total arable land: 1) Land which at the time of field study was either in cultivation or under secondary forest, 2) Land deemed arable but under high forest. Because these latter areas have not been cultivated in the recent past, because they are important sources of non-domesticated resources, and because, being at high altitudes and frequently covered by

cloud they would doubtless be only marginally productive under cultivation, it was considered advisable to segregate them in calculations of carrying capacity.

Because pigs have trophic requirements of a magnitude comparable to those of humans, the pig population had to be taken into consideration in estimates of carrying capacity for humans. Estimates were, therefore, made of carrying capacity for humans with the pig population at its minimum and maximum sizes. Minimum pig population size was assumed to be represented by the number of pigs surviving the pig festival in 1963. At that time the ratio of pigs, averaging sixty to seventy-five pounds, to people was .24:1. Maximum pig population size was assumed to be represented by the number of animals possessed by the Tsembaga at the beginning of the pig festival in 1962. The ratio of pigs, averaging 120-150 pounds each, to people at that time was .83:1.

Because all Tsembaga gardens made in 1962 were measured by chain and compass only one calculation was made for human carrying capacity with maximum pig population. All Tsembaga gardens made in 1963 could not be measured, however, and it was necessary to calculate the value of variable A, the amount of land put under cultivation per capita. Three methods were used in this calculation. The results produced by using the extreme values for variable A are reflected in

the range shown for human carrying capacity with the pig population at minimum size. It is well to note here, however, that two of the three calculations for variable A were separated by a difference of only four per cent while the third calculation was separated from one of these by twenty-seven per cent. The use of the aberrant value for variable A produces the lower figure, 290 persons, for carrying capacity with the pig population at minimum. For reasons discussed in appendix X this figure is deemed to be less reliable than the higher figures.

Carrying capacity for pigs, holding the size and composition of the human population constant, was also estimated. Two methods were used, and in applying one of these methods the two extreme values were again used for variable A. The lower figure, 142 pigs, was produced by the use of the aberrant value for variable A, and is deemed to be less reliable than the higher figure, 240 pigs (of 120-150 pound size).

The results of the various estimates are summarized in Table 10.

TABLE 10

Estimates of Carrying Capacity
Human and Pig Populations

Tsembaga Territory

	Secondary Forest	High Forest	Total
Human Population (pig population held to minimum)	290-397	44-60	334-457
Human Population (pig population maintained at maximum)	251	38	284
Human Population, mean carrying capacity	271-324	42-49	313-373
Pig Population (human population held constant)	142-240	62	204-302

Several comments should be made concerning these figures. It would be well to reiterate that the figure of 290 persons, if the pig population is never allowed to exceed minimum size, is probably too low. On the other hand, the figure of 397 persons may be too high for the number of people that can be supported by land under secondary forest. A calculation employing the intermediate value derived for variable A produces a carrying capacity figure of 383 persons. Averaging the three calculations yields a figure of 356 persons.

It should be underlined here that the carrying capacities for humans with the pig population at minimum represents an estimate of the number of people which could be

supported on Tsembaga territory if the ratio of pigs (of sixty to seventy-five pound size) to people was never allowed to exceed .24:1. Similarly, the figures for carrying capacity for humans, pig population at maximum, is an attempt to estimate the number of people which could be maintained if the ratio of pigs (of 120-150 pound size) to people was constantly maintained at a ratio of .83:1. In fact, the pig population fluctuates, and the actual carrying capacity for humans lies between the figures estimated in connection with the extreme sizes of pig herds. Where in this range the actual carrying capacity will fall depends upon demographic processes within the pig population, themselves dependent upon so many factors, including the vicissitudes of the human population, that precise estimation would be impossible. No more could be done here than to strike means between the estimates of carrying capacity with minimum and maximum herd sizes. These have been represented as mean carrying capacity.

It would be well to make explicit that figures for carrying capacities for pigs must be interpreted in a similar way. These figures represent attempts at estimating the number of pigs of 120-150 pound size which could be supported continuously on Tsembaga territory, if the size and composition of the human population remains constant. Since the size of the pig population fluctuates it could doubtless exceed considerably for years at a time the figures presented here

without degrading the territory. Thus, although the Tsembaga pig population stood in 1962 above one of the figures derived for carrying capacity this does not mean, granting the correctness of the figure, that the number of pigs had actually exceeded the capacity of the territory to support pigs.

If the estimates which have been presented here enjoy even approximate accuracy the Tsembaga were well below the carrying capacity of their territory in 1962 and 1963. There have been times in the past, however, during which this might not have been the case. In the last chapter it was suggested that a population of 250 to 300 persons is indicated for the period thirty to forty years prior to field work. At that time the Tsembaga had less land. It was during that period that they annexed about 135 acres (surface area) of arable land by driving out a group called the Dimbagai-Yimyagai, who had previously lived immediately to their east.

It may be that the larger populations at earlier times were compensated for by differences in horticultural and pig-herding practices. Information concerning this is fragmentary and unamenable to quantification. People do say that the number of pigs regarded as sufficient for a pig festival was smaller in earlier times. Considering the amount of labor necessary to make gardens with stone tools, this would not be surprising. People also say that they previously

ate more bananas, and it may be that before the arrival of steel tools smaller gardens were kept in production longer, with third or even fourth generation bananas making a much more important contribution to the diet than they did in 1962-1963. Information, however, is conflicting and unclear.

It may well be asked why additional virgin forest was not put into cultivation during periods of high population. These lands could have provided a substantial increment to the number of people which could be supported on Tsembaga territory. That they were not utilized, at least in fairly recent times, is insufficiently explained by the fact that cutting gardens is ritually proscribed in much of the area. Other factors may be suggested, however.

First, the Jimi Valley lands are both distant and exposed to enemies. The latter reason was agreed upon by all informants, who said that their ancestors did make some gardens there, but the area has been avoided since the development of the enmity with the Kundagai. Even in the absence of such an enmity, however, the regular utilization of lands three or four hours' hard walk (including climbs of 2000-4000 feet in both directions) from other arable lands could not be very attractive.

Secondly, these are marginal lands. Considering both the low yields of high altitude gardens and the long

fallows which they seem to require, these lands are judged to be less than forty percent as productive as the best land which the Tsembaga have under production. Clearing virgin forest without steel tools must have been extremely arduous, and it may have been that people would have eaten less, kept fewer pigs, lived or gardened uxorilocally or sororilocally, or seized their neighbors' land rather than expend effort in cultivating such poor ground.

Third, a point made in Section 3 of this chapter should be kept in mind. These areas in their condition as virgin forest are important sources of animal food, fibre, building materials and other items. Data are insufficient to estimate the extent to which deprivation of these items, attendant upon removal of the present vegetation cover, would adversely affect the Tsembaga. It is surely the case, however, that although the estimations of carrying capacity here have been based upon domesticated foodstuffs other items are necessary to the well-being and even survival of the population.

6.0 Summary and conclusion

The aim of this chapter has been to describe, in metrical terms where possible, the relations between a local population and the environment in which it subsists. Relevant aspects of the environment were described, and important subsistence procedures, notably horticulture and pig husbandry,

were summarized in terms of energy expenditure, land use, and energy and protein return. No attempt was made to estimate either the amount of land required by the Tsembaga to fulfill needs for non-domesticated resources or the amount of energy expended in fulfilling such needs. The contribution of non-domesticated animal foods to the diet was discussed, however. Possible functions of positive and negative religious prescriptions in optimizing the distribution and consumption of scarce animal foods were suggested. The effects of the activities of the human population and their pigs upon that portion of the biosphere within which they take place was also discussed.

Some interrelations between entities or processes were discussed in the course of their descriptions. The relationship between the increasing size of pig herds, on the one hand, and residential "denucleation" and the development of secondary growth on the other is an example, but many possible interrelations remain unexplored or inexplicit. It has not been the main purpose of this chapter, however, to describe the functioning of what may be regarded as a system. It has been rather to describe and, where possible, assign values to components of that system.

The designation of dimensions of the phenomena described in this chapter as variables in a system confers

an advantage beyond that of facilitating the expression of their interrelations. It also makes it possible to specify approximately the limits within which the system--that is, a particular set of dynamic interrelationships among specified variables--can continue to exist.

First, the parameters of the system may be designated. These are dimensions of conditions which affect variables within the system but which vary independently of any of the variables designated as components of the system. Included among the parameters of the system which is emerging here are aspects of such factors as terrain, altitude, temperature, rainfall, and insolation.

The presence or absence of variables within a system cannot be explained in terms of the other variables in the system. Presence or absence can, however, sometimes be explained in terms of the parameters of the system. Brookfield's (1964) discussion of insolation, sweet potato cultivation, and population density in the New Guinea highlands is a recent example of explanation of presence or absence by reference to the parameters of systems. Kroeber's (1939) discussion of maize is another example. The specification of parameters is, of course, especially important in comparative studies. A description of the ways in which the Tsembaga relate to their immediate environment may be adequate without reference to

rainfall, temperature, or altitude. The same might be done for the Chimbu people. In comparing Tsembaga and Chimbu subsistence procedures, diet, and nutritive status, however, we would note important differences. These are in large measure due to parameters of the system: the limits of toleration of certain plants, most importantly Hibiscus manihot, which doesn't grow above 4500 feet, and Gnetum gnemon, which doesn't grow above 4000 feet,² probably exclude them from the Chimbu inventory, from which they are apparently absent. The temperature, rainfall, and altitudinal values which form limits to the system which is being described here have not been established. Information has, however, been presented to facilitate comparison with materials from other areas.

In addition to designating limiting conditions or parameters, it may also become possible, when dimensions of phenomena are regarded as variables in a system, to discover the "system-destroying" values of these variables. The last section of this chapter was an attempt to discover the carrying capacity of Tsembaga territory, that is, system-destroying values for the size of a human population of given age and sex composition, a pig population composed of animals of a certain size, and for various combinations of pigs and people.

The formulae for computing carrying capacity may be

regarded as summary statements of the interrelations of the variables which they include. They do not, however, elucidate the mechanisms by which the values of all the variables are regulated. A carrying capacity figure, that is, indicates ranges of values within which variables must remain if the system is to endure. It does not indicate how the values are kept within those ranges. In the course of the descriptions in this chapter, some processes and mechanisms which contribute to maintaining variables with "ranges of viability" have been mentioned. In Section 3, the affect of selective weeding upon the length of time required for the fallow on garden sites was suggested. Other examples could be mentioned. In a later chapter the ritual means by which other variables are kept from reaching system-destroying levels will be discussed.

FOOTNOTES TO CHAPTER III

1. There are indications that other local populations of Maring speakers nearer to large expanses of low lying virgin forest tend to make a somewhat greater percentage of their gardens in virgin forest.
2. These altitudes represent their limits in the Simbai Valley. They are found at higher altitudes elsewhere including the Jimi Valley

CHAPTER IV

RELATIONS WITH OTHER LOCAL POPULATIONS

As the Tsembaga form part of a network of relationships with non-human components of their immediate environment, so do they participate in a set of relationships with other local populations similar to themselves living in areas external to their territory.

It is the purpose of this chapter to summarize these relationships. In the next chapter the way in which these two sets of relationships are regulated through ritual will be described and discussed.

1.0 The location of other groups

The population size and territorial area of the Tsembaga falls around the middle of the ranges manifested by Simbai Valley Maring groups. The small size of territories, and the large numbers of people in each, results in the proximity of both the residences and subsistence activities of adjacent groups. The houses of one of the clans belonging to the local population immediately to the east are not more than a half mile distant from the houses of the Tsembaga. The residences of the local group to the west of the Tsembaga are about one and one half miles away.

The area immediately to the east of the Tsembaga

is occupied by the Tuguma. The two territories are separated by a border which follows certain watercourses from near the top of the Bismarck mountain to the Simbai River. The Tsembaga refer to the Tuguma, along with themselves, as aman yindok ("inside" or "between" people), denoting by this that they and the Tuguma form an enclave of friendly people who occupy a continuous area between people who are their enemies. The territory to the east of the Tuguma is occupied by the Kanump-Kaur, long-standing enemies of the Tuguma. The territory to the west of the Tsembaga is occupied by the Kundagai, enemies of the Tsembaga in four wars in the forty or fifty years prior to 1962.

This spatial distribution of friends and enemies on the same valley wall seems in certain respects to be the typical Maring pattern. According to Vayda, almost every Maring local population shares at least one border with an enemy, and in almost every case the antagonists are located on the same side of the valley. Enmities between groups separated by the major rivers, the Simbai and the Jimi, in the valley bottoms do occur, but are rare and transitory. Enmities between groups separated by the mountain ridge do not, according to Vayda, occur at all.¹ It is relevant that the trade routes run, generally, across the grain of the land. Commodities which do not occur on one's own territory, or occur

only in insufficient quantities, are obtained from people living across the river or over the ridge in the next valley.

It may also be relevant that a man would find it difficult to exploit land separated from his residence by a major ridge or river. Because residences are in the middle altitudes, the walk to land across the river or in the next valley is long, and inevitably involves climbing several thousand feet. During some parts of the year, moreover, the major rivers become impassable for days or weeks at a time. Only by moving his residence can a man conveniently utilize such distant ground for regular root crop gardens. This may not be attractive, even to land-short people.

It is not surprising, in short, that friendly relations prevail between groups separated by mountain ridge or river. Their relationship is one of mutual advantage in that they supply each other with needed or desired commodities, and non-competitive in that their lands are not of great use to each other.

Conversely, it is not surprising that relationships between groups living side by side on the same valley wall are frequently antagonistic. Such adjacent groups do not depend upon each other for commodities. They are thus not bound together by the material exchanges that characterize the relationships of people whose territories are separated by

mountain ridge or river. Their proximity, furthermore, increases the probability of friction between them. While it is extremely unlikely, for instance, that the pigs of groups separated by mountain or river will damage each other's gardens, it is a common occurrence in the relations of groups living adjacent to each other on the same valley wall.

It is also the case that some of the garden land of the neighboring group is likely to be as convenient to a man's residence as some of his own land. If a group were land-short, it would be to the conveniently located land of the adjacent group that its members would look, rather than to land across the river or the mountain.

In contrast, then, to relations between groups located across the grain of the land from each other, the relations of groups occupying adjacent territories on the same valley wall may become competitive in respect to land, and are not mutually advantageous in respect to the exchange of those goods in which the territories of each might be lacking.

2.0 Friendly relations

Relations with friendly groups are concerned with and bound by exchanges of women and goods.

2.1 Marriage

The Tsembaga state a preference for wives who are

also Tsembaga by birth. Reasons for this have already been suggested. A man receives rights in land from his wife's agnates. Only if this land is close by, however, may it be effectively used. Conversely, Tsembaga say that they prefer, other things being equal, to give sisters and daughters to local men so that even after her marriage a girl may continue to participate, to some extent, with her unmarried brothers or widowed father in gardening activities. Women and widowers, moreover, want at least one of their daughters to be married close by so that they may be assured of the funerary services which women perform.

These stated preferences are reflected in practice. Of the fifty married women, including widows, among the Tsembaga in 1962 and 1963, twenty-two, or forty-four per cent, were Tsembaga by birth. Eleven more were Tuguma by birth. Women of proximate origin thus comprised sixty-six per cent of living Tsembaga wives and widows. The remainder came from groups occupying territories across the Simbai River or on the other side of the Bismarck mountain ridge.

Forty-one married women of Tsembaga birth were known to be alive during the same period. In addition to the twenty-two who were married to Tsembaga men, seven were married to the Tuguma. The remaining fourteen had gone either to Jimi Valley men or to men north of the Simbai River.

Full satisfaction of a preference for local endogamy is unlikely among groups the size of the Tsembaga. Even if the Tuguma, who number two hundred twenty-five people, are added, the population remains too small for easy local endogamy. Groups of such size are subject to imbalance in the numbers of persons in each sex available for marriage, especially when the sexes are subject to differential mortality and, perhaps, differential birth factors. It may safely be said that the Tsembaga depend upon other local groups for women for demographic reasons,²

While unions between men and women of a single local origin confer certain advantages upon both parties and their natal agnatic groups, unions between people of different local origins confer others. Unions across the grain of the land serve to strengthen trading relationship, for one thing. Perhaps more important to the welfare of the group is that allies are recruited through affinal ties. Thus, while it may be that the Tsembaga depend upon other groups for women for simple demographic reasons, the resulting interlocal ties enhance their ability to obtain commodities in trade and support in warfare.

Most marriages are arranged between the natal groups of the principals. In some instances an immediate direct exchange takes place. The two women are exchanged upon the same

day. More common are delayed direct exchanges, in which a man, when he receives a woman, promises to reciprocate by sending to his wife's natal group at some future time a specified sister who is as yet too young to marry. A few women are given in what may be regarded as a transgenerationally delayed direct exchange. There is a rule which stipulates that one of a woman's granddaughters is to be returned to her natal group. This is, in effect, a prescribed second patrilateral cross-cousin marriage (between a man and woman who call each other "brother" and "sister"). Such marriages are actually contracted in very few cases. Indirect exchanges are most common. The bride's natal group uses the wealth received from her husband to make payments on a woman procured elsewhere. Women are also sometimes given as compensation for certain services, such as revenging homicides, and figure in wergeld settlements. This will be discussed later in the contexts of ritual and warfare.

In most instances no payment, or a very small one, is made at the time the bride is taken by the groom. The first payment often takes place after the couple has harvested a garden which they have planted together, but it may be delayed even longer. Payments are made even for women received as compensation for services or as wergeld. In cases of direct exchange exactly corresponding amounts of valuables

change hands. In the Simbai Valley I observed payments consisting of shell valuables, axes, beads, bushknives and pork. Until very recently non-utilitarian stone axes were also included. In two of the twenty payments observed, small amounts of money were included. Neither live pigs nor bird plumes figure in Simbai Valley bride prices. In the Jimi Valley, however, bird plumes are sometimes included. Throughout their lives and upon their deaths, payments are made for a woman and the children she bears. The first payments are usually the largest, however, and may consist of over thirty wealth items, as well as cooked pig. Live pigs are not included in any affinal payments.

Although most marriages are the products of agreements reached by male members of the natal groups of the bride and groom, a girl's wishes in the matter are given serious consideration. Furthermore, it must not be imagined that the bride-to-be necessarily remains passive while her disposition is being arranged. Girls are often reported to refuse to go to the men whom their brothers or fathers select for them, or having gone, to run away. Moreover, it not infrequently happens that girls run off to men without the prior consent of their male agnates. Fourteen, or twenty-eight per cent of the fifty living married women and widows included in the sample were obtained by their husbands without the prior consent of their

male relatives. This figure, which represents only those elopements which became enduring marriages, does not, of course, reflect the frequency of such occurrences, which must be much higher, for marriages are brittle previous to the birth of children. One Tuguma man who had two wives in 1963 reported that he had previously taken seven other women, only one of whom had died. Some of the remaining six were sent back to their natal groups by him while others left of their own accord. This number of unions for one man may approach the extreme, but many men report several short-lived marriages.

Girls not only have considerable prerogatives in the final decisions concerning their marital disposition, but also exercise considerable choice in the earlier stages of the process of mate selection. It is the female who initiates courtship, and young men attempt to make themselves appealing so that their advances will be solicited. In this the kaiko plays an important part. This will be discussed in the next chapter.

2.2 Trade

A variety of goods come to the Tsembaga through exchanges with other local groups and in recent years, through exchanges with Europeans as well.

While a number of other items figure in inter-group exchanges, most important during the period of field work were

bird of paradise plumes, axes, bushknives, European salt, shells, furs, and pigs. Previous to the arrival of Europeans and European goods, native salt manufactured from the waters of salt springs by Simbai Valley people, including the Tsembaga, and stone axes³ manufactured in two locations in the Jimi Valley, were of great importance.

The importance of pigs in inter-group trade during the period 1962-1963 was exaggerated by my presence. During that period the Tsembaga obtained in trade from other local groups thirty-one baby pigs (pigs above the age of three or four months are almost never traded). Most of these were obtained, however, with salt, face paint, or beads obtained from me in trade for food, or with shillings earned by carrying cargo for me. It is doubtful if half that number would have been obtained in my absence. Of the one hundred sixty-nine pigs constituting the herd at the beginning of the pig festival in June of 1962, fifty-six were born elsewhere. Only twenty-two of these, or thirteen per cent of the herd, were obtained in trade from other places, however. The remaining thirty-four were brought to Tsembaga by their masters upon return from their exile following the military defeat of late 1953 or early 1954. To put it slightly differently, eighty-seven per cent of the pigs constituting the Tsembaga herd at the commencement of the pig festival were born on the territory of their masters.

In pre-contact times as now, plumes and some furs came to the Tsembaga from northerly directions. The Tsembaga themselves contributed to the trade a few furs and plumes and, like their Simbai Valley neighbors, salt of their own manufacture. These items were sent to the south for commodities that came from that direction: pigs, shells, and both working and "bridal" stone axes.

Two of the items, salt and working axes, which moved through the pre-contact exchange apparatus, were necessary or important to survival. Most were not. Bird of paradise plumes, fur headbands, shell ornaments, and bridal axes play no direct part in human subsistence. Neither do the minor items figuring in the inter-local exchanges: green beetles, pigments, and loose animal fur, all used to ornament the person, shields, or clothing.

Aesthetic considerations should not, perhaps, be overlooked in a discussion of this trade. To the Tsembaga and their neighbors, all of whom are without sculpture, ornamentation of the self or of shields is a form of artistic expression. They consider fine plumes and shells, gold lip or green sea snail, to be among the most beautiful objects in the world. Men like to possess these objects for their own sakes. They also, however, want the plumes so that they may be enticing to women when they dance, and they want the shells

so that they may pay for the women they obtain.

It is also important that these valuables could, in pre-contact times, be freely exchanged for stone axes and native salt. This exchangeability, it may be suggested, served to stimulate the production and to facilitate the movement of the utilitarian commodities. Trade among the Maring is based upon direct exchanges between individuals. It may be questioned whether a direct exchange apparatus which move only two or three items critical to subsistence would be viable.

If native salt and working axes were the only items moving along a trade route, or were the only items which were freely exchangeable for each other, sufficient supplies of both might be jeopardized by mere inequities in production. Insufficiencies would develop because the production of each of the two commodities would not be articulated to the demand for that commodity, but by the demand for the commodity for which it was exchanged. The production of native salt, that is, would not be limited by the demand for salt, but by the demand for axes. If all that the Simbai people could obtain for their salt were working axes, they would be likely to refrain from salt manufacturing if they were in possession of a large supply of axes, regardless of the state of the salt supply in the Jimi Valley. The converse would be the case if the ax manufacturers had large stockpiles of salt.

It may be asked if the persisting dyadic relationships through which the commodities sometimes moved would not in themselves be sufficiently important to the participants to compel them to supply the needs of their counterparts as a matter entirely separate from the fulfillment of their own needs. (See Sahlins, 1965). In the case of the Maring salt-stone ax trade the answer must be "no." The salt producers and stone ax producers were in almost all cases separated by at least two intervening peoples. A man may be able to bring moral pressure successfully to bear upon a kin or non-kin trading partner to supply his needs, or conversely, a man might feel morally bound to fulfill the needs of a trading partner. If, however, a man must put pressure on a trading partner to put pressure on a second, who will in turn put it on a third, who will attempt to get an ax from the manufacturers, success is less likely. It may be suggested that formal trading partner arrangements may be sufficient to accomplish necessary exchanges in situations in which the trading partners exchange goods which they themselves have produced. When, however, a number of trade links separates the producers other mechanisms may have to be employed. To put it a little differently, trading partnerships may adequately fulfill needs for exotic materials when each trader or each local group is the center of a web-like trading network. When, however, each

trader or local group is a link in a chain-like exchange structure, the trading partnership by itself may not be sufficient to maintain an adequate supply of exotic materials. In such a situation the producers and consumers of a particular commodity may be separated from each other by a number of links and are usually unknown to each other. Moral pressure, which might induce production on the part of a trading partner becomes too diluted between producers and consumers remote from each other to be dependable.

Although they are both necessary to survival, the demands for both salt and working axes are limited. A man can eat just so much salt or use just so many axes, even if he is supplying some to kinsmen. If only salt and stone axes could be exchanged for each other, the maintenance of a sufficiency of both throughout the population would require a niceness of balance between the quantities of each produced and between their respective exchange values, both constantly fluctuating in response to such processes as local demographic changes. Without some kind of coordinating or directing managerial agency it seems hardly likely that such balance could be maintained. Where "redistributive systems" operate, that is, in populations in which supra-local authorities may demand production and enforce deliveries, exchange sets of such narrow scope may work. They might even work in "reciprocal

systems" in which the parties to the transactions are groups in each of which production may be commanded by a local authority who might, conceivably, take into consideration the requirements of other groups. Among the Maring, however, the exchange apparatus was, and continues to be, based upon reciprocity between individuals, and no authority, local or supra-local, exists which may demand production or enforce deliveries.

The exchangeability of plumes, shells, and bridal axes with native salt and working axes changes the relationship between these commodities. While the demands for salt and working axes are limited by the amounts required for specific processes of production, extraction, or metabolism, this is not the case with valuables. Plumes are perishable and there is, thus, a constant demand for new ones. The size of bride prices is unspecified in advance, but a man is usually under pressure from his affines to pay well for his wife and is shamed if he is not able to do so. The unlimited demand for the valuables required to entice or pay for women provided a mechanism for articulating the production of each of the two items critical to metabolism or subsistence to their own demand. As long as it was possible to exchange salt for shells or bridal axes, commodities for which the need was large but indefinite, salt would be produced. The production of salt

would be suspended only with the suspension of the demand for it, and this demand, presumably, would reflect its status as a physiological necessity or near necessity. Conversely, as long as it was possible to obtain valuables for working axes, the latter would be produced. The demand for working axes, it may be assumed, would be a function of the numbers of individuals gardening, total areas under production, and the kind of vegetation in which gardens were being cut.

It should be further noted that the indefinite nature of the demand for valuables could serve to cushion fluctuations in the demand for salt and working axes relative to each other. If, for instance, local population increases in the Simbai Valley increased demands for working axes at a greater rate than increases in the demand for salt developed in the Jimi Valley, the differences could be absorbed by an increased flow of valuables from the Simbai to Jimi Valleys. Any accumulation of valuables which the ax manufacturers might begin to amass would represent no threat to the continuation of ax production. Such accumulations might be drawn off by enlarged bride payments. They also might permit the ax manufacturers to obtain more wives. This could mean that women would flow from the Simbai Valley to the Jimi Valley, a movement which would suppress the birth rate in the Simbai Valley and augment it in the Jimi. Not only might the valuables have facilitated the

distribution of axes and salt; they also might have thus provided a mechanism for distributing people more or less evenly over a broad area by adjusting differences in local population dynamics.

In sum, it has been suggested that non-utilitarian commodities, such as bird of paradise plumes, shells, and "bridal" axes, if they are freely interchangeable with critical commodities, such as salt and working axes, may serve as a "functional alternative" to the supra-local management of the exchange of the metabolically critical commodities. It has been further suggested that where valuables not only are interchangeable for the critical commodities, but also are used in bride prices, they may serve a demographic function by moving women from localities of rapid population expansion to areas of slower population expansion. The way in which the pig festivals form an important part of this mechanism will be discussed in the next chapter.

No direct quantitative data in support of this interpretation of Maring trade are available, unfortunately, since the production of both native salt and stone axes ceased some years before the commencement of field work. These suggestions may, however, serve as hypotheses which could be tested in areas which have experienced less contact with Europeans.

3.0 Hostile relations

Hostile relations between Maring groups are characterized by long periods of ritually sanctioned mutual avoidance interrupted by armed confrontation or conflict. The enemy groups invariably share a border, and in almost every case these borders run from range top to river. Enemy groups, that is, occupy adjacent territories on the same valley wall.

The last engagements in which the Tsembaga participated as one of the two principal combatant groups occurred in late 1953 or early 1954. Their enemy was Kundagai-Aikupa, the local population occupying the territory immediately to their west. They had fought against this group on three other occasions during the preceding thirty to forty years.

Since their last fight against the Kundagai-Aikupa, many Tsembaga have participated in other engagements, either as allies or members of other local populations. The most recent encounter in which they participated occurred in 1958. In this battle, which was among the last to occur in the Maring-speaking area, they were allied to the Tuguma against the Kanump-Kaur. Field work, thus, did not commence until four years after the most recent fighting. Information concerning fighting and the rituals associated with it thus rests mainly upon informants' statements.

3.1 The causes of warfare

The proximate causes of Maring warfare may be derived directly from accounts of fights and the events preceding them. The ecological-demographic conditions which may have underlain much of Maring fighting must remain hypothetical, since reliable quantified data concerning such conditions at and preceding outbreaks of warfare are unavailable.

3.1.1 Proximate causes

Accounts of hostilities suggest that a distinction be made between events which originate hostilities between two groups and acts which merely maintain enmities which were previously established.

3.1.1.1 Origin of hostilities and the possibility of early composition

In every instance for which I have collected information hostilities between previously friendly groups followed upon violence between one or more members of each of the groups. The violence, in turn, was induced in particular instances reported by informants by (1) taking a woman without the prior permission of her agnates, (2) rape, (3) shooting a pig which had invaded a garden, (4) stealing crops, (5) poaching game and stealing scarce wild resources, (6) sorcery accusations. Surely other acts must also have induced violence

leading to intergroup fighting.

A violent episode between single or few members of a pair of groups did not in all cases lead to armed conflict. Whether or not it did seems to have been in the main dependent upon (1) the results of the violence, (2) the previous relationship of the two groups.

If the violence resulted in homicide, armed conflict between the groups of which the participants were members was more likely than if it resulted in mere wounding. It sometimes occurred, however, that homicides were peacefully composed and that, conversely, less-than-fatal injuries led to inter-group fighting. The previous relationship of the groups to which the antagonists belonged is significant here. If the antagonists were members of different clans within a single local population, it was likely that the trouble would be composed. When, for instance, the Tomegai and Merkai clans of the Tsembaga had a confrontation many years ago, members of the other Tsembaga clans interposed themselves between the shields of the antagonists and, admonishing them that it was wrong for brothers to fight, implored them to break off the struggle, which they did. That such fights, which are referred to as "inside fights" (ura aman) or "brother fights" (gui bamp), were usually contained may well have been a function of the great number of affinal and cognatic ties binding together

the several agnatic groups which together form a local population. These ties not only provided a set of relationships through which composition might be attempted but also strong incentives for local neutrals as well as antagonists to seek settlement. It is likely that every or almost every local neutral, because of the high degree of local endogamy, would have close relatives among both sets of antagonists. If brother fights were allowed to proceed, these relationships would be seriously damaged. If armed hostilities were not speedily resolved, a pair of full brothers from a neutral clan who had wives from the opposing antagonists would be likely to find themselves staring at each other across raised shields on a fighting ground, for military assistance is recruited through affinal connections. Even if things did not come to quite this pass, their normal intercourse might well be inhibited. Interdining taboos are associated with formal enmity relations, and neutrals must make a choice. If the natal groups of the wives of brothers become enemies, either the brothers must choose between eating with each other or with their respective wives, or one or both of the wives must refuse to adopt the interdining taboos of her natal group. If a woman refuses to adopt the taboos of her natal group, she may no longer interdine with them. In any case, dyadic relations, which are heavily loaded both economically and with

sentiment, are subjected to rather serious symbolic and behavioral impediments by unresolved disputes.

There are other incentives for the composition of inter-clan disputes between members of different clans within the local population.

It was shown in the last chapter that the local population as a unit exploits the territory. All individuals have access to non-domesticated resources existing anywhere on the territory, and garden land is intermingled. A dispute between the sub-clans of a clan, or between two clans within a single local population could, if it were not composed or at least contained, make it necessary for the population to redisperse itself over these resources. Individuals, knowing that parcels of land upon which they are presently gardening or upon which they plan to garden would have to be abandoned in case of a continuing dispute usually do not desire such a redispersal and are anxious to see a composition affected.

It is, furthermore, the case that the local population forms a single military formation which as a unit faces the enemy. Intra-population disputes debilitate such a unit, and may even diminish it in size, for it sometimes happens that one of the parties to the dispute departs from the local population. Such a loss may jeopardize the position of those

remaining in later confrontations with the enemy. As the maximum size of local populations is limited by the carrying capacities of their territories, so are minima set by the size of the groups whom they confront as enemies. That this principal seems not to be lost upon the Maring is indicated by repeated instances of depleted groups inviting people from elsewhere to join them on their land. Three such events are reported by informants to have occurred within the Tsembaga and Tuguma local populations during the fifty years previous to field work, and Vayda and Cook (1964:801) suggest that such occurrences were common throughout the Maring and Narak areas.

Local populations may also be regarded as congregations in that the performances of certain important rituals by constituent land-holding groups are coordinated. That this coordination is a product of their joint participation as principal combatants in warfare will be discussed later. Suffice it to say here that the Maring may regard the necessity to continue the performance of these rituals coordinately as another imperative to compose disputes within the local population.

Between friendly adjacent groups which do not form a single local population, who do not, that is, share rights in the non-domesticated resources of a combined territory, who do not form a single military unit in confrontations with

the same enemy, and who do not both plant and uproot their rumbim at the same time, composition of disputes is less likely. While there is considerable intermarriage between such adjacent groups, it is usually less than that which takes place within each of the local groups. There are thus fewer channels through which the composition of disputes may be effected and less incentive to compose such disputes than is the case within the single local population. Such disputes, moreover, endanger neither patterns of dispersal over resources nor the military power of the antagonists to the same extent as do intra-group disputes. While there may be some intermingling of garden land between such groups, unless they are in the process of fusion it seldom reaches the proportions that it does within single local populations. While they act as allies to each other in the military encounters that each have with their separate enemies, there is a difference between the ways in which principal combatants and allies participate in fights.

It may be said, thus, that fighting between separate territorial groups is more likely to occur than fighting between descent groups which are constituents of a single territorial group, or local population. Composition of disputes within the local population is more likely because of the mutual interests not only of the antagonists but also of other agnatic groups forming part of the same local population. All

of the members of the local population, furthermore, are closely bound to each other in a reticulate web of kinship connections which serve as channels through which trouble cases may be settled. "Inside" or "brother" fights do occur, and sometimes lead to fission and the adoption of formal enmity relations, but we shall not be concerned with such fights here. The remainder of this chapter and the next will be concerned with fighting between separate local populations.

3.1.1.2 The maintenance of hostilities

A principle of absolute reciprocity in homicide is supposedly in force. Mutual killing, that is, is supposed to be even before a pair of antagonistic groups may terminate their enmity. If killing is not even, a series of military engagements may be terminated by a truce, but it is a truce only, with arms to be taken up again in the future. The ways in which periods of truce are regulated through ritual will be discussed in the next chapter.

An even score in killing is not easy to achieve, even though all persons, men, women, children, and babes in arms are considered, for purposes of vengeance, to be equivalent. Most military episodes terminate with blood debts remaining. The last round of fighting between the Tsembaga and Kundagai-Aikupa, for instance, was the result of an attempt

by some Tsembaga to erase a blood debt by killing a Kundagai. This blood debt was the product of the previous series of engagements, perhaps ten or twelve years earlier, which was, in turn, the product of blood debts arising out of a yet earlier conflict.

Some practices may act to preserve the principle of homicidal reciprocity while mitigating the rigorousness of its application. A distinction between the responsibilities of allies and principal combatants has an effect, as may certain magical and religious procedures. These will be discussed later. Here it may be mentioned that the ways in which responsibility for revenge and credit for homicide are assigned may serve to temper the requirement of absolute reciprocity. A clan is responsible for the vengeance of deaths sustained by its own members and their wives. If in the course of a battle an enemy is brought down, it is usually the case that a number of men participate in administering the coup de grace. Each, claiming credit for the homicide, may regard vengeance accomplished for a member of his own clan. One corpse, thus, may fulfill the reciprocal requirements of several homicides.

On the other hand, the way in which responsibility for homicide is assigned serves to extend and exacerbate enmities and, perhaps, to increase killing. The agnates of the victim of homicide hold not only the agnatic group of the slayer,

but the entire local population of which the slayer is a member, responsible. It is against any member of this larger group that vengeance can be wreaked. A previously uninvolved agnatic group may thus become embroiled in a vendetta by suffering revenge for a killing which was not committed by any of its members. Obligated to repay such a homicide, its members will seek vengeance against the local population of the slayer, victimizing, perhaps, a group which was not party to the aggression they themselves had suffered.

3.1.2 Underlying causes: population pressure

While data are deficient, and while informants deny fighting over land, there are indications that at least one of the fights in which Tsembaga have been involved was a response to population pressure.

No census material is available for the period during and immediately preceding a fight between the Tsembaga, primarily the Merkai clan, and the Dimbagai-Yimyagai thirty to forty years ago. It was estimated early in Chapter II, however, that Tsembaga population probably stood between 250 and 300 persons at the time. Estimates also suggest that such a number would have been pressing upon the carrying capacity of a territory which was, at the time, smaller than in 1962-1963. People say, furthermore, that at the time of the fight there were many people and not much land.

The circumstances surrounding the fight itself are also suggestive. The dispute which may be regarded as the proximate cause of the fight should have been easily composed since it did not result in homicide.

The first garden which Merkai men passed in returning from the high altitude virgin forest belonged to a man named Pangwai, who was living with the Dimbagai-Yimyagai group. Being thirsty, they made a habit of helping themselves to a bit of Pangwai's sugar cane when they passed his garden. Irritated at what he regarded to be Merkai thievery, Pangwai one day took to his bow and shot Kati, whom he surprised in the act of taking sugar. Kati was not seriously injured, having received nothing more than an unbarbed arrow in the buttock, but the Merkai, saying that he had taken only a little sugar to assuage his thirst, and not taro, which would indeed have been stealing, took to their weapons.

A striking aspect of this dispute is the agnatic affiliations of the principals. While Pangwai was living with the Dimbagai-Yimyagai, he was actually a Merkai by birth. While Kati was living with the Merkai, he was actually a Karam speaking man living sororilocally with a sister married to a Merkai. No Dimbagai-Yimyagai was party to the dispute. The Merkai could as easily have regarded the incident as an intra-clan dispute as an inter-local population matter. Moreover,

they were not required to avenge Kati, for Kati was not an agnate.

Another point of interest is that at the time the fight broke out there were nine Merkai men living and gardening uxorilocally, sororilocally, or matrilocally upon the territory of the Dimbagai-Yimyagai, while only one Dimbagai-Yimyagai man was gardening on Merkai territory. Informants, while they do not make clear why these Merkai did not maintain patrilocal residence while gardening on Dimbagai-Yimyagai ground, state that their reason for gardening on land other than that of their own clan was land shortage.

These men, it should be noted, fought on the side of the Dimbagai-Yimyagai against their own agnates. This indicates either that they had accreted to the Dimbagai-Yimyagai or more likely, that the two groups were fusing when the fight broke out. Such an example of aborted fusion would suggest a density dependent sequence of events:

With local increases in population size, land grants to affines serve to even out the dispersal of persons over wider areas than is possible through reliance upon descent principles alone. If, however, further population increase results in an absolute shortage of land throughout the area, fighting, leading to the extrusion of one or the other of the previously fusing groups, is likely. When the number of

persons living in an area is increasing, that is, adjacent local populations intermarry. With further increase they fight. If the adjacent local populations happen to be agnatic groups, it will appear that with increasing density an agnatic territorial principle is replaced by a non-unilineal principle, which is replaced, with further increasing density, by a reassertion of the agnatic principle. This suggestion has relevance to the general discussion of the relation of population pressure and agnation in Oceania which has been carried on for some time (Brookfield and Brown, 1963: 170ff; Goodenough, 1955: 80, 81; Meggitt, 1965: 260ff). Tsembaga information is sufficient to suggest, but not to demonstrate, that the agnatic principle is likely to be in accord with the actual composition of territorial groups when density is either low or very high. Where densities are moderate, or moderately high, it is suggested, territorial groups are likely to include, on the other hand, many non-agnates. The analysis of data collected by Clarke in 1964 among the ~~Bomagai-Angolian~~, a Maring group showing considerably lower population density than the Tsembaga, may elucidate this question.

There is even less information concerning the demographic and environmental conditions prevailing at the time of other fights. It may be suggested here, however, that the frequencies of some kinds of disputes are density dependent.

If twenty men, for example, each own one pig and have one garden, there are 400 possibilities for pigs to cause disputes between men by damaging gardens. If the number of men is raised to forty, each of which still has one pig and one garden, the number of possibilities for dispute has increased to 1600, other things being equal. In like manner doubling in the numbers of unmarried males and unmarried females also, perhaps, more than doubles the possibilities of woman-stealing and other dispute-producing incidents. It is being suggested here that sources of irritation increase at a greater rate than population size. If population increase were taken to be linear, the increase in some causes of dispute, if not actual dispute, might be taken to be roughly geometric. It might even be possible to find some way to express an "irritation coefficient" of population size mathematically.

This increasing irritability should begin to express itself in disputes well below the actual carrying capacity of an area. Concerning the Tsembaga, however, there is little relevant information of an even anecdotal sort. The earliest fight about which Tsembaga informants have any clear recollection took place fifty or sixty years prior to field work, which was before the fusion of the five clans into a single unit. Informants say that the Kamungagai and Tsembaga clans, which together fought a group living across the Simbai River, has sufficient ground at the time.

Previous to this, in the time of their grandfathers, middle-aged informants say, fights were infrequent and enmities were transitory, there are also indications that population was smaller. There is some evidence, albeit equivocal, in genealogies, in the flora, in clan histories, and in accounts of the removal of virgin forest from extensive tracts below 4500 feet within the past sixty years, to indicate that the Tsembaga and their neighbors have arrived in the Simbai Valley within the past two hundred years, that they were relatively peaceful for a long while after their arrival, and that when inter-group fighting commenced, population had already expanded considerably, but had not yet approached carrying capacity.

It may be pointed out that increasing irritability with increasing population size below carrying capacity levels might serve, if some of the disputes result in the movement of individuals or groups, to protect the environment from degradation by continually redispersing populations over available land.

3.2 Composition of fighting forces

Fighting forces always, or almost always, include two categories of men. The first may be referred to as principal combatants. These are members of the local populations which are parties to the dispute from which the armed conflict

has arisen. The second are allies. These are members of other local populations who are recruited by the principal combatants through cognatic or affinal ties. In some instances men also give armed assistance to non-related trading partners.

Because of frequent intermarriage between the Tuguma and Tsembaga through a number of generations, almost every member of each has affines or cognates in the other. The result is, in effect, that the Tuguma as a unit assist the Tsembaga in their fights against the Kundagai, and the Tsembaga as a unit come to the aid of the Tuguma in their encounters with the Kanump-Kaur. While it may be the case that Tuguma-Tsembaga form a single military unit for the defense of a continuous area, the rationale of recruitment of one by the other remains kinship ties between individuals. These ties are less numerous between groups separated by mountain ridge or river. The result is that military assistance rendered by such groups to each other is on a smaller scale, consisting of men who are closely related to the principal combatants and, if these men are influential, some of their relatives as well.

Principal combatants are responsible for casualties sustained by their allies. If an ally is killed, that local population which he was assisting must compensate his agnates with, among other things, a woman, whose first son will bear his name. The practice of assigning the responsibility for

casualties sustained by allies to the principal combatants whom they assist, rather than to enemies, may serve to diminish the frequency of fighting throughout the Maring area. It frequently occurs that enemies find themselves confronting each other only as allies of the principal combatants. The Kanump-Kaur, for instance, who are the enemies of the Tuguma, have many affinal connections with the Kundagai, and therefore turn out in large numbers to assist the Kundagai in their fights against the Tsembaga, who are assisted by the Tuguma. The Tuguma and Kanamp-Kaur face each other in such situations not as principal combatants but as allies of opposing principal combatants. If in the course of such an encounter the Tuguma slay a Kanump-Kaur, they may regard this as revenge for a previously slain Tuguma. The Kanump-Kaur, on the other hand, would not charge this slaying to the Tuguma, but look to the Kundagai for redress. If such a killing evens the score between the two groups it is not necessary for one of them to attempt a revenge killing on its own responsibility, thus setting off a new round of fights.

3.3 Fighting and the rituals associated with fighting

Accounts of fighting and the rituals associated with fighting sometimes conflict. This is the case particularly with respect to the sequence and details of pre-fight ritual procedures. Differences in accounts may in part be explained

by variations in the practice of different groups and even different men. These variations will be discussed elsewhere. A simplified account of ritual performances is sufficient here. What follows reflects the practice of two of the three Tsembaga land-holding groups. The practices of the third differ in some details, according to informants.

3.3.1 Fight stages

Two stages may be discerned in most fights. These are distinguished in terms of the weapons employed and the rituals performed.

3.3.1.1 The "small fight"

The first of the two stages is referred to as the "nothing fight" (ura auere), or "small fight" (bamp acimp).

3.3.1.1.1 Arranging the engagement

The group suffering the injury which has provoked the fight calls out to the enemy to prepare for an encounter on a designated fight ground. One or two days notice is usually given, which provides ample time for both sides to mobilize their allies and to clear the fight ground of underbrush. This task falls equally heavily upon men of both sides, but encounters between the bush-clearing details of the antagonistic groups are avoided. Informants say that if

members of one of the groups arrive at the fight ground to find their opponents already at work they will withdraw for some distance, until their opponents retire, after which they will enter the fight ground and finish the clearing.

3.3.1.1.2 Rituals preceding the small fight

Pre-fight rituals are performed separately by the three separate Tsembaga land-holding groups.

On the night previous to a "small" or "nothing" fight, informants say, the warriors convene by clans or sub-clans in men's houses to inform the spirits of both the high and low ground of the next morning's encounter. As they sit chanting in a darkness illuminated only by the embers of small fires, shamans (kun kaze yu), of whom there are several in each clan, induce in themselves an ecstasy by inhaling deeply and rapidly the smoke of bespelled cigars made from strong native tobacco. When his nomane, (his animated, immortal, thought stuff,) departs through his nose to seek out in high places the smoke woman (kun kaze ambra), the shaman begins to tremble and gibber. Soon the smoke woman "strikes" him. Led by his nomane she enters the shaman's head by way of his nose, and his ecstasy reaches its height. Rising to his feet he dances about the embers in a low crouch, sobbing, chanting, and screaming in tongues. It is through the smoke woman that the ancestors are now being informed by the living of the fight and it

is through her that they are now signifying their endorsement of the enterprise and sending assurances of their protection. It is, informants say, the smoke woman who speaks in tongues through the shaman's mouth.

The protection of the ancestors is bestowed upon the warriors through the shaman's body. As he dances within the circle of men, the shaman takes each of their extended hands in turn, and with it wipes sweat from his own armpits. This sweat, driven from his body by the heat of the entering spirit, is said to be hot, and therefore imparts strength. No pigs are killed at this time, informants agree, but slaughter is promised in the event of a satisfactory outcome of the fight.

It is not clear whether the smoke woman is asked at this time to name those members of the enemy group who may be easily killed and to warn those members of the local group who are in special danger. Some informants say that this forms part of the procedure preceding the more deadly second stage of fighting only.

In the morning spells are said by "fight magic men" (bamp kunda yu), of whom there are one to three in each clan, and who are usually, but not necessarily, shamans as well, over the bows and arrows so that they will be strong, accurate and sharp, and over the shields so that they will stop the arrows of the enemy. Small bundles, called "fight packages"

(bamp yuk) or "fight bags" (bamp kuŋ), containing both the exuviae of enemies and the thorny leaves of the males of a rare, unidentified tree growing in the kamunga, called the "fight tree" (ap bamp), are pressed to the hearts and heads of each man by the fight magic men. Pressing the "fight leaves" (bamp wunt) contained in the fight packages to the heart and head of a man diminishes his fear. Control over the exuviae of enemies, and their confinement within the same package as the leaves, enhances the opportunities for killing those whose exuviae is represented. These materials--bits of hair, fragments of leaves worn over the buttocks, dirt scraped from the skin--are obtained from neutrals who have kinship connections among the enemy and therefore may visit them. A neutral himself may, if he suspects a man of being a witch (koimp) or sorcerer (kum yu), acquire such exuviae by stealth, but it is said that sometimes a man's own clan brothers, suspicious of witchcraft or sorcery, will give some of his exuviae to a neutral to deliver to the enemy.

While one fight magic man is pressing the fight package to the hearts of all men, another is ritually applying a grey clay (gir), obtained from the wora, or low ground, to their legs so that they will remain strong throughout the day.

When treatment both of the heart and legs is completed,

lengths of green bamboo are laid on a fire. With the men gathered in a circle around them, one or more fight magic men kneel by the fire and talk to the ancestors, sobbing as they implore protection. When the bamboo explodes, the men stamp their feet and, crying "oooooooo", leave in single file for the fight ground; carrying shields, bows and arrows. They sing a song called wobar as they proceed, in a peculiar prancing gait, toward battle.

3.3.1.1.3 The engagement

In the small fight only bows and arrows, and perhaps throwing spears, are used. Some informants say that hand to hand weapons, axes and jabbing spears, are not even brought to the fight ground, but this is doubtful.

The antagonistic groups, informants say, line up on the fight ground within easy bow shot of each other. Informants say that allies and principal combatants are intermingled in the formations. Their shields, which are very large, averaging 2½ by 5 feet, are propped up, permitting the bowman to dart out to take shots and dart back again. To demonstrate their bravery, men also dart out from behind the shields to draw enemy fire. Casualties were not numerous and deaths even fewer, for the unfletched arrows of the Maring seldom kill.

It may be that the "small" or "nothing" fight is

less a serious battle than a device for composing a quarrel before more lethal fighting, with its attendant ritual constraints, develops. The relative harmlessness of a bow and arrow engagement from stationary positions with cover well provided by shields itself suggests such a possibility, but there are more cogent reasons for seeing the small fight in such a light.

First, small fights were protracted. Accounts of engagements in the past indicate that in some instances there were four or five days of such fighting before escalation took place. Such a period might allow tempers to cool while satisfying the bellicose imperatives of manhood.

Second, while there are no third parties with either the power or authority to adjudicate disputes, the formations of the antagonists include allies, men less committed to the quarrel than the principal combatants. These men often have a considerable interest in seeing the quarrel settled without going any further, for they themselves have no direct grievance and may have close relatives in the enemy formation. When the Tuguma fought the Tsevent, for example, some Tsembaga came to the assistance of both of the antagonists. In one instance, this split two full brothers who had sisters married into each of the opposing groups. While taking their places in the military formations of the antagonists, such men may serve to

dampen the ardor of the principal combatants by counseling, in an oblique way, moderation. This seems to have occurred during confrontations in which the principal combatants had previously been friendly. During the Tuguma-Tsevent fight, informants say, some of the Tsembaga allies of both antagonists, instead of hurling insults at their opponents, lamented loudly and continually about the evil of brothers fighting. Their laments in this instance were unheeded, perhaps because two or three Tuguma are reported to have been killed by arrows during the little fight. If there had been no fatalities, or if only one Tuguma had been killed in reciprocation for the homicide suffered by the Tsevent which had led to the fight, the preachings of the Tsembaga may have had more effect.

Third, the small fight, in encounters in which the antagonists have previously been friends, affords an opportunity for non-allied neutrals to attempt to intervene. Reference has already been made to the fight between the Dimbagai-Yimyagai and the Merkai clan of the Tsembaga. At the initial engagement neutrals stood on a knoll, informants say, overlooking the fight ground, admonishing both sides that it is wrong for brothers to fight, demanding that the combatants quit the field, and throwing rocks at both antagonistic formations. Their efforts were unavailing, it must be reported, and the fight escalated.

Fourth, in a situation in which there are no third parties with the power or authority to adjudicate disputes, the "small fight" brings the antagonists within the range of each others' voices while keeping them out of the range of each others' deadlier weapons. Informants say that this opportunity for communication was used mainly to hurl insults at each other, but there is some evidence to indicate that in some fights, at least, the opportunity was used to compose the quarrel. Information on this aspect of the small fight is ambiguous. There are several reported instances of small fights being terminated by shouted negotiations after one side had sustained a fatality which the other side could regard as full reciprocation for a homicide it had sustained and which had set off the fight. This is somewhat different, the termination of the conflict being attributed to fulfillment of revenge requirements, rather than to the negotiations. The small fight, in these instances, however, provided an opportunity to fulfill the revenge prerequisites of negotiation without recourse to deadlier fighting, which would have been more likely to compound grievances than to cancel them out.

When information is derived mainly from the war stories of old campaigners, it is difficult or impossible to know what actually occurred. There are, nevertheless, indications that the small fight operated, albeit in an inefficient

way, to suppress rather than to encourage hostilities. Such an interpretation acquires additional plausibility when the small fight is compared to the deadlier encounter which usually followed it, and when the process of escalation is examined.

3.3.1.2 Escalation

Informants' accounts indicate that from the first day of the small fight, or certainly after one or two days, members of one or both of the antagonistic groups would begin to shout to both their opponents and their comrades that they had had enough of the "nothing fight" and that the time had come for a serious engagement. The data are insufficient, but it may be that such sentiments formed a kind of counterpoint to the laments of allies, in the case of fights between erstwhile friends, for the lost peace. The small fight may perhaps be viewed as a debate, held in a setting which minimized the danger of casualties while satisfying martial imperatives, between those eager to fight and those hoping to preserve the peace. All the interested parties, both the antagonists and their less committed allies, were present and in a position to contribute opinions and sentiments.

The small fight was, further, a show of force.

The antagonists were given an opportunity to assess the strength

of their enemies and to shape their policy accordingly. There is little information on this point, but an apparent equivalence of forces may have encouraged composition of the quarrel. Conversely, an apparent disparity may have induced the weaker group to flee without putting the matter to a further test of arms. Some informants say that this is what happened in the second round of engagements between the Dimbagai-Yimyagai and the Merkai, but agreement among informants is not complete.

As a show of force, the small fight may resemble in certain respects the war games and military displays of more complex societies. It bears an even closer apparent resemblance, however, to the agonistic territorial displays of other animal species and may well have had an effect similar to that which some scholars (e.g., Wynne-Edwards, 1962) attribute to this kind of animal behavior; maintenance of an optimum population dispersal at a minimum expense in blood.

The success of such exercises in diplomacy in avoiding escalation depended largely on two factors. These were, first, the previous history of the relationship between the antagonists. If their hostility were long-standing or if the homicide score between the two were seriously out of balance, those eager to fight would no doubt prevail. Also important was the extent to which the events of the bow and arrow fighting exacerbated or assuaged hostilities. It may be expected

that if casualties were few tempers would cool and voices would be added to those speaking in the cause of peace.

Eventually the talk would, as the Tsembaga say, "become one." If those in favor of peace prevailed, the fight would be dropped, and if the antagonists had, until this engagement, been friendly, they could resume their friendship without going through elaborate ritual procedures.

It was frequently, perhaps even usually the case, however, that a consensus in favor of fighting crystallized. If it did, the antagonists withdrew from the fight ground for at least two days to prepare ritually for the forthcoming encounter.

3.3.1.3 The ax fight

The second, more serious stage of the fight has no native designation, being referred to by Tsembaga as simply ura kunu^vai, "the fight itself," or "the true fight." It will be referred to here as the ax fight, although jabbing spears, throwing spears and bows and arrows are also employed.

3.3.1.3.1 Rituals preceding the ax fight

The rituals preparatory to the ax fight are much more elaborate than those which precede the small fight.

3.3.1.3.1.1 Uprooting the yu miñ rumbim

In the last chapter it was mentioned that each land

holding group periodically plants a ritual Cordyline fruticosa bush called the yu miñ rumbim or "men's souls rumbim."⁶

A group may not participate as principal combatants in ax fights with its yu miñ rumbim in the ground. There are periods when land-holding groups do not have yu miñ rumbim growing, and fighting is generally confined to such periods. This will be discussed in the next chapter. It infrequently happens, however, that a group which has uprooted its rumbim will initiate hostilities while the yu miñ rumbim of its opponents remains in the ground. If a group has suffered an attack while its yu miñ rumbim continues to grow, it must, before proceeding to the other rituals preparatory to the ax fight, uproot this plant..

The elaborate rituals which surround the uprooting of the rumbim under peaceful conditions are abbreviated when a group is forced into the procedure by enemy action. Description of the procedure will be reserved for the discussion of the kaiko, the context in which it more frequently occurs.

3.3.1.3.1.2 Hanging the fighting stones

Each of the land-holding groups has in its possession at least one pair of "fighting stones" (bamp ku). These are also sometimes referred to as aram ku the meaning of aram being obscure. These stones are in possession of one or two

of the fight magic men, who are referred to as "aram stone men" (aram ku yu) or, because of the large number of taboos under which they labor, "taboo men" (acek yu). These objects, which are in fact stone mortars and pestles made by a vanished and unremembered people, are occasionally found in the ground in both the Jimi and Simbai Valleys. Informants believe, however, that all of them originated at the first home of the smoke woman, Mount Oipor, in the upper Jimi Valley, and say that their ancestors obtained them from people in that vicinity.

The fight stones are ordinarily kept in a small, round house called ringi yin (yin/house; ringi/fighting ash). During the period when the yu min rumbim is not in the ground, the stones are kept in a small net bag on the floor of the house, where they also remain during the small fight. When the ax fight is agreed upon, the net bag is taken from its resting place and hung near the top of the center pole. Informants say that this is done by the taboo men unceremoniously, but it is a momentous act. By hanging up the fighting stones, a group places itself in a position of debt to both allies and ancestors for their assistance in the forthcoming ax fight. These debts can be fulfilled only through the prolonged ritual procedures which will be discussed in the next chapter.

The act of hanging the fighting stones signifies

the assumption by the entire local population or various of its members of a large number of taboos. These include, for all members, females and children as well as adult males, prohibitions against trapping marsupials, eating eels, or eating at the same time marsupials and pandanus fruit. Males may not eat the flesh of pigs killed for the kaiko of other groups, nor a large variety of marsupials, some yams, and a number of green vegetables. A number of other foods may be eaten by both men and women, but not shared by them. Drums may not be beaten, and the movements of some men are severely restricted. The taboo men, some informants say, may not depart from the territory of the local population, although others say they may visit the adjacent Tuguma, but not those groups whose territories lie across the Bismarck mountain ridge or the Simbai River. Furthermore, the fires over which their food is prepared, or which serve to heat stones for the ovens from which they partake, may not be used to cook food for members of other local populations.

Most important, the opposing group, which may have been until this moment, if they had previously been friends, referred to as "brothers" (gui) now become, formally, "ax men" (čenaŋ yu), or enemies. Their territory may no longer be entered except in battle, and outside of the context of battle, members of the enemy group may not be touched or even addressed.

One is not even supposed to look at their faces. No cultivated food grown on enemy ground may be eaten, nor may food grown elsewhere by a member of the enemy group. Should fatalities be suffered, food grown by allies of the enemy must also be avoided, and while they may be addressed and even visited, their houses may not be entered. If no fatalities are suffered, food which allies of the enemy have grown may be eaten, but dining from the same fire with them is tabooed. The act of hanging the fighting stones, in short, not only terminates any kind of mutually supportive relations between the principal combatants, but also places impedences upon the future relations of principal combatants with the allies of their opponents. Moreover, some impedences, particularly in the area of food sharing, affect relations between allies of the opposing principal combatants if they suffer fatalities.

Hanging the fighting stones, furthermore, also pushes any possibility of reconciliation between the principal combatants years into the future. While the fighting stones hang truces are possible, but reconciliations are not. The time for quick composition of the dispute has passed.

3.3.1.3.1.3 Bringing the red spirits into the fire and making the "ringi"

After the stones have been hung on the center pole,

one of the fight magic men climbs to the roof of the ringi house, where he ignites a stick of wood taken from a tree called kauit (Cryptocarya sp.). This is obtained from the dwelling places of the red spirits near the top of the Bismarck mountain ridge. Kauit is one of the varieties of trees which are said to be the houses of the red spirits. It is particularly difficult to ignite, and the fight magic man sobs as he recounts to the red spirits the circumstances which have led to this performance and implores them to come into the fire. When he succeeds in igniting the kauit he returns to the ground and ignites with it a fire which has been laid inside the ringi house to heat oven stones and in which the ritual ash, ringi, will be prepared from logs of kanam (Albizzia sp.) kamukai (Colona scabra), and pokai (Alphitonia iacana). These second growth trees have themselves no ritual significance, being used, informants say, only because their combustion produces good black charcoal. Their ash, or charcoal, is supernaturally powerful only because the red spirits themselves have been brought into the fire upon which it is prepared. The oven stones also partake of the supernatural power of this fire, and the fight stones, always strong, are fortified by the smoke which surrounds them.

A second fire is laid outside the house, for the purpose of heating cooking stones for a second oven. This is

ignited at the same time as the indoor fire, but not with the kauit. The red spirits do not enter or ignite this fire, and no ringi is prepared in it.

3.3.1.3.1.4 Sacrificing the pigs

Two pigs are now slain. One of them is to be offered to the red spirits and must be a male. The second, to be given to the spirits of the low ground (the raua mai, a category, it will be recalled, which includes both raua tukump, spirits of rot, and koipa mangian), may be either male or female..

When pigs are sacrificed to them, spirits are usually addressed in a peculiar screaming style. The message is delivered in staccato phrases, interrupted with increasing frequency by meaningless loud, sharp yells until, just before the pig is struck on the head with the club, the staccato "Ah! ah! ah! ah! ah!" has replaced words completely. Informants say that the addresses to the spirits in connection with the killing of the pigs in preparation for the ax fight follows this pattern, which I have observed in other contexts on several occasions.

The red spirits are first approached. They are not addressed as raua mugi. Instead a series of allusive terms referring to their characteristics and activities, and pseudonyms which may also be allusive, but which remain obscure,

are used. Allusive designations include "sun-fire" (runga-yiñe), referring to their hotness and, therefore, strength; "orchid, cassowary" (norum-kombri), referring to their habitation of high places and fighting qualities, and niñ niñ koramon, which designates the act of lighting the fire on the roof of the ringi house.

After being addressed as a class, individual red spirits, the slain brothers, fathers, and perhaps grandfathers of the living are addressed, being told to bring their associates to watch and listen.

Having alerted the red spirits, the slaughterer, who is one of the fight magic men, proceeds with his address. The burden of his message is to tell the spirits that an ax fight is about to start. He promises that the living will attempt to avenge their deaths and ask their help. He invites them to eat the pig that is about to be killed for them and to come into the heads of the living. He promises that only members of the local population will join them in eating the flesh of this pig. Men from other places, he tells the red spirits, will be given other pigs.

His short address finished, the slaughterer runs back and forth in front of the pig, which is tethered by one leg only, striking the animal with his club while on the run. One blow usually suffices.

The spirits of the low ground are approached in a similar way, being addressed neither as raua mai nor raua tukump, but as ancestors (ana-koka, literally, father-grandfather) and as koipa mangian. These spirits are also told of the forthcoming encounter, and they are invited to eat the flesh of the pig offered them, and to take hold of, or strengthen, the legs of the living.

The pigs are then placed in the ovens for cooking. The pig dedicated to the red spirits, sometimes referred to as the "head pig," is cooked in an oven built entirely above the ground out of wood and leaves. Stones heated on the fire made inside the ringi house, which had been ignited by and entered into by the red spirits are used in this oven.

3.3.1.3.1.5 Divination

After the pigs have been put into their ovens, the men retire into the men's house. They spend a substantial portion of the night in chanting while the shamans contact the smoke woman, whom they ask to name those enemies who may be easily killed and to warn those of the local men who are in especially great danger. It is usually the case, informants say, that only one or two enemy men are designated easy marks in each of the three to six Tsembaga men's houses in which shamans perform. Similarly, only a few of the locals are

warned. Informants say that a warned man is urged by his fellows to stay away from the fight ground, but his usual response is to refuse, saying that he will kill one of them first, after which it is alright if he himself is killed. He may add that it makes little difference if he is killed, for many clan brothers will survive him. If a warned man survives the fighting, his reputation is enhanced, for his miñ, his life essence, is said to be strong.

A second procedure is also used to mark those of the enemy who may be easily killed. A separate small above-ground oven is built in the ringi house for the cooking of the head of the pig killed for the red spirits. During the night, informants say, the miñ of some of the sleeping enemy, which wander abroad in dreaming, may be lured by the pleasant odor of cooking pork into the ringi house, where they will partake of the pig's head. Such men may be killed. The taboo man sits by the oven and recites the names of enemy men. The head of the pig, it is said, whistles when the name of an enemy whose miñ has partaken of it is enunciated. The whistling of the pig's head is said to be audible not only to the taboo man but also to others, most of whom cannot be in the ringi house, but are, rather, in nearby men's houses or, less likely, out of doors.

Several aspects of these two types of divination

ritual should be discussed.

(a) Limitation on killing: It is of interest that only a few of the enemy are marked for easy killing by the two procedures. It may be that this is simply the expression of a realistic appraisal of the situation, i.e., that it would not be easy to kill a larger number. There is some suggestion, however, that the number designated, although not large, represents "sufficient" homicides, enough that is, as far as the local group is concerned, to halt the fighting. This is not necessarily a reflection of the "homicide score" obtaining between the antagonists, for the group which has suffered fewer fatalities in the past also goes through such divining procedures. The data are far from sufficient, but it may be that such divination sets up a rough "killing quota." The possibility of such quotas being established through ritual or other means could be explored by anthropologists working in areas where warfare still occurs.

(b) Marking enemies as self-fulfilling prophecies: The designation of certain enemies as easy prey may serve to direct the homicidal attentions of the entire force to them. It is not unlikely, that is, that such prophecies are to some extent self-fulfilling. If this is the case, both shamanistic practices and pig's head divination are constantly reinforced by their apparent successes.

Clear information relevant to this matter is no longer to be obtained. Conversations with shamans would indicate a high degree of coterminousness between marked and slain enemies. Shamans, however, boast about their own successes and, in confidence, disparage the abilities of other practitioners. The actual facts of particular cases cannot be known for certain.

(c) Self-fulfilling prophesies, exuviae and social control: It may be that the use of enemy exuviae,⁷ combined with the practice of predicting whom among the enemy are objects of easy homicide, may act as part of a social control mechanism. As in the matter of the accuracy of predictions made by shamans, data are deficient concerning fight packages, for their owners, while sometimes boastful concerning their efficacy, are always secretive about their specific contents. Only they and the intermediaries from whom they have obtained material know whose exuviae is held by a fight magic man; the following must remain, thus, no more than a suggestion.

Among the Tsembaga, all men who are in possession of fight packages happen to be shamans as well (this need not be the case). I was informed by one of these men that those enemies whom the smoke woman marked for killing through him were among those whose exuviae or whose father's exuviae, were contained in his fight package. If it is the case that

designations of the smoke woman are to some extent self-fulfilling prophecies, then those whose exuviae are contained within the fight package are more likely to be killed than other members of the enemy force.

The motive which informants offer for the betrayal of a man to his enemy by transmission to them of his exuviae--suspicion of witchcraft or sorcery--is suggestive. While it is entirely possible that the victim of such a betrayal may be the innocent object of unprovoked antagonism, it is also possible that the covert antagonism of which he is a victim has been induced by his departure from certain approved modes of behavior.

It is unlikely that such a person would have aroused general animosity. Widespread antagonism toward a member of the group is likely to lead to general agreement that he is a witch. When such agreement exists, devious procedures are unnecessary. A man's own clan brothers will kill him. No such killings took place among the Tsembaga during the period of field work, but frequently grumblings were heard concerning who would be killed for a witch had the government not arrived, and descriptions of the personalities of individuals killed for witchcraft in the past indicate that the victims are likely to be bad-tempered, argumentative, and assertive.

Information is both insufficient and general, but

does suggest that those likely to incur suspicion of witchcraft include those who are well off in women, valuables, pigs, and crops, but who are not generous. For reasons which are not clear, the Maring regard especially marked success in pig-husbandry or gardening to be associated with witchcraft and sorcery. If a man's pigs and gardens prosper out of proportion to those of his neighbors, he invites suspicion. It is the exuviae of such a man, it is suggested here, that is likely to be sent to the enemy, with empirical consequences resembling those which such a betrayal is reputed to have. There are thus strong reasons for a successful man to be sufficiently generous to allay the envy of those surrounding him. At the least, fear that one's exuviae might come to rest through treachery in the fight package of an enemy, like fear of sorcery and witchcraft and fear of being suspected of sorcery and witchcraft, is a factor in maintaining the social and economic egalitarianism which characterizes Maring society.⁸ The fight packages of the enemy may indeed be worthy of the fear in which they are held, because those whose exuviae are contained in them may be in greater physical danger than their clan brothers.

This suggestion must apply mainly to the practice of shamanism by men possessing a fight package, for it is not clear how the whistling of the pig's head is produced. Taboo men say, of course, that it is the head of the pig which

whistles, and other people don't know. Few people, or none at all, watch the taboo man's face during the procedure, and it is possible that he simply puckers his lips and blows. It is also possible that the steam of the oven in some way produces the sound. If this is the case, the emission of the whistle could, but would not necessarily, be under the control of the taboo man.

(d) Warnings: It may be the case that warnings, like designations of whom among the enemy may be killed, are correct in a greater than chance number of cases. If a shaman could judge whom among his clan brothers his counterpart in the enemy group would mark for killing, or whom the enemy might try especially hard to kill, a warning might be given this man.

While any member of a local population may be slain in retaliation for a homicide committed by one of its members, it is sometimes the case that the victim's group marks one of the killer's group as the preferred object for revenge slaying. This may be the killer himself, or one of his sons, although according to Vayda among some Maring groups it is the custom to designate a member of the enemy group who physically resembles the victim. Such a practice carries the ideal of absolute reciprocity to the extreme.

While a shaman might not know whose exuviae was held by the enemy, he might be able to judge who fit into other

categories likely to receive their attention. He might thus be able to issue warnings which have a better than chance possibility of being correct.

3.3.1.3.1.6 Planting rumbim

Some time during the night, two rumbim are planted in the enclosure in which are located the ringi house and the men's house in which the men are assembled. These rumbim, which are also, according to some informants, called yu miñ rumbim, are planted to keep the miñ of the men inside the enclosure when, on the following day, they themselves leave it for battle. That is to say, the men leave their miñ, their life stuff, behind when they go to battle. Tsembaga say that if their miñ were exposed to the powerful spells made by enemy fight magic men, they would surely succumb, their possessors falling victim to enemy weapons. The miñ, therefore, must be left in a safe place, and kept from following their possessors into battle or running off if frightened. The rumbim prevents them from leaving the enclosure. Informants say that no Tsembaga knows the kunda, or magic, that must be applied to these rumbim. One old Tuguma man comes to perform this ritual for all the Tsembaga.

3.3.1.3.1.7 Fight magic on stakes

During the night the fight magic men paint and bespell a number of small stakes. Before dawn they go quietly

to the fight ground where they push them into the ground sufficiently far so that they cannot be seen. These stakes are said by informants to cause the loss by the enemy of their miñ, if they are brought to the battlefield. Informants do not report the encounter of opposing fight magic men on the fight ground. Whether there were conventions by which such meetings were avoided was not investigated.

3.3.1.3.1.8 Taking the ringi

At dawn the pigs are taken from the ovens. The fat belly of the "leg pig," the pig dedicated to the spirits of the low ground, is covered with salt. When the allies arrive, as soon as possible after dawn, they are given portions of this salted pig fat, which they eat immediately along with the green vegetables, mostly ferns, with which the pig was cooked. The remainder of the pig will be recooked and given to them in the evening, after the day's fighting.

The procedure in which the pig offered the red spirits, the "head pig," is involved is more elaborate. Before its salted belly is eaten by the principal combatants, they put on the ringi. The heart and lungs of the pig are placed on a small table in the ringi house, and the fighting stones are removed from their net bag and laid on top of them. One informant says that the red spirits have themselves come into

the stones through the fire. Placing the stones on top of the heart and lungs permits the red spirits to partake of these parts. The men then enter the house two or three at a time to take the ringi, the black ash made in the fire ignited by the red spirits. They are asked if they prefer to take ringi from the fighting stone called the wai, the male, which is the pestle, or from the mai, meaning in this instance the female, which is the mortar. Their choice has a bearing upon the permanence of some of the taboos, to be discussed below, which are assumed at this time. If the mai is selected, the taboo man uses it to apply a little of the ringi to the shoulders and forehead of the warrior. If the wai is chosen, the taboo man applies to it some of the ash, which the warrior licks off. It is unclear whether it is the contact with the stones, the reception of the ringi or both which brings the red spirits into the head, but informants agree that this is the effect of the procedure. When men go to battle, their miñ are left behind, but the hot, dry, hard red spirits are thought to have come literally into their heads where they burn, informants say, like fires, imbuing them with strength, anger, and the desire for revenge.

After having received the ringi ritually from the taboo man the warrior retires from the house with a handful of ash so that he may blacken his entire body. Now that the

red spirits are inside him and he himself is "hot," he may apply the "hot" protective and strengthening ash to his skin. Had he done this previous to being marked by the female stone or licking the male stone his skin, informants say, would have come up in blisters from the supernatural heat of the ringi.

Ringi is also applied, Tsembaga say, so that the face of the warriors may not be seen by the enemy, in accordance with one of the taboos assumed when the fighting stones were hung a few hours earlier. It is said that if the enemy can see a man's face, he will be killed.

If face and body blackening renders recognition of individuals more difficult, it could operate to diffuse the homicidal efforts of the enemy, which might otherwise be concentrated on a few marked men. A more important effect of the practice may be that it provides a highly visible means for distinguishing principal combatants from allies. It is only principal combatants who wear ringi. It is a striking fact of Maring warfare that principal combatants suffer much heavier casualties than those who have come to their aid. This is partly attributable to a preference for killing principal combatants. It is toward them that anger is felt, and it is often the case that a man has close and friendly relations with allies of the enemy. The realization of this preference may be facilitated by ringi, which makes it easy to distinguish,

even out of the corner of an eye, a principal combatant from an ally. It is an irony that the application of ringi, which supposedly protects the wearer, may actually increase his danger while protecting others. While it supposedly confounds recognition, it may make instantly recognizable those who belong to the category of preferred victims.

It hardly needs to be pointed out that data to substantiate a positive relationship between the wearing of ringi and casualties suffered could only be derived from direct, and detailed observation of actual combat. This interpretation must, therefore, remain hypothetical. It may be suggested, however, that workers in areas where warfare continues could explore the possibility of a relationship between differences in the ornamentation worn by various categories of warriors and differences in casualty rates.

The taboos assumed with the ringi are extensive and include both limitations on social intercourse and prohibitions against certain foods. The taboos on social intercourse refer mainly to relations with women. A man cannot, while he is wearing ringi, eat food from the same fire as a woman or cooked by a woman. While he may speak to women, they may not be touched. Sexual intercourse is, of course, forbidden. Women, and anything touched by women, are said to be "cold." Contact with them would extinguish the fires burning in men's heads.

Conversely, contact with the hot men would, it is thought, literally blister the skins of the women.

Food taboos are extensive. All wild animal foods are forbidden. Snakes, eels, catfish, lizards, and frogs are proscribed, it is said, because they are "cold." Marsupials are not eaten, informants say, because they are the pigs of the red spirits, and cannot now be taken until the living are in a position to give their masters pork in return for them. Some green vegetables are also forbidden. These include Setaria palmaefolia and hibiscus leaves. The latter are forbidden because they are wet and slippery. Their ingestion will not only extinguish the fires in the head but also make it difficult to grip an enemy in hand to hand struggling. No explanation for the taboo against Setaria could be obtained, and it may be that it was imported with the plant or developed in a former home area long ago. Taboos against the ingestion of this plant by males obtain elsewhere in the highlands (see Newman, 1964: 263-266). Some bananas and yams are also tabooed. These are, in the main, soft varieties, which it is said would injure the hardness or strength of their consumers. All food grown in the wora should be avoided, and unless the fight ground is located there, men should not enter the wora.

All of these taboos remain in effect until, at the earliest, the ringi is ritually removed at the end of the fight.

If a man has taken ringi from the male stone some taboos remain for the rest of his life or at least until he is a very old man. These permanent taboos include prohibitions against the ingestion of snakes, eels, catfish, lizards, frogs, and many of the marsupials which live in the high forest. Since most men take ringi from the male stone the great bulk of these subsidiary protein sources are, as it has already been mentioned in an earlier chapter, reserved for women and children.

Permanent prohibitions also apply to certain vegetables. These include all varieties of Setaria palmaefolia, some yams and some bananas.

There are, in addition, a number of other plants which may be eaten, but never from the same plant that has fed a woman. Several varieties of Pandanus conoideus fruit fall into this category, as do sugar canes, banana, and Saccharum edule varieties which have red skins or leaves.

3.3.1.3.1.9 Eating the pig and the fighting leaves

After the ringi has been applied a hasty meal is made of the greens with which the pig has been cooked. The pork, however, except for the bellies, are returned to their ovens for re-cooking with fresh greens, in preparation for consumption at the end of the day. The men then form a circle,

and heavily salted belly fat and fighting leaves are consumed. Informants say that the consumption of the fighting leaf makes them wild and bloodthirsty, but the effect is probably psychological rather than physiological, for the ingestion of the prescribed amount produced no effect upon me. Concerning the consumption of salted pig belly no explanation involving specific supernatural or natural processes could be elicited from any Tsembaga. All simply agreed that the ancestors had decreed that they do so, and to ignore the wishes of the ancestors would be to court death on the battlefield. It may be, however, that this act, taken in reference to dead ancestors, has important empirical consequences. First, it is accompanied by an absolute taboo upon the ingestion of any liquid whatsoever while on the fight ground. Certainly no man who wears ringgi, and perhaps no allied warrior, although this is not clear, may drink water or the juice of sugar cane, nor eat cucumbers nor papaya while the engagement continues. The rationale for this taboo, in light of previous discussion, is apparent. These cold, wet foods will extinguish the fire that burn in a man's head, leaving him weak and defenseless. A man, therefore, does not drink from the time that he consumes the salted pig belly until he quits the fight ground later in the day. To note that the resulting thirst might well limit the length of the fighting day is not to be facetious, particularly in light of the fact that fighting takes place usually

on sunny days. (Fighting is postponed if there is rain, for rain would extinguish the fires in men's heads) Indeed, some Tsembaga men have admitted that fighting would cease for the day when the warriors became too thirsty to fight any longer. The ingestion of salted pig belly and the associated taboo on taking fluids may, thus, mitigate the sanguinary consequences of combat by shortening the fighting day. Other consequences of salt and fat consumption, however, may have operated to increase the intensity of the fighting while it did last.

The Maring diet is deficient in sodium. That most Maring will eat pure table salt by the handful indicates this clearly, since sodium appetite appears to be directly correlated with sodium needs (J. Sabine, personal communication, 1965). The manufacture of native salt was discontinued some years before field work began and no samples were obtained. Because the native salt was made from the waters of mineral springs and not reduced from plant ash it is, despite the lack of samples, quite certain that it was a sodium salt, however. The ingestion of large amounts of sodium just previous to fighting would have permitted the warriors to sweat normally while maintaining normal blood volume. Lacking this additional sodium they might well have experienced a lowering in blood volume as they lost sodium through sweating, and consequently suffered weakness. (W. V. Macfarlane, Frederick L. Dunn, personal communications, 1965).

Sabine (personal communication, 1965) points out that the salt may also play a part in the catabolization of the fat, which, according to Macfarlane (personal communication, 1965) would become available for energy expenditure about two hours after consumption, thus providing a "second wind" to the tiring warrior.

The consumption of the lean pork at the end of the day, it may be mentioned, would offset to some extent the nitrogen loss attending the stressful fighting.

3.3.1.3.1.10 Applying the fight package, putting ringi on the weapons, and the final divination.

After the fighting leaves and salted belly have been consumed, the men form a circle and fight magic men press the fight packages to their hearts and their heads, to the cassowary plumes which adorn their heads and to the weapons as well. Another fight magic man applies bespelled gir, a grey clay, to their ankels and feet. The taboo men rub ringi on all of the jabbing spears and axes.

Having finished the application of the fighting package, the fight magic men build a fire outside of the circle formed by the men and lay on it lengths of green bamboo. Both sets of ancestors are asked again for their aid and protection.

In the meantime, the men have enclosed the inside of the circle by making a fence of their shields. The taboo men

are inside this circle, and when the bamboo explodes they begin to scream out to the red spirits, asking again who may be killed among the enemy and who among the locals are in great danger. Informants say that this is the only occasion upon which the red spirits themselves communicate with the living without going through the intermediate smoke woman. The taboo man screams, leaps in the air, hurls himself against the wall of shields. His eyes roll up into his head showing only the whites and his tongue protrudes. He screams out the names and, after writhing on the ground lies still for a moment or two. He is assisted to his feet by one of the fight magic men while the men yell war cries. More bamboo is exploded and the men, led by a fight magic man waving his fighting package in the direction of the fight ground, leave for battle brandishing their weapons singing a song called de, and shouting war cries. The taboo men, who recover quickly, join the procession.

3.3.1.3.2 The engagement

In contrast to the "small" or "nothing" fight, both axes and two types of jabbing spear are employed. The point of one type is armed with a sharpened beak of a Sickle Bill, which remains in the wound when the weapon is withdrawn. The other is barbed for half of its seven to nine foot length. Below the barbs three or four prongs project forward and outward at an angle to the shaft. Such a weapon seems designed

for defense against headlong charges, which are not indicated by informants' accounts to have been a regular feature of Maring warfare.

Informants say that on the fight ground formations were mixed, both principal combatants and allies standing side by side.

The taboo man remained in the rear, heavily protected by the men closest to him. The slightest wound sustained by a taboo man it is said, portended the inevitable death of one of the men of his group, and if he were killed it meant that his side would be routed. Such a belief could operate, of course, to mitigate the severity of fighting if both sides spent their energy in trying to shoot the taboo men of their opponents, and if his men fled upon the death of a taboo man. There is no suggestion from any informant, however, that ax fights declined into attempts to shoot the enemy taboo man while others of the enemy were being ignored.

Concerning leadership on the fight ground there is little information. It is quite clear, however, that discipline was not tight nor control close. Formations were several ranks deep, with the men in the front row being relieved by those behind them from time to time. While the opposing men in the front ranks were fighting a series of duels from behind their enormous shields, bowmen in the ranks further to the rear shot

at those who exposed themselves, and gave support to the men in the first rank. Fatalities generally occurred when a man in the front rank was brought down by an arrow. His opponent, supported by nearby comrades, would then rush in to finish him off with axes. The fallen man's comrades would also rush to his defense, protecting him with their shields, if possible.

Informants' accounts give the impression that this static positional fight was most common. In most engagements the opposing forces stood toe to toe behind their huge shields with no tactical or strategic movement taking place. A series of such engagements frequently continued sporadically for weeks, with only light casualties being sustained by either side. The antagonists, it seems, were waiting for the day that their enemies would arrive on the fight ground without the support of their allies. On the day that a group found itself with a clear numerical advantage, instead of taking up the usual static positions it would charge.

Maintaining the support of allies seems to have become increasingly difficult as the fighting went on. Informants say that they simply tired of participating in a fight which was not their own. Victory, thus, must have often gone to that group which could continue to mobilize its allies the longest. There are two clear-cut instances of this involving the Tuguma and the Tsembaga. In their last conflict with the

Kundagai, it was on the day that their allies, the Tuguma, did not appear that the Tsembaga were routed. The Kundagai, heavily supported by the Kanump-Kaur and other groups, took advantage of the absence of the Tuguma to mount a charge. The Tsembaga suffered eighteen fatalities on this one day, six of them being women and children, and many other people were wounded. Casualties, thus, sometimes reached heavy proportions.

The Kanump-Kaur avoided the more dire consequences of the failure of their allies to appear for an engagement against the Tuguma. When they heard that the Kandembent-Namikai, their most important supporters, were not going to arrive, they didn't go to the fight ground themselves. They simply gathered up their women, children and pigs and fled their territory. Vayda has gathered accounts of similar behavior among a number of Jimi Valley Maring groups.

Waiting for a numerical advantage followed by a charge was, it is indicated by informants' accounts, the most frequently employed strategic and tactical procedure. There were others, however, as well. An example of ambush is to be found in Tuguma history. Night time raids were rare, but did occur. Accounts of battles indicate, furthermore, that flanking and surrounding movements were sometimes attempted, a force gaining by stealth its enemy's rear or flank, opening him to either cross fire or charges from two directions.

These latter maneuvers were probably only attempted by forces with some numerical superiority.

3.3.1.3.3 Ritual, the frequency of engagements, and the slaughter of pigs

Informants' accounts indicate that an ax fight often went on for weeks, or perhaps even months. Engagements, however, did not take place every day. Rain confined men to their houses, for it is cold and wet and would, men say, dampen the fires of the red spirits burning in their heads.

The requirements of ritual also resulted in interruptions. The frequency of ritual performance was, to a large extent, directly correlated with the frequency of casualties, for most of the rituals were performed in connection with casualties.

After a fatality, engagements were discontinued while the group which suffered the loss mourned the deceased and performed the necessary funerary rites. These included killing one or more pigs.

Those who inflicted the fatality also had to undertake ritual performances to protect themselves from the spirit of their victim. It is said that the miñ of the slain man follows the killer home, menacing not only the killer himself but all of his co-residents. If the killer sleeps in the men's

house the spirit of the slain man might follow him inside, wreaking vengeance upon all who are present. When a man kills an enemy, therefore, he sleeps away from his fellows to keep from exposing them to danger. To protect himself, it is the ringi house in which he sleeps.

In the morning the killer slaughters one of his own pigs for the red spirits. In his address he tells them that with their help he has killed an enemy and he now gives them pig in thanks for their assistance. He asks that the miñ of the slain be prevented from killing him or any of his brothers. He invites the red spirits first to eat the pig being offered them and later to assist the living in killing more of the enemy. Since the allies may not partake of pig offered to the red spirits, a second pig may be killed and dedicated to the spirits of the low ground, but this is not clear.

While the pig is in the oven the fight magic men prepare to drive the spirit of the slain man off the territory through a procedure called "extraction and disposal magic" (kunda guio warunton). They fashion brooms from rumbim and obtain from the forest several four to six foot lengths of the vine deraka (Pipturus sp.) leaves of močam (Aglomena sp.) and a few three to five foot poles one to two inches in diameter of ganč, a tree of the Rubiaceae family. The posts are sharpened on the bottom and painted at the top with earth

pigments. Spells are said over these four kinds of objects and they are passed out among the men. Bamboo is laid in a fire and the ancestors are asked to assist the living in driving away the spirit of the slain man. When the bamboo explodes the men stamp their feet and cry out. Those who are carrying the bespelled objects run all over the enclosure. The men with rumbim make sweeping motions as they run. Those carrying the vine derake whip the ground while the men with the sharpened ganc posts thrust their points into the earth at frequent intervals. The močam are carried by their two to three foot stems with the leaf held a foot or so above the ground. As the men run they shout occasionally "Pio!"("Go!")

After having covered the enclosure thoroughly, they go out through the gate and head for the houses of the women. Other men follow, brandishing weapons, and shouting battle cries. Every house and every enclosure is visited, so that the spirit of the slain man, wherever it is, and the supernatural corruption (tukump) which it has spread, may be beaten by the deraka, pierced by the ganc posts, "bitten" by the močam leaves (which contain oxalic acid), and swept by the rumbim toward the boundary. There, amidst battle cries, the four plants are deposited, after having again been bespelled to bring harm to the enemy by sending to their territory not only the spirit of the dead man, but also his tukump.

While neither rituals performed by the victim's nor the killer's group require more than a day or two to complete, fighting may be discontinued for considerably longer, five to seven days, informants say, being not unusual. It was the victim's group that was to call out the challenge for a new engagement but sometimes they delayed, since fatalities, informants indicate, do damage to the faith of the victim's group in the efficacy of its ritual performances. After a death, therefore, requests might be sent to renowned fight magic men in friendly groups, asking them for their assistance. By the time that the invitations reached such men and they had travelled to the territory of those who had sent for them, several days might have passed. These "cease-fire" periods were used by combatants on both sides to take care of garden work if necessary. Another day might then be spent in preparation for the visitor's rituals and in their performance. After their completion the challenge for a new round of fighting could be issued. Both sides again killed pigs for the red spirits and the spirits of the low ground, and sent word to their allies that the time for a new engagement had been set.

Wounding, when it was serious, also resulted in interruptions of the fighting, according to informants. The victim's group would on these occasions kill a pig for the red spirits, which would be eaten by the victim and his agnates.

New engagements might be delayed until it was clear whether the injured man would live or die.

Several obvious points concerning "ritual cease-fires" may be summarized here. First, interruptions in the fighting provided the combatants with an opportunity to perform necessary subsistence tasks.

Second, they relieved the psychological and physiological stress which must have accompanied an ax fight. The requirement of the rituals for the slaughter and consumption of pigs, furthermore, may also have served to mitigate the ill effects of the increased catabolization of protein brought about by this stress.

Third, it is possible that such interruptions may have enhanced the opportunities for the re-establishment of peace on a more prolonged basis. For one thing, each cease-fire resulted in a partial or full demobilization of the allies, who returned to their own territories. Informants' accounts suggest that remobilizing allies became increasingly difficult as fights dragged on. A group which was having difficulty rallying its supporters for a new encounter might choose not to issue the challenge, or, if the homicide score was not too desparate, to send word to the enemy, either through intermediaries or by shouting, that a truce was desired. This was likely to be acceptable if the fighting had

been protracted and some casualties had been sustained. Informants report that men would say that enough have been killed or wounded for the present, that if the fighting continues everyone will be killed, and that it is better to perform the truce rituals now, with the fighting to be resumed again some time in the future.

3.3.2 Terminating the fight

Most ax fights ended in a truce. Sometimes, as suggested above, termination of the hostilities was arranged during periods when fighting had already been interrupted by the necessity to perform rituals. At other times it was arranged while both sides were on the fight ground.

According to informants, such agreements were reached at least three times by the Tsembaga and their enemies the Kundagai. Evening the homicide score, while not necessary, no doubt facilitated the invocation of truce. Old informants say that in the first fight against the Kundagai, when the score was evened by the slaying of a Tsembaga man to four deaths on each side, the Tsembaga called out to the Kundagai that their requirements for revenge had now been fulfilled and that both sides should return to their respective houses to plant the yu min rumbim, signifying truce. On the other two occasions when truces were declared there were disparities in

the homicide score, but the contestants agreed that killing had been sufficient for the time being and that the pressures of gardening and pig herding required a cessation of conflict.

Truces continued for the duration of the ritual cycle. The description and timing of this cycle will be discussed in the next chapter. It is sufficient to note here that these ritual cycles were protracted, as were the truces which were coterminous with them. They sometimes endured for fifteen or even twenty years, although ten or twelve years was probably average.

Not all fights ended in truces, however. It sometimes happened that one side was routed. The victors, in such instances, after killing every man, woman and child unfortunate enough to be caught, laid waste the territory of the vanquished. After the defeat of the Tsembaga in 1953, the Kundagai tore up the Tsembaga gardens, cut down most of the pandanus and ambiam (Gnetum gnemon) groves, desecrated the raku, the burial places where pig sacrifices are made, burned the houses and killed all the adolescent and adult pigs. Their deprivations were directed toward making it as difficult as possible for the Tsembaga to return to their own territory, rather than toward the acquisition of booty. Since the Tsembaga were cenang yu, or formal enemies to them foodstuffs grown by the Tsembaga were supernaturally proscribed. Their booty was, therefore, limited to

baby pigs which could be taken home to be raised and, perhaps, to wealth objects, such as plumes and shells, which the fleeing Tsembaga had left behind. The slain pigs were not allowed to rot, however. Neutrals, seeing the smoke of the burning Tsembaga houses, immediately came and carried the carcasses back to their own houses for cooking.

Having done what they could to lay waste Tsembaga territory, the Kundagai retired to their own ground. The immediate occupation of Tsembaga territory was tabooed to the Kundagai. It will be recalled that when the fighting stones are hung up a taboo against entering enemy territory except in anger comes into effect. The armed conflict having come to an end and despoilation having been completed, the Kundagai thus not only returned to their own ground but were restrained from re-entering Tsembaga territory by fear of both the ancestral spirits of the Tsembaga who were thought to remain, at least for a time, on the ground lost by their living descendants, and also by fear of their own ancestral spirits from whom the injunction emanated.

If the defeated do not return to their territory, it remains vacant while the fighting stones of the victors remain hanging from the center poles of their ringi houses. I know of only one instance in Maring history in which the territory of the routed group was immediately occupied by the

victors. In 1955 the Kauwasi, a Jimi Valley group, routed their neighbors, the Cenda. Some members of the victorious forces announced their intention to make gardens immediately on the ground abandoned by their opponents. They were actually prevented from doing so by the Australian government, whose presence was first being felt in the area.

This case is instructive in that it may illustrate the limits beyond which supernatural constraints cannot contain demographic and ecological pressures. The Kauwasi are the most numerous of all Maring local populations. They numbered, in 1963, nearly 900 persons, according to Vayda, and there is no reason to believe that they were fewer in 1955. In 1955, moreover, their numbers had been swollen by refugees from the Tsembaga, Ambrakwi and Tsengamp. There must have been at the time over 1000 persons in residence on Kauwasi territory, and 1100 is not unlikely.

The land of the Kauwasi, moreover, is poor. Large areas are in grass, and much of the gardening takes place in very young secondary growth. There are indications, in short, that the Kauwasi were pressing the carrying capacity of their environment, a state of affairs that could only have been exacerbated by the influx of refugees.

It is further interesting to note that some but not all Kauwasi informants deny any intention of occupying the territory of

the Cenda themselves. They say that it was not they but the Tsembaga, Tsengamp and Ambrakwi refugees who were going to take Cenda land. They say that these refugees could do so because they were not themselves enemies of the Cenda but were merely assisting the Dauwasi in the fight.

Accounts of routs indicate that in some instances the members of the vanquished group do not return to their territory. The group fragments as the survivors flee to affines or cognates. The Tsembaga who survived the 1953 disaster took refuge with seven different local populations, two of which were across the Simbai River to the north, while three were to the south, across the mountain in the Jimi Valley. To rally these small and scattered remnants for an attempt at reoccupation would have been difficult in light of their dispersion, their abiding fear of the Kundagai, and their ruined pandanus and ambiam groves. The Tsembaga ceased to exist as a group after their defeat, and if it were not for agents of the newly arrived Australian government, who offered to protect them, it is unlikely that they would, as a group, have returned to their territory. Not only was such a return discouraged by the dangers and difficulties attendant upon such an enterprise, but continued residence with their hosts was encouraged by participation in rituals which had the effect of converting their de facto membership in these local populations to de jure membership. This will be discussed in

the next chapter.

While accounts indicate that the return of an entire local population to its abandoned territory often did not occur, it was frequently and perhaps usually the case that a fraction of that territory would be reoccupied by remnants of the vanquished group under the cover of those among whom they had refuged. Some Tsembaga, for example, after being driven off their territory by the Kundagai, took refuge with the Tuguma immediately to the east. As members of the Tuguma group, or under their protection, they re-entered the eastern portion of their territory where they made a few gardens. In this enterprise they were accompanied by a few Tuguma who were told by Tsembaga relatives who had refuged elsewhere to avail themselves of their lost ground. So far as I know, the re-occupied Tsembaga territory was used for gardening only. Houses remained at a greater distance from the enemy border. Such limited reoccupation of abandoned territory is reported in two other instances in Tuguma-Tsembaga history.

3.3.3 The truce ritual: planting the rumbim

Even when truces have been arranged on the battlefield, the antagonists remain uncertain of each other's sincerity. If, after a protracted period, active hostilities are not resumed, truce-making rituals are performed. Informants, who it must be admitted are inaccurate in such matters,

indicate the period is a month or so. In addition to a sufficient time lapse since the last engagement, it may have been that word came to each of the principal combatant groups through neutrals certifying the resolve of their opponents to terminate the fighting. In light of the reticulate nature of intergroup relationships throughout the Maring area this is likely, but no statements from informants give support to the possibility.

Discussion will be confined to the truce rituals performed by groups which remain on their own territory after the fight. The scattered survivors of a rout remove the ringi from their bodies with little ceremony, and this will not concern us here.

It should be made clear that the antagonists do not participate together in truce rituals. Each conducts them separately.

When a group is assured that its opponents have given up any intention of prolonging the hostilities, word is sent to the allies to assemble for the killing of the pigs and the planting of rumbim.

Depending upon the size of the pig herd, the length of the conflict, and the number of casualties sustained, the pig slaughter may be substantial. The slaughter takes place at the raku, locations at which ancestors had houses when living. These are scattered throughout the territory, and every

man has a number at which he sometimes sacrifices pigs. The specific raku at which slaughter is to take place are designated on this, as on all other occasions, by shamans who tell each man where the ancestors wish to eat their pork. On pig-slaughtering occasions during the period of field work shamans' advice resulted in all or most of the members of a sub-clan being directed to the same raku, but there were always some men killing all or some of their pigs by themselves in isolated raku. Informants say that this was also the case when rum-bim was planted. Accompanying the locals to the raku are their affines, cognates, and, perhaps, non-kin trading partners from other places who assisted them in the fight.

Some of the pigs killed are for the red spirits, but most are for the spirits of the low ground. The burden of the addresses to both categories of ancestors is to thank them for their assistance in the fight.

After cooking, most of the pig which was dedicated to the spirits of the low ground is immediately presented to the allies, who take it home with them when the rituals are over. The fat bellies are first removed, however, for formal presentation. This belly fat, along with that taken from the pigs dedicated to the red spirits, is brought to the men's house enclosure where the ringi house stands. This is the scene, on the following day, of the planting of the rum-bim.

Everyone, including allies, women, and children, assembles for this ritual. In preparation all varieties of wild animals are captured: marsupials, snakes, lizards, frogs, rats, insects, grubs and birds. A special oven is prepared out of bark. It is about three feet square and rests directly on the ground. This oven is loaded with greens, the wild animals, and the belly fat of the pigs dedicated to the red spirits, which is cut in little pieces. While this is cooking the presentation of the belly fat of the pigs dedicated to the spirits of the low ground is made to the allies. These men sit in a circle and, as their names are called, their local affines, cognates, or trading partners push handfuls of now cold salted belly fat into their mouths. A second local relative assists by pushing additional salt into the mouth and by sprinkling more on the shoulders. There is a vague order of precedence in these proceedings. The sons of slain men, if there be any, will be called first, and men who have killed enemies next.

After the presentation to their allies has been made, the principal combatants may remove their ringi. The fight magic men bespell the cloth-like tents of certain tree caterpillars which are used as wash clothes, and the sap taken from the tree yingam (unident), which serves as a soap.

These spells are among those included in the category

known as "turning word" (andik men). Throughout the remainder of the entire ritual cycle, andik men is performed from time to time to "turn off", or reverse, magic performed or ritual states assumed in connection with the ax fight.

As the oven is opened, the taboo man addresses both categories of ancestors, recounting the circumstances of the fight and announcing to them that the taboos associated with the ringi will now be removed. The men then cleanse themselves of ringi. With the removal of the ringi the taboos against sexual intercourse, food cooked by women, and some of the foods forbidden during the time of fighting are terminated. The men, along with the women and children, may now consume the contents of the oven. Informants say, when questioned about it directly, that those men who took ringi orally from the wai, or pestle, avoid the snake, lizard, rat, and other forbidden foods which the oven contains, while those who received ringi from the mortar, or mai, eat, like the women and children, everything. This may not be the case, however. It must be hard to distinguish a small piece of forbidden cooked rat from a small piece of perhaps acceptable marsupial, and it must be impossible to distinguish pieces of acceptable marsupial from marsupials which are tabooed. This may be, in short, an occasion when food taboos are in fact abrogated simply because mistakes may be impossible to avoid.

Before the contents of the oven are consumed, the yu min rumbim, always a red leafed variety of Cordyline fruticosa, called tundoko, is planted. After it has been bespelled with andik men, it is placed directly in the middle of the square bark oven in which the food has just been cooked. The ancestors are addressed by one of the fight magic men. He thanks them for both preserving the lives of the men who survived the fight and for not allowing them to be dispossessed of their territory. He repeats that the fight is over and tells them that the rumbim is now being planted on their own territory. He assures them that while it remains in the ground the living will not fight or turn their thoughts to fighting. He deprecates the amount of pigs given to them and to the allies, but promises that while the rumbim remains in the ground the thoughts and efforts of the living will be directed only toward raising taro and more pigs so that some time in the future, when the pigs are of sufficient size and number, the rumbim may be uprooted and pork in great quantity can be given to them and to the allies for their assistance in the fight.

He also asks the spirits to care well for the rumbim, for if it does not flourish neither will the men. All of the local males are then directed to place a hand on the plant as the earth is tamped around its roots. The taboo man tells them that intercourse with their wives will now result in

children and that the children will be strong and grow quickly.

Some informants say that the laying of hands on the rumbim actually introduces the miñ, the life stuff of the men and boys, into the rumbim, where they remain for safe-keeping. Others deny that this is the case and explain that while this rumbim is planted for the sake of the men, their miñ remain either in the rumbim planted the night previous to the ax fight (see section 3.3.1.3.1.6), or confined by that rumbim to the men's house enclosure. It has already been mentioned that both are sometimes referred to as yu miñ rumbim (men's "souls" rumbim), and the exact whereabouts of the men's miñ is not a matter of great concern here. It is clear, however, that the rumbim is associated with males. Indeed, women may not touch this plant.

Another plant, amame (Coelus sentellariodes), a low, fragrant, herbacious, in this case green-leafed, ornamental, is planted for women. When the men unclasp the rumbim, the taboo man plants the amame around the outside periphery of the oven. Some informants say that small pieces of fat from the belly of the pig are planted with the amame, and all agree that it is referred to as the "pig belly amame" (koni kump amame). While planting it the taboo man asks the spirits of the low ground to care well for the amame, that the pigs grow fat, that the women be fertile, and that gardens flourish.

The sexual and fertility content of this ritual seems apparent. The placement in space of the ritual objects associated with male and female may represent the procreative act which, in turn, symbolizes fertility in general. It is in the receptacle that later received the rumbim that the varied fruits of the land were cooked, and pigs and gardens are associated with the same plant as are women. It must be mentioned here, however, that rumbim and amame are also planted over graves, and death as well as fertility might also be symbolized here. It has already been suggested that death and fertility are not antithetical in the Maring view, however.

It seems apparent too, that this ritual, following as it does the removal of the ringi, which terminates the supernatural restrictions associated with fighting, reorients the participants toward peaceful activities. Their attention and efforts are directed away from their borders and those who live across their borders. They may now turn inward, and devote themselves to prospering within their successfully defended territory. The cleansing of the ringi followed by the planting of the rumbim and amame, in short, ends war and begins peace.

Another important aspect of the ritual planting of rumbim is its affirmation of the connection of the individual to the group, and the group to its territory. The ability to

plant rumbim indicates the successful defense of the territory against outside threat. Rumbim may be planted only on the territory. Groups which have been driven off their land cannot as groups perform this ritual elsewhere. Survivors of routs, after having taken ringi from the fighting stones of their hosts during their hosts' fights, participate in planting rumbim with their hosts. This act attaches refugees to the land of the groups which have harbored them, and, moreover, clears the way for the annexation of their abandoned territory by those who drove them off it. When a refugee sacrifices a pig in connection with the rumbim planting of his hosts, he invites his ancestors to leave their old residence and partake of pork in the new place. Even the ancestors, thus, of a routed group eventually vacate the territory from which their living descendants have been driven.

The peace which follows the planting of rumbim is a truce only. The fighting stones remain hanging from the center pole of the ringi house, and intercourse with the enemy remains forbidden. The period during which the rumbim remains in the ground is, moreover, a time of debt. The debts are to the allies and ancestors who have not yet been fully repaid for their assistance in the fight which has just been finished.

The debt to ancestors involves several taboos which remain in effect while the rumbim remains in the ground. Eels,

which are said to be the pigs of koipa mangian, may not be eaten, and marsupials, which are said to be the pigs of the red spirits may not be trapped. Before the living may again avail themselves of these "pigs" raised by the spirits it is necessary for the living to raise pigs themselves to give in return.

Pigs killed in connection with the pig festivals of other groups may not be eaten by men. Informants say that men would be ashamed to eat the festival pig of other people when they have not yet raised sufficient pigs to conduct a pig festival themselves, and such pig, when it is received, is given to the women and children.

A taboo on beating drums also prevails. While their rumbim remains in the ground the members of a group, when invited to dance elsewhere, dance with weapons rather than drums in their hands.

Further taboos remain which seem to segregate some of the components of the community associated with the red spirits, and thus warfare, from some of those associated with the spirits of the low ground, and thus peaceful activities. Marsupials, the "pigs of the red spirits," may not be trapped. Although they may be eaten, they may not be mixed with pandanus fruit, which is associated with the spirits of the low ground. Red skinned sugars, bananas, and Saccharum edule, as

well as certain varieties of pandanus and certain species of marsupials may be eaten by both men and women, but they may not share the same plant or animal. Men, moreover, may not eat certain soft tubers, particularly some varieties of Dioscoria alata, D. bulbifera, and D. esculenta, which grow in the wora.

Two of these taboos have certain empirical effects which may be made explicit here. First, as has already been mentioned in the last chapter, the taboo against the consumption of "festival pig" from other places applies only to adult and adolescent males. Women and children, who are most in need of protein, are the physiological beneficiaries of this taboo. Second, the taboo against trapping marsupials can only redound to the advantage of the marsupial population. During the period of field work, although no count was kept, it was clear that almost all marsupials taken were taken in traps, rather than by shooting. The yields of trapping, moreover, seemed substantial. When trapping is permitted, several hundred animals may be taken in the course of a year. There are no data concerning the population dynamics of marsupials inhabiting Tsembaga territory, but it may be that the prolonged prohibition on trapping permits these animals to recover from exploitation which might otherwise decimate them.

While these taboos may have an effect upon the well-being of the local population, they are unimportant in comparison

to another concomitant of the debtor status which is acknowledged with the planting of the rumbim. The spirits and the allies must be rewarded for their assistance in the fight just finished before aggression may again be undertaken. If a group attacks its enemy before these debts are paid, help will be forthcoming from neither spirits nor allies. Informants agree that both allies and ancestors would be sufficiently angered by a group which initiated new hostilities before fulfilling obligations accrued in the last round to refuse to assist. These sanctions are sufficiently frightening to make breaches of the peace rare.⁹ A "truce of God" thus prevails until there are sufficient pigs to present to the allies and spirits and to uproot the rumbim. One of the aims of the next chapter will be to discuss what constitutes "sufficient pigs," and how long it takes to acquire them.

4.0 Summary and conclusion

In this chapter the relations of the Tsembaga to other local populations have been described. In the earlier sections the exchange of women and goods with friendly groups was treated, and some suggestions were made concerning the systemic nature of the exchange apparatus in pre-contact times. The next chapter will discuss the ways in which public events associated with rituals both provide settings in which exchanges

take place and facilitate the movement of utilitarian goods by creating a demand for the non-utilitarian goods for which they are exchanged.

Some suggestions were made concerning the nature of the fighting itself, notably that the earlier "nothing fight" stage was more diplomatic than military. It should again be emphasized that the Maring were pacified three or four years before field work commenced. The description of fighting presented here, therefore, had to be reconstructed from the accounts of old campaigners and is not the product of direct observation. Accounts of a substantial number of informants were checked against each other, however, and reasonable accuracy may be presumed. The same cautionary statement should be made concerning the rituals associated with warfare. While rituals similar to some of those described were observed in other contexts, the discussion was based upon informants' accounts. Such information cannot merit the same degree of acceptance as that which is derived from direct observation. The role imputed to ritual during the conduct of warfare must, therefore, remain to some degree hypothetical. The accounts do suggest, however, that fighting rituals, or their requirements, resulted in:

1. the interruption of fighting, making it possible to perform necessary subsistence tasks and facilitating the establishment of prolonged truces;

2. the provision of means, the application of ringi, for distinguishing principal combatants from their allies, thus protecting allies from bearing the full brunt of casualties in fights not of their own making, and consequently allowing them to continue, in some instances at least, as peacemakers;
3. the reinforcement of belief in the efficacy of religious performances by providing opportunities for the enunciation of self-fulfilling prophecies;
4. the formation, through the practice of betraying the exuviae of suspected witches to enemies, of a social control mechanism;
5. the strengthening of warriors by requiring them to ingest large quantities of salt before proceeding to the fight ground;
6. the limitation of casualties by shortening the fighting day through the application of a taboo against drinking on the battle ground, after the consumption of salted pig fat;
7. the provision of opportunities for the consumption of high quality protein at a time when it was particularly beneficial physiologically.

Another aspect of the role of the rituals associated with fighting may be accepted with greater certainty, since its effects were available to direct observation. These rituals resulted in:

8. the increase in the protein intake of those portions of the population, women, and children, who most require it, as a regular part of the diet through the permanent or protracted taboos assumed by adult males upon undergoing the rituals immediately antecedent to the ax fight.

Some suggestions of a more abstract or general nature may be made concerning the effects of the rituals.

First, it has been suggested that several of the rituals described here may contribute to the accomplishment of the ends for which they are manifestly undertaken. In the cases of foretelling enemies to be slain and in the case of the betrayal of exuviae to the enemy the mechanism which may bring about the desired end is the self-fulfilling prophecy. Concerning the ingestion of salt, fat, and pork at times when it is particularly beneficial physiologically to do so, it can only be said that the people's beliefs concerning the supernatural and their behavior in respect to it seems appropriate to the stress situations in which they find themselves. There is an isomorphism between the supernatural, on the one hand, and natural elements and processes of which the actors could hardly be aware on the other. How such isomorphism comes to be cannot be explained, except to make the general suggestion that since it is adaptive it is selected for.

It must be that there are many other mechanisms through which magical or religious procedures actually accomplish their intended ends. Aside from psychological factors, however, (e.g., the role of faith in effecting cures) this area does not seem to have received sufficient attention from anthropologists. An exception is Moore's suggestion that scapulamancy

may enhance the effectiveness of caribou hunting among the Naskapi Indians by eliminating unconscious regularities in the behavior of the hunters, regularities which might be learned by the caribou. By telling the Indians where to go to hunt game, the cracks and spots in the scapula, Moore suggests, may operate as a primitive table of random numbers (Moore, 1957).

On a yet more abstract level, such disparities between motives and consequences suggest that ritual sometimes operates to mask from actors the empirical effects of behavior which, if understood, might not be undertaken. (Vayda and Rappaport, in press). Two corollary hypotheses may be suggested, although it should be made clear that they probably cannot be tested empirically.

First, in some instances the masked consequences of rituals may include benefits to the actor which he cannot, because of values or ideals, admit. A Maring fighting man is expected to speak and act ferociously. That the taboo against drinking on the battlefield limits his ability to do violence is a fact which cannot be admitted, for such an admission would fly in the face of bellicose ideals. Ritual, in this instance, it is suggested, saves both values and lives, for it makes possible the coexistence of conflicting imperatives and it mediates the relations between them. This is a notion which is implicit in the psychoanalytic literature relating to ritual

(e.g., Reik, 1946) and is similar to suggestions made by Gluckman and others in reference to ritual and social structure (1962).

The instance of the ringi is different and almost converse. It is a truism of evolutionary theory that a trait which is adaptive on one level of organization may be non-adaptive on others. The case of the sickling trait, which confers an advantage on a population as a whole but is lethal to some of the individuals who constitute the population, is classic (Livingstone: 1958, 1962). It may be that the application of ringi, which it has been suggested is disadvantageous or non-adaptive for its wearers, is adaptive as far as the entire Maring population is concerned. By diminishing casualties sustained by allies it lessens disruptions of social ties between groups other than the principal combatants, thus maintaining relatively undamaged the cooperative networks within which subsistence activities and exchanges of women and goods take place. It is being suggested here, in other words, that this ritual serves to induce behavior on the part of constituent units of a population which is non-adaptive for themselves but adaptive for the population as a whole.

The final section of this chapter was concerned with the rituals which effect the transition from war to peace. It was suggested that these rituals:

1. may operate to conserve a marsupial fauna which might otherwise be over-exploited;
2. through the taboos associated with them increase the protein intake of women and children at the expense of men;
3. contribute to the redispersion of people over land by providing a means, participation in the ritual planting of rumbim, for assigning de jure membership in new groups to refugees. This same ritual also facilitates the occupation by new groups of abandoned territories by evacuating from them the ancestral spirits of the former residents.

Most importantly, the rituals described in the last section of this chapter establish a "truce of God." The duration of this truce and the rituals which culminate it will constitute the subject of the next chapter.

FOOTNOTES TO CHAPTER IV

1. The term "enmity" refers here to the relationship between groups who have opposed each other as principal combatants (see section 3.2 below) in rounds of warfare.
2. The majority of non-local marriages are with members of other Maring speaking groups, but four of the living wives and widows resident among the Tsembaga in 1963 came from nearby Karam speaking groups. Two living women of Tsembaga birth were married to Karam speakers and another to a Gainj man. While no Tsembaga were married to Narak speakers prior to November 1963, marriage between Jimi Valley Maring and Narak speakers is frequent. It may be that propinquity, rather than linguistic affiliation, is the decisive factor in inter-group marriage. This question is likely to be resolved with the analysis of marriage data collected by A. P. Vayda during a pan-Maring census conducted in 1963.
3. Two types of stone ax may be distinguished. Working axes are characterized by heavy, usually short blades, and were used for clearing, gardening, and fighting. They were sometimes wielded during dancing and figured in bride prices and other payments to affines. While a variety of stones were used, danunt, black basaltic blades, were most common. Gema, blades of light green, grey, or white stone were also common. The results of a petrological study, undertaken by John Chappell of the University of Auckland, in 1964 have not yet been published.
4. Glasse (1959) reports very similar assignments of responsibility among the Huli people of the southern highlands of New Guinea.
5. While I have not witnessed the performance of shamans in connection with fighting, I have seen shamans perform in a number of contexts. Informants assure me that their performances in the context of fighting are similar to those which I have witnessed.
6. In contrast to the nomane, which is immortal, the miñ is lost at death. Conversely, its abandonment of the body, an occurrence which may be induced by sorcery, bewitchment, or fright, results in death. The miñ is thought to walk abroad in dreams, and the moment of waking is particularly dangerous, for a sudden awakening may not allow it to return to the body. The miñ may, in short, be regarded as mortal life stuff.

7. Contents mentioned by informants include nail pairings, hair, dirt scraped from the skin, fragments of leaves worn over the buttocks, and perhaps other items as well. No attempt was made to obtain a comprehensive list of possible materials.

8. Both Wolf (1955: 46), and Kluckhohn (1944: 67-68) have made similar suggestions concerning the functions of fear and suspicion of witchcraft in other kinds of communities in other parts of the world.

9. Out of a corpus which includes information on more than twenty fights, three cases of violation are known. It is interesting that in two of these three cases the violators were the Kauwas' who, it was mentioned earlier, are the largest of the Maring local populations and who may well have been pressing the populational limits of their territory at the time. That it was the Kauwasi who violated the rumbim truce, as well as the prohibition, mentioned earlier, against immediate occupation of the territory out of which an enemy has been driven, reinforces the notion that there are definite limits to the amount of demographic or ecological pressure which can be contained by supernatural sanctions.

CHAPTER V

THE KAIKO

The aim of this chapter is to describe the way in which the length of the ritual cycle, and thus the length of the truce which depends upon the ritual cycle, is regulated, and to describe and discuss the kaiko, the year-long pig festival which is the cycle's culmination.

1.0 Regulating the length of the cycle

The kaiko is initiated by uprooting the rumbim which was planted after the fight. To uproot the rumbim requires "sufficient pigs." The first aim of this chapter, therefore, is to describe how "sufficient pigs" are accumulated, and to define this quantity.

1.1 The origin of the pigs

The question of the origins of the pigs constituting the herd when it is of "sufficient size" to stage the kaiko is of importance here. It has already been pointed out in an earlier chapter that only thirteen percent of the pigs constituting the herd at the outset of the Tsembaga kaiko in 1962 were purchased from people outside the local population. Accumulation of sufficient pigs to uproot the rumbim, therefore, seems to depend largely upon the natural increase of the local

herd, rather than upon the purchase of animals from members of other local populations.

1.2 "Sufficient" pigs

The obligations of members of the local population to make presentations of pork to others do not define the number of pigs which is sufficient to uproot the rumbim initiating the kaiko. Such obligations exist, and they must be fulfilled, but they set only a lower limit on the number of pigs that need be killed. This becomes clear when it is understood that except in instances in which a presentation of pork will be made in reciprocation for an equal amount of pork previously received, the size of presentations are at the discretion of the donor. It is certainly the case that he gains prestige if he makes large presentations. But there is in most cases no specific amount which a man requires to meet his obligations. Moreover, in those instances in which a man has specific requirements, his herd is likely to include animals in excess of those required to meet his obligations. These will be consumed by himself and his family.

The fulfillment of obligations to spirits, similarly, does not require the slaughter of a specified number of animals. Pigs must be killed in certain contexts, but the number may be few or many.

It seems clear that the definition of a "sufficient" number of pigs must be sought in areas other than that of obligation to the living or dead. In earlier chapters the role of the pig in Tsembaga subsistence was discussed. It will be useful to turn here to a brief review of this material.

1.2.1 The role of pigs

Perhaps the most important contribution made by pigs to the welfare of the Tsembaga is the protein which they provide during periods of stress. They also provide certain other services to the human population: by eating feces and garbage they keep residential areas clean and also improve the efficiency of the use to which crops are put. The foraging of small numbers of pigs for limited periods of time not only utilizes tubers which might otherwise be wasted, but might also be of benefit to the arboreal component of the developing second growth.

Small numbers of pigs are easy to keep, since they are fed substandard tubers which are harvested in the course of extracting from the ground the ration for humans. It may, in fact, be said that by eating the ration presented them the animals provide a further service to their masters: they convert tubers of only marginal usefulness as food for humans to high quality protein.

There are, on the other hand, trying concomitants of population expansion among the pigs.

First, as the pig population expands, residential groupings become more and more fragmented. Just prior to a kaiko the pattern is likely to be one of sub-clan hamlets and scattered homesteads. The number of people with whom any individual has frequent social contacts is thus diminished. This must represent a deprivation to the Tsembaga, who, like most other people, enjoy meeting and talking, and may also result in a lowered effectiveness of the social structure. It will be recalled, for instance, that consensus formation is achieved through informal conversations, the "talk" eventually "becoming one." Residential proximity should accelerate this process, residential dispersion inhibit it.

Perhaps more important, a scattered settlement pattern is vulnerable to attack. A truce prevails with the antagonists of the last fight as long as the rumbim remains in the ground. There may be other groups across other borders, however, who do not have rumbim in the ground and who would, therefore, be free to initiate armed hostilities should a dispute develop.

Second, the increased pig population requires additional work. The magnitude of the labor requirements of pig husbandry has already been pointed out, but some further aspects of the matter must receive additional discussion.

Third, and also requiring additional discussion, with an increased pig herd the possibilities of garden invasion by pigs are increased. Such events frequently result not only in damaged crops, but also in slain pigs and serious fights. Slain pigs and serious fights, in turn, accelerate further the scattering of residences.

As Vayda, Leeds, and Smith have said of Melanesian pigs in general, they "apparently are in the category of those good things of which there can be too much." (1961: 71). The question is not how many pigs are required to uproot the rum-bim and stage a kaiko. It is, rather, how many pigs can be tolerated, and how long it takes to acquire them.

1.2.2 Time required to accumulate "sufficient" pigs: good places and bad.

Tsembaga say that if a place is "good" it doesn't take very many years to accumulate sufficient pigs to uproot the rum-bim. If a place is "bad", however, it takes much longer.

A "good" place, Tsembaga say, is a place where people remain well. It may be inferred a good place, then, is one in which the pig population expands because its natural increase exceeds the demands made upon it for ritual slaughter, most of which are associated with misfortune. A "bad" place, on the other hand, is one in which people often sicken or die,

and is, thus, a place requiring frequent pig sacrifices. In a "bad" place the herd increases slowly, or not at all, or even may sometimes diminish over considerable periods of time.

While misfortune sometimes directly befalls pigs themselves, and while some pigs are killed during non-festival periods for presentations to affines¹ or in connection with cyclical rituals which have nothing to do with misfortune,² the dynamics of a Maring pig herd may be regarded as a rough index of the well-being of the human population with which it is associated.

It is difficult to translate statements concerning "good" and "bad" places into years. Informants who, it has already been pointed out, are not usually accurate in estimates of duration, indicate that sufficient pigs to uproot the rumbin may be accumulated in five or six years if a place is good.

Between two and three years is required for Tsembaga pigs to reach maximum size. Five or six years would allow both the juveniles surviving the slaughter attendant upon planting the rumbin, and some of their offspring to reach maturity. A third generation might also be well grown. It may be remembered from an earlier chapter, however, that pregnancies among Tsembaga pigs are infrequent. Only fourteen pregnancies were conceived out of at least ninety-nine possibilities

during the period of field work. Infant mortality among pigs is also high. It may also be recalled that little more than two pigs per litter survived to six months during the period October 1962 - December 1963. The indications are, thus, that the increase of the pig population is likely to be slow even if the ritual demands for slaughter are few. A place, in short, would have to be very good indeed for a pig population of sixty juveniles, the number surviving the kaiko in November 1963, to expand to a size approximating the 169 animals constituting the herd at the outset of the kaiko in June 1962 in six years.

The Tsembaga staged four earlier kaiko during the fifty to sixty year period ending in 1963. Thus, there were on the average approximately twelve to fifteen years between kaiko. It is not clear in most cases, however, how much time elapsed between one kaiko and the next fight, although indications are that fighting usually did break out fairly quickly. An average of eight to twelve years between the planting of rumbin and the accumulation of sufficient pigs to uproot it is, perhaps, not too inaccurate an estimate for the Tsembaga.

It must be emphasized that particular inter-kaiko periods fall well outside the mean of twelve to fifteen years suggested for the Tsembaga. Vayda reports groups which had not staged a kaiko for over twenty years. If the number of misfortunes during a given period is either abnormally high or

abnormally low, or even if there are chance variations of a sufficient magnitude in pig natality or mortality from injury or illness, the length of the ritual cycle may depart considerably from the values suggested here.

1.2.3 Pigs, labor and women

It may be recalled that the Tomegai clan, which numbered sixteen persons, had 36.1% more acreage in production when the herd was at its maximum than it did when the herd was at its minimum. The difference, in square feet, was approximately 75,000, and it was estimated that this acreage required for production, harvesting and transport, a labor input of about 495,000 calories. Since the reduction in the herd amounted to eleven adult or adolescent animals, it may be assumed that the energy expense for keeping each of these pigs was approximately 45,000 calories per annum, or, on an average, approximately 125 calories per day.

Since sweet potato and manioc are fed to the pigs the burden of this labor falls mainly upon the women. Aside from felling the trees, making the fences, helping in the clearing of underbush, harvesting some of the surface crops and caring for the sugar cane, men do little in the sweet potato gardens which constitute the additional acreage. It is the women who plant and harvest the root crops, do much the greater

part of the weeding, and almost all of the carrying. Exact computation is difficult, but it seems fair to assume that 100 of the 125 calories which are expended as a daily average for each pig are expended by women. The question becomes: how many pigs can a woman care for?

In an earlier chapter consumption data were presented. The daily ration of a woman, it was estimated, provides her with about 2150 calories. For women of Tsembaga body size an allowance of about 950 calories should be made for basal metabolism. This leaves approximately 1200 calories for expenditure in all activities. Beside the care of pigs these include gardening for herself and her family, cooking, child tending, and the manufacture of such items as net bags, string aprons, and loin cloths, to say nothing of socializing and procreating. It is little wonder that the sixty-six Tsembaga females estimated to be over ten years of age were, at the outset of the kaiko in 1962, caring for only 169 pigs. There were, that is, only 2.4 pigs of 120-150 pound size to each female. The range in the number of animals cared for by individual women was from zero to eight. When the latter figure is adjusted to an equivalent in 120-150 pound animals, however, the range becomes zero to six.

On the basis of the rough calculation of 100 calories per day per pig, the care of six pigs would demand fifty per

cent of the energy a woman would have available for activity. It is not surprising that only one woman was keeping such a number unassisted, and only four women were keeping five. These numbers, it is not unreasonable to assume, approximate the maximum number that a strong adult female can care for. Since ten to fifteen year old girls and old women are also included among the pig herding females, and since these categories are not capable of as much exertion as females between fifteen and fifty, the maximum number of animals that can be cared for by the "average female" should be lowered to four. Since there were sixty-six females over the age of ten among the Tsembaga during the period of field work a herd of 264 animals could have been supported. It has already been pointed out, however, that the kaiko started with far fewer animals. It is probable that pig populations never approach the maximum size supportable by all the women in a local population. Since pigs are individually owned, some women find themselves burdened with several pigs before others have any at all. It is with the husbands of women already burdened with pigs that public agitation to uproot the rumbim and stage the kaiko apparently starts.

According to informants, as early as 1960 or 1961 certain men were already urging that a kaiko be staged. These men included the owners of the largest numbers of pigs.

Among the reasons that these men gave me for wanting to have the kaiko was that they were tired of planting sweet potato gardens. One, however, was frank enough to state that it was his wife who was tired, and that she had been telling him so incessantly. Close observation of the domestic scene at the house of the wife of another of these men suggests that he too must have been subjected to complaints from his wife concerning the arduousness of maintaining five pigs as well as her family. Also prominent in the agitation was a widower who had been left with the equivalent of between five and six animals of 120-150 pound size and only a thirteen-year-old daughter to attend them. He had been forced into planting and harvesting sweet potatoes himself, and on several occasions complained pathetically to me about this aspect of a widower's lot.

The response of men with few or no pigs to the talk of an approaching kaiko was to attempt to acquire animals. Only shoats, usually under the age of three or four months, are traded, and they are always in short supply. Some were available from local litters, however, and some were obtained from other groups, particularly those residing in the Jimi Valley. As more people obtained more pigs, voices were added to those favoring the uprooting of the rumbim.

While it is not possible to specify a precise number of pigs which is sufficient to uproot the rumbim, a general

statement in ecological terms can now be made. Agitation for a kaiko starts when the relationship of some pigs to their owners changes from one of support (emergency protein supply, conversion of sub-standard tubers, etc.) to one of parasitism (burdensome or even intolerable energy demands).³ There are sufficient pigs to uproot the rumbim when the relationship of pigs to their owners has changed from one of support to one of parasitism in enough cases to determine the consensus within the local population.

The kaiko thus provides, among a group in which the slaughter of pigs is in large measure advantageously restricted by ritual to stress situations, a ritual means for disposing of a parasitic surplus of animals. In somewhat different terms it may also be said that the kaiko provides a means for limiting the amount of calories expended in acquiring animal protein. That the pig festivals of the Chimbu people of the New Guinea highlands also serve to rid people of pig populations which have become parasitic has been implied by Brown and Brookfield (1959)

its [the pig ceremony's] timing depends upon the rate of growth and increase of pigs, as the main feature is a massive pig killing and distribution of cooked pork ... (p. 46).

"The peak of the pig cycle...occurs immediately before a bugla gende [pig ceremony] when an adult pig population several times

the size⁴ of the human population makes heavy demands on land and labour,...much more and much stronger fencing is required to keep pigs out of cultivated land... Large additional areas must be planted, not only for ceremonial foods demanded by the bugla gende, but also to provide more sweet potatoes for the pigs"...(p. 22).

1.2.4 The destructiveness of pigs

In addition to preserving the people from further parasitism by their erstwhile mutuals, the kaiko is a response to and a protective reaction against the destruction of gardens by pigs. This function of pig festivals has already been suggested by Vayda, Leeds and Smith (1961).

...the pig population may...increase to such an extent as to become more and more a menace to the people's gardens. Among New Guinea highlanders and some other Melanesians, the fact of having a large pig population on hand is the "trigger" for holding great festivals in which so many hundreds or sometimes even thousands of pigs are slaughtered....whether intended as such or not by the people themselves, these massive slaughters are a way of keeping the land from being overrun by pigs" (p. 71).

Brown and Brookfield (1959: 22) have emphasized the social consequences of such depredations by pigs and have suggested that among the Chimbu the disputes which they cause "must be innumerable."

Because the people and their pigs were domiciled on one side of a steeply banked stream while all of their gardens

were on the other side, there were few cases of damage to Tsembaga gardens by domestic pigs during the period of field work. This geographical segregation of pigs from gardens was, however, both unusual and transitory. Informants say that there had never before been such separation, and it is unlikely that it will occur again.

Events among the neighboring Tuguma during 1963 are doubtless more representative of the extent to which the herd menaces the gardens just previous to kaiko. Tuguma human and pig populations were roughly comparable in size to those living on Tsembaga territory. During the period of field work at least six Tuguma pigs were shot and killed after having damaged gardens. There may have been other shootings, news of which never reached my ears, and there must have been other garden invasions in which the guilty animals were not caught.

Some of these incidents formed the basis of serious disputes. In one of these, further pig killing resulted as the owner of a slain pig revenged himself upon an animal of the man who had previously killed his. One of the principals in this affair talked bitterly of moving away from Tuguma to take up permanent residence with his wife's brother, a Tsembaga. He didn't move his residence, but he did make his most extensive taro-yam garden for the year 1963 on Tsembaga land received by usufructory grant from his wife's brother, and

he was very clear in stating that he had chosen to plant in this location to get away from Tuguma pigs. Another man, a Tsembaga who had been living uxori-locally with the Tuguma, moved back to Tsembaga territory during 1963 after one of his pigs had been killed in someone else's taro-yam garden. It is likely that he would have eventually returned to Tsembaga anyway, but he said that it was this incident which was decisive.

Another Simbai Valley Maring group, the Kanump, were evidently experiencing tribulations similar to those of the Tuguma during 1963 just before they too expected to stage a kaiko. Informants there told Vayda that they wanted to have their kaiko soon because the pigs were ruining the gardens.

While it is damage to gardens of which the pigs are directly guilty, the effects of their depredations are frequently more serious than loss of foodstuffs. Garden damage sometimes leads to violence between the pig owner and the garden owner. More often it results in interpersonal taboos between the principals: they refuse to eat food cooked over the same fire, and each refuses to eat anything grown by the other. Parties to such disputes sometimes threaten to leave the territory, and no doubt occasionally do. The process of residential dispersal which accompanies the expansion of the herd from shortly after the planting of the rumbim threatens to reach its logical conclusion: people moving to residences out of the

territory, and perhaps being permanently lost to the local group. Pigs may, in short, become competitors (for the planted crops) as well as parasites of the human population, and their competition can drive people off the land. It may be suggested that the kaiko, in addition to being a regulatory response on the part of the people to the parasitism of their pigs, may also be a regulatory response to the growing competitive ability of the increased pig population.

1.2.5 Population densities and triggering the kaiko

Data from the Tuguma and Kanump-Kaur local populations are insufficient, but it may be that the relative importance of the two aspects of large pig herds, their parasitic requirements and their competitive abilities, vary with population densities. In less densely populated areas, or in situations like that of the Tsembaga in which the gardens were protected from pigs, their parasitism may determine the triggering of the kaiko. In more densely settled areas, and in areas such as those occupied by the Tuguma and Kanump-Kaur, in which the gardens are more easily accessible to pigs it may be their competition which determines the consensus. To put it a little differently, where population density is high and the gardens are accessible to the pigs the number of animals required to reach an intolerable level of destructiveness might be fewer

than the number required to reach an intolerable level of energy expenditure on the part of the women.

In either case the kaiko is likely to be triggered by population levels of pigs and people below the carrying capacity of the territory.

In the case of the Tsembaga kaiko of 1962-1963, which was clearly triggered by the parasitism of the pigs, this is obvious. It was estimated in an earlier chapter that with a human population of the size and composition displayed by the Tsembaga in 1963, the pig population could reach cyclical maxima considerably in excess of the number present without exceeding the carrying capacity of the territory. While a precise estimate cannot be made, 250 to 300 animals at the cyclical maximum would perhaps not exceed the territorial limits. A pig population within such a range of magnitude would require each woman and girl to care for 4 to 4.5 animals of 120 to 150 pound size. The estimates which have been presented here indicate that such a number is beyond likelihood of achievement. The physiological capacity of women to care for pigs is below the capacity of the territory to provide the animals with sustenance.

Unlike situations in which the kaiko is triggered by the excessive labor demands of pigs, the triggering of kaiko by the destructiveness of the animals may be regarded

as a process which is directly related to the density of the human population. It seems clear, that with any expansion in human population there will be an increase in the number of gardens if tools, techniques, and crop inventories and planting proportions are held constant. If the area is limited, as the territories of Maring local populations are, the greater the number of gardens the shorter will be the distance between them and the domiciles of pigs. That the opportunities for pig damage increase geometrically while the populations of people and pigs increase only arithmetically has already been suggested in another context. It may be suggested here that as the human population expands, its members, increasingly troubled by the depredation of gardens, will define progressively smaller numbers of pigs as sufficient for the kaiko. As the human population approaches carrying capacity the number will be small. No estimates have yet been made of the densities of local populations of Maring other than the Tsembaga. This construction must be a hypothetical one at present. It may be recalled, however, that the Tsembaga say that when, in previous times, their numbers were greater they staged the kaiko with fewer pigs. It may cautiously be suggested that if the carrying capacity of a territory is to be exceeded it will be exceeded by people and not pigs.

Density dependent processes may, and probably often

do, operate at levels below carrying capacity. This has been pointed out with respect to human populations by Birdsell (1957), and with respect to populations of other animals, Wynne-Edwards (1962, 1965) has suggested that it is rare for their numbers to be affected only after increase to the level of carrying capacity. Regulation is more commonly effected through density-dependent processes, such as suppression of ovulation, dispersion, and inhibition of copulation, at much lower population levels.

Whether the kaiko is triggered by the parasitism of the pigs or by their competition, it does seem clear that the regulation of the relationship between the pig and human populations which is effected through the ritual cycle helps, by periodically reducing the pig population, to keep the combined demands of people and pigs below the carrying capacity of the territory. It helps, in other words, to maintain adequate fallow periods in the secondary forests and to preserve the virgin forest cover over areas, however marginal, that might otherwise be turned to cultivation.

A further regulatory aspect of the ritual cycle may be suggested here. While the kaiko cannot prevent an expanding human population from exceeding the carrying capacity of its territory it may serve to relieve local population pressure by affording increased opportunities for expansive aggression.

If it is the case that as a population grows fewer pigs are sufficient to uproot the rumbim, truces should be shorter, for the fewer the required number of pigs the less time it should take to accumulate them. To put this in the converse, the occasions when it is permissible to attack one's neighbors become more frequent. Data collected by Vayda should throw considerable light on this question, although unequivocal answers may never be gained due to the difficulties inherent in estimating such things as population sizes prior to fights which took place long ago, and the precise intervals between fights among a people unaccustomed to reckoning in years.

While some of the suggestions made toward the end of this section must remain hypothetical, it may be said, in summary, that the ritual cycle may be regarded as a mechanism which, by responding to changes in the relationships between variables in a system, returns these variables to former and more viable levels. These variables include the number and size of the pigs and the rate of their increase, and the size, composition and caloric intake of the human population, as well as the amount of land available to them, the distances between gardens and the domiciles of pigs, and, perhaps, other items as well. Information from the Tsembaga and other Maring groups support the suggestion made by Vayda, Leeds and Smith (1961:72) that pig festivals "help to maintain a long-term balance between

Melanesian man and the crops and fauna from which he draws his sustenance."

1.3 The ritual cycle of the enemy

While the size and rate of growth of the local pig population are clearly the most important determinants of the time at which a kaiko will be initiated, the ritual cycle of the enemy may be a perturbing factor.

Both the accounts of informants concerning pre-contact times, and the observation of events in the Simbai and Jimi Valleys in 1962 and 1963 indicate that the kaiko of antagonists were held at the same, or close to the same time. Rarely, it seems, were the initiation of these events by the two principal parties to the same fight separated by more than one or two years.

Informants deny that the imminence of the enemy's kaiko affects their own plans, and it is likely that the fact that the kaiko of antagonists nearly coincide is often the result of similar processes operating in similar populations. Nevertheless, the fact that a group which has completed its kaiko is free to initiate hostilities, while one which has not completed its kaiko is not, suggests that informants' denials are expressions of ideals, rather than reports of actual motivations.

Being one year behind the enemy in initiating the kaiko does not expose a group to danger. Since the kaiko usually lasts for a little more than a year the tardy group commences its kaiko shortly before or just shortly after its enemies have completed theirs. Attacks may not be mounted by a group until its kaiko is completed, and attacks on groups which are engaged in the kaiko seem not to have occurred. Reasons for this are not clear, but it is perhaps because kaiko are a matter of supra-local interest. The services rendered by any and all kaiko to the entire Maring and adjacent populations in terms of the movement of goods and the exchange of personnel, as well as the pork distributions will be discussed later in this chapter. It is sufficient to say here that these services are considerable and that their disruption would be regarded, even by members of neutral groups, as inconvenient, if not intolerable. It is doubtful whether a group could rally the support of allies for an attack upon another which is engaged in a kaiko.

An interval of two years, however, between the kaiko of enemies places the tardy group in danger. Their rumbim remains in the ground during a protracted period in which their enemies are free to attack them. The renewal of old hostilities is, thus, at the sole discretion of an enemy who may choose the time, place, and manner of attack. In at least one instance

in Maring history an old antagonism was renewed by a group which, having finished its kaiko, mounted a surprise raid upon their old adversaries, whose rumbim had not yet been uprooted.

The implications of tardiness are apparent to the Maring. There can be little doubt, furthermore, that all groups frequently receive through neutrals information concerning events occurring on enemy territory. It may thus have been the case that in some instances groups chose to stage the kaiko with somewhat fewer animals than a number representing their level of toleration.

2.0 The kaiko

Under the pressure of the increasing pig herd, and, possibly, in consideration also of events occurring within the enemy group, a consensus to stage the kaiko is finally achieved. This section will describe the various events which together comprise the kaiko, and discuss their effect upon population dispersion, upon the movement of food, goods and personnel, and upon both intra- and inter-local social and political relations.

2.1 Planting the stakes at the boundary

Preparations for the kaiko are initiated by planting stakes at the boundary of the territory. This ritual is performed during the earlier part of the drier season, after the trees have been cut for the new taro-yam gardens but before

planting has begun. Among the Tsembaga in 1962 this ritual took place in June or July, some three or four months before the commencement of field work. Performances which were reported to be and doubtless were, similar, were observed among the Tuguma, who planted stakes for their kaiko in June 1963.

As in the case of all important rituals, shamans first sought the ancestor's approval for the matter at hand, and asked them to designate those pigs which they wanted to receive, to specify the raku, or pig killing places, at which they wanted to receive them, and to appoint the day on which the killing should take place. Allies of the previous fights, in both the Tuguma and Tsembaga cases, were informed of the appointed day so that they could prepare for their parts in the proceedings.

The number of animals killed for stake planting is small. Informants agree that the Tsembaga killed only seven in 1962, and say that in earlier times only three were killed, one by each land holding group. That a larger number were killed in 1962 was due to taboos which had come into effect during the exile of 1953-1956, and which made it impossible for all members of any single land holding group to share either food or cooking fires.⁵

In the addresses accompanying the slaughter of the pigs the ancestors were thanked for caring for both the people

and the pigs. They were told that there were now sufficient animals for the kaiko, and that the people wanted to plant stakes at the boundary.

The bodies of the slain animals were cooked in earth ovens at the raku, and apportioned to all members of the local population, regardless of age or sex. The head, heart and lungs, however, were brought back to the ringi houses, inside of which they were cooked in konj mbint, above ground ovens.⁶

It is while the head, hearts and lungs are cooking that the stakes are planted. The preliminary portions of the procedure need not be described here, for they are similar to those employed after an enemy has been killed during active hostilities. Extraction and disposal⁷ spells are made upon the rumbim, močam, deraka and painted stakes, and the territory is rid of both the spirits of slain enemies, who may have returned to work evil, and the corruption which such spirits spread.

The processions which have started from the various ringi houses and which separately rid their residential areas of supernatural danger, meet in the newly cut but not yet planted taro-yam gardens, which are made in one or several large clusters. During the kaiko year among the Tsembaga this resulted in a continuous swidden covering an area of over twenty acres. Especially careful attention is given to these gardens

since it is from them that visitors to the kaiko will be fed. Since illness suffered by visitors would be blamed upon the locals, these gardens are deemed to be likely targets for the mischief of antagonistic spirits who sometimes make crops poisonous, and it is not considered safe to plant them until they have been thus treated.

After they have finished with the new garden the assemblage, led by men waving bamp yuk (fighting packages) before them, proceeds to the enemy border. They follow the path which they took to the fight ground during the hostilities, and on the way they are joined by contingents from allied groups who also bring stakes, and who, if they killed any of the enemy, have gone through similar preliminary procedures at home. On the way to the boundary all sing welowe, the song which was sung during hostilities on the way home from the fight ground only on the days when an enemy was killed.

At the border the new stakes are planted. These, together with the old stakes and living rumbim to which the cleansing objects are tied, now form a gate to the territory. Spells are made to send both the enemy spirits and their corruption back to the enemy territory from which they came. Large trees are then designated for felling, one for each enemy killed. The groups responsible for the killings, both local land holding groups and allies, fell them so that they fall

across, or at least in the direction of, the border. While they chop, the men sing welowe, and the fight magic men rub the trees with their fighting packages.

Some informants say that the act of cutting down the trees is simply a celebration of the power of the fighting packages, with the aid of which men "as big as trees" were killed. Others say that the trees are being offered to the spirits of the slain men to use as residences. Cutting them so that they fall across the border, moreover, sends the spirits of the trees⁸ across the border, where, it is hoped, their presence will induce the spirits of the slain men to remain.

The procession then returns home, the allies dispersing to their various territories, the locals to their several ringi houses.

With the opening of the ovens at the local ringi houses the taboo against trapping marsupials is abrogated.⁹ Andik men, "turning word" spells are made on cuttings of the shrubs gañingai (Elatostema sp.). These are held in the steam of the newly opened oven by a fight magic man who, in a conversational tone, addressing both the living and the deceased, recounts the story of the fight, the subsequent planting of the rumbim, and enumerates the taboos which have remained in effect ever since. He says that now that the stakes have been planted the men would like to trap marsupials so that drum

heads can be made, but when they fought, he continues, they said that they could not trap marsupials and these words remain inside of them. Before they set their traps, therefore, they must rid themselves of these words. The gāningai is then passed among the men and boys, each throwing back his head and brushing himself upward from the navel to the mouth. While brushing, each announces that he is ridding himself of the words of the taboo and he makes a spitting sound.¹⁰ The pig is then eaten and the ritual concluded.

That this ritual terminates the "closed season" on marsupials requires no further discussion. Two other aspects of these procedures should be commented upon.

First, the assemblage which joins to plant stakes is supra-local. The territory which is being redefined by the planting of the stakes belongs to only one of the assembled groups, but the participation of several of them seems to signify joint defense of the territory. Stake planting rituals may perhaps be regarded as cyclic ratifications of mutual assistance agreements.

They also may be regarded as display behavior. Every participant in such a procession has an opportunity to gauge the size or strength of the entire assemblage and of its constituent units.

The enemy is also exposed to this display. Enemies are said to be afraid to come to the border, or anywhere near

it, to witness the spectacle. They therefore view the procession only from a distance. Indeed, if the terrain is very broken, as at the Tsembaga-Kundagai border, or thickly wooded, as is the border between the Kanump-Kaur and the Tuguma, the enemy does not see the procession at all. He hears it, however. Some enemy men, while remaining out of eyeshot, come close to the border to make counter magic against the evil which is being sent to them by the stake planters. Even those who remain at greater remove hear the procession, for the sound of two hundred men or more singing and shouting battle cries carries far in the quiet valley.

The enemy also hears about the procession either from eye witnesses or, more likely, from those to whom eye witnesses have spoken. These reports are inevitably impressive simply because the Maring have no terms for quantities larger than twenty. Most second or third hand accounts of events among the Maring are exaggerated, and it is likely, despite the lack of numerical terminology, that these are too. At the least, the enemy gets the impression that a very large number of men participated in the ritual, and this might serve to temper any bellicose plans which he might in the future entertain.

The most important aspect of the ritual is not that of display, however. It concerns where the stakes are planted.

If the enemy was not driven off its territory in the

last fight, but remained to plant rumbim; or if, having been driven out, the enemy has returned and planted rumbim, the stakes are planted at the boundary which existed previous to the fight.

If, however, the enemy was driven out of its territory and never returned to plant rumbim, the procession does not stop at the old border. It proceeds into the territory of the former enemies and the stakes are planted at a new location. A new boundary is thus established which incorporates into the territory land previously held by the enemy.

The Tsembaga and most other Marings say that fights do not take place over land, and that land occupied by other groups cannot be annexed. To signify its occupation, however, a group must plant rumbim upon its land. Areas annexed in stake planting rituals are areas upon which no rumbim is planted. They are, therefore, not lands belonging to the enemy, they are lands which the enemy has presumably abandoned. They are vacant.

A simple rule may be presented here: if one of a pair of antagonistic groups can plant its stakes before its opponent can plant its rumbim, it may annex land previously held by its opponent.

It is not only the vanquished who have abandoned their territory. It is assumed that it has now been abandoned by

the ancestors of the vanquished as well. The surviving members of the erstwhile enemy group have by this time resided with other groups for a number of years, and all or most of them will already have had occasion to sacrifice pigs to their ancestors at their new residences. When they do so they invite these spirits to come to the new place of the living where they will continue to receive sacrifices in the future. Ancestors of vanquished groups thus relinquish their guardianship over the territory, making it available to the victorious groups. Meanwhile, the de facto membership of the living in the groups with which they have taken refuge is converted to de jure membership. Sooner or later the groups with which they have taken up residence will have occasion to plant yu miñ rumbim, and the refugee men as coresidents will participate, thus ritually validating their connection to the new territory and the new group. A second rule of population redistribution may thus be stated: a man becomes a member of a territorial group by participating with it in the planting of rumbim.

There are two processes which modify or complicate the lasting effects of these rules.

The first is partial reoccupation by a routed group prior to stake planting by the victorious group. It is often the case that some members of a routed group will take refuge with an adjacent group, under whose cover they will reoccupy

some of their lost territory. This has happened at least twice in Tuguma-Tsembaga history. When the Dimbagai-Yimyagai, many years ago, were first driven from their land by the Tsembaga on their west, some took refuge with the Dinagai, then a local population of their east. As members of the Dinagai they reoccupied the eastern portion of their territory. The Merkai clan of the Tsembaga recognized this as an annexation of part of the territory by the Dinagai, with whom they were friendly, rather than as reoccupation by their former foes. They therefore planted their stakes to incorporate only part of the territory from which they had driven their enemies. Similar processes took place following the rout of the Tsevent by the Tuguma.

Second, while the planting of stakes to annex abandoned territory provides what might be characterized as de jure rights to that territory, anxieties seem to remain with the conquerors concerning use of and residence on this land. These apparently become explicit during times of misfortune.

During 1962-1963 almost all of the Tsembaga residences were on land which had, at one time, belonged to the Dimbagai-Yimyagai. In 1962 five Tsembaga men and one Tsembaga woman of middle age or younger died of illness, and in early 1963 two more young men, a young woman and a child sickened and quickly died. After each mortality there was much talk of giving the land back to the Dimbagai-Yimyagai. Some people

said that the Dimbagai-Yimyagai ancestors, wanting to return to their own land, were sending illness. Others blamed the deaths on living Dimbagai-Yimyagai who, they said, were sending the illness magically. Consensus in favor of abandonment seemed to form rapidly, but it could not be acted upon immediately because, in addition to the residences, the kaiko dance ground happened to be on the old Dimbagai-Yimyagai territory. Removal, therefore, had to be delayed until the termination of the kaiko.

This delay permitted the consensus to dissolve.

After most of the deaths, talk in favor of removal seemed to remain firm for two or three weeks. After a month or a little longer, however, those who had advocated removal were frequently surprised when they were reminded of their position. They would point out that the Dimbagai-Yimyagai had all planted rumbim elsewhere, that the Dimbagai-Yimyagai ancestors had long ago vacated the territory, and that the matter was ancient history. Statements to the effect of "It was our fathers who drove them out, and now we ourselves have children" were common.

If they hadn't been detained by the presence of the dance ground, however, the Tsembaga may well have given the territory back to the Dimbagai-Yimyagai. Because of Australian pacification they no longer needed to fear the presence of a reconstituted Dimbagai-Yimyagai, who at any rate would not be numerically strong, on their border. Furthermore, all indications

are that the Tsembaga had experienced considerable depopulation since they annexed Dimbagai-Yimyagai land. They now had, or at least said they had, sufficient land without the old Dimbagai-Yimyagai territory, and estimations of carrying capacity support their view.

History thus indicates that annexation of land through conquest and the subsequent stake planting is reversible through peaceful processes. It further suggests that the mechanism through which the annexation is reversed, involving both native theories of disease etiology and native behavior when suffering an especially high incidence of disease, is density dependent. Groups which, because of depopulation, no longer need land which they have conquered may abandon it under the impact of further depopulation.

2.2 Preparing the dance ground

In the weeks previous to and just following the planting of stakes, the settlement pattern changes from one of scattered homesteads and sub-clan and clan hamlets to one of relative nucleation around a traditional dance ground.

This, of course, results in the concentration of a large number of pigs in a relatively small area. This concentration is temporary, lasting, usually, little more than a year, and its ill effects upon second growth are, therefore,

limited. It may also be that the threat of pigs to the gardens during this period is offset by the practice of planting, during kaiko years, the taro-yam gardens in large clusters. Clustered gardens require fewer linear feet of fence per unit of cultivated area because a reduction in total periphery is effected. Fencing around the taro-yam gardens in kaiko years seems to be exceptionally stout, and it may be that the reduction in linear requirements for fencing permits this sturdier construction. It may also be usual for gardens during festival years to be planted at greater remove from the residences than in other years, placing them thus beyond the usual daily range of pigs. Almost all of the gardens planted by the Tsembaga in 1962 were at least thirty minutes walk away from the residences. It is not possible, however, to generalize from Tsembaga procedures in 1962, because, as has already been mentioned, their settlement had been, contrary to usual arrangements, nucleated for some years previous to the kaiko, and most of the arable land close to the settlement was under secondary forest too young to cut. The Tuguma gardens planted in 1963, the year of the Tuguma kaiko, were generally not as far from the settlement as those of the Tsembaga.

While the Tsembaga settlement was nucleated long before the kaiko, it was far from any of the old dance grounds. Instead of moving their residences to the proximity of one of

the old dance grounds they prepared a new one within the area encompassed by their settlement. The work was considerable, for the site sloped at an angle of more than twenty degrees. Instead of the easy task of removing weeds and saplings from a place previously used for dancing, they were faced with the necessity of leveling a considerable area. Since no one could do more than exhort others to work, and since enthusiasm for the task waxed and waned, it took months to level (roughly) an area of about one hundred fifty by two hundred feet. Improvements were being made and additional areas were being won from the slope deep into the kaiko.

The work was not confined to preparing the ground. Two large houses, each about twenty-five feet by thirty-five feet and eight or nine feet high at the center, also had to be built at the edge of the dance ground to accommodate visitors in the event of rain. Two houses, rather than one, are necessary at almost all kaiko because a man may never enter a house into which an enemy has ever set foot, and some of the groups to be entertained are almost always enemies of others.

Immediately after the stake planting, and before leveling had actually begun a fence was built around those portions of the area where the ground did not fall off so steeply as to make approach difficult. At the gate, the root of a variety of rumbim called dawa, the leaves of which are

used to cover the buttocks when dancing, was buried after being bespelled. This ritual, which included an address to the ancestors had, according to informants, two purposes; to induce the ancestors to look kindly upon the dance ground, that both local and visitors alike might dance strongly and that their drums might sound rich; and second, to keep within the fence the miñ, the life stuff, of the local girls while the kaiko continued. That some of their unmarried girls might elope with visitors whose strong dancing and finery had captured their fancies is a fear often expressed by men.

2.3 Uprooting the rumbim

With the ripening of the first marita pandanus, a yellow fruited variety called yambai, preparations for uprooting the rumbim begin. In Tsembaga territory this fruit is ready to eat in late August or early September, by which time two months, or a little more, has elapsed since the stake planting, and the bulk of men's work in the new gardens should be finished or close to finished.

When the yambai, which is a scarce variety, becomes ripe it is eaten once, after which a taboo is assumed by everyone on its further consumption. Even the word for marita, "komba", must be avoided, and a circumlocution is used until the taboo is renounced during the rituals immediately antecedent

to uprooting the rumbim. Marita, informants say, is associated with the spirits of the low ground, and it is now time to trap ma, a category which includes marsupials for the most part. Ma are said to be the "pigs of the red spirits". It is to these spirits to whom undivided attention must now be turned. The ingestion of marita, or even the enunciation of its name, would make this difficult or impossible, either because the act would annoy the red spirits or because it would have some direct effect upon the body or mind. This renunciation, it must be said, costs the people little, for after the few komba yambai fruits are finished virtually no marita becomes ripe until middle or late October.

Marsupial trapping is carried on separately by the least inclusive agnatic units, clans in some cases, sub-clans in others, in their own komon, tracts in the high altitude virgin forest which are said to be the homes of the red spirits. While at ordinary times a man may set his traps anywhere on Tsembaga territory he may now set them only in the komon of his own minimal agnatic unit because it is only with one's own ancestors that "pigs", may be exchanged.

Before the traps are placed, shamans contact the red spirits, saying to them that the pigs of the living are now sufficient in number to be exchanged for the red spirits' pigs, i.e., marsupials. They ask the smoke woman to designate

those trees in which the red spirits will place those marsupials which they wish to give to the living; and it is in these trees that the traps are placed. During the course of the period the smoke woman is asked, from time to time, to designate further trees.

Adolescent boys and men through middle age participate in the trapping. Because this is an activity associated with the red spirits, the trappers are subject to many of the same taboos which obtained during warfare. They may not have sexual intercourse, or even touch women, nor may they eat food prepared by women. They should not set foot in the wora, the lower portion of the territory, and food grown in the wora should be avoided. They may not leave the territory, and they may not eat food cooked over the same fires as men from other local populations.

After being skinned, the trapped marsupials are smoked by the old men and boys too young to join in the trapping. Some of the animals taken early are preserved for two months or more. Informants say that it is only in the context of this ritual trapping period that meat is thus preserved and smoking was never observed during the field work period.

Special smoke houses are built for this purpose. While the actual trapping is conducted independently by minimal agnatic units, smoke houses are usually built, informants

say, by land holding groups. There was some modification of this among the Tsembaga in 1962 however, because of the food and fire taboos, mentioned earlier, which split these groups.

When the variety of marita called pengup, ripens in mid-October, the men leave off trapping and prepare to uproot the rumbim. The preparations are elaborate, for pigs must be slaughtered at the raku, which means that shelters and above ground ovens must be built, and vegetables and firewood must be obtained. The allies also must be informed so that they may attend.

The ritual performance at the raku on the day before the rumbim is uprooted are both elaborate and exotic. Pigs are sacrificed for both the spirits of the high ground, the red spirits and the smoke woman, and the spirits of the low ground. In the address antecedent to the sacrifice for the spirits of the high ground, in addition to being thanked for their help in warfare, the spirits are thanked for the marsupials which they have provided, and are told that they are now being given pig in exchange for them. Among some Maring local populations cassowaries are also commonly sacrificed for the red spirits, but the Tsembaga keep very few of these birds.

The pigs having been killed, oven stones are laid on a large fire to heat while the butchering of the pigs and the preparation of the smoked marsupials for cooking proceeds.

When these preparations have been completed two large red pandanus fruits, harvested with great care on the previous day from groves in low ground are brought forth. The groves from which the fruits are obtained may either be those planted by persons now deceased, or those in which the remains of dead are buried. A procession forms, composed of all those present. Led by two men who continually raise and lower the pandanus fruits which they are carrying, it circles the fire chanting:

<u>komba ku komba</u>	<u>yanga yanga munga munga</u>
<u>kam ku komba</u>	<u>yanga yanga munga munga</u>
<u>bri komba</u>	<u>yanga yanga munga munga...etc.</u>

(Marita, ascend to and come down from komba ku

Marita, ascend to and come down from kam ku

Marita, ascend to and come down from bri...etc.

Komba ku and kam ku are high places on Tsembaga territory where the smoke woman is said to dwell. Bri, another of her dwelling places, is a mountain in the Jimi Valley. The chant continues, naming many other high places in the Jimi Valley which are said to be homes of the smoke woman, and becomes more frenzied as it proceeds. The voices of some of the men break into sobs. When the catalog of the homes of the smoke woman is almost completed the procession halts. All males lay a hand on one of the marita fruits, while the females grasp the other. When the chant is completed, one of the adult men

seizes the marita of the males and with it leaps onto the oven stones which have now been heating for well over one hour.

Bounding up and down on the hot stones, he stabs the fruit with a cassowary bone, then leaps off. He repeats the performance with the marita of the females.

The various foods are now put into the ovens. The pig dedicated to the red spirits and the smoke woman is cooked in an oven constructed above ground, while that for the spirits of the low ground is placed in an earth oven. Marita and marsupials are cooked together, but two ovens are made for this mixture because fight magic men suffer an enduring taboo on the consumption of some marsupials with women.

When the ovens are opened, those men who have participated in warfare gather around the above-ground ovens. The head of pig cooked therein is raised on high while one of the men recounts the story of the last fight, thanks the spirits of the high ground for their assistance, tells them they are being given this pig and that more will be given to them at the end of the kaiko. The address concludes with the request to the spirits to take this pig which is now being offered them and return to their high places. The oven of the spirits of the low ground, that made in the earth, is opened without ritual.

All of the greens and some of the flesh from both

ovens is consumed at the raku, but most of the flesh is brought to the residences for later consumption or, in the case of the pig cooked in the earth ovens, for distribution to members of other groups.

Before the marita and marsupials may be eaten, several taboos must be abrogated. One of these has applied to novice shamans, who have been prohibited from eating any marita since being "struck" by the smoke woman, in some cases years before. The others have applied to all persons. These were, first, the prohibition, in effect for several months, against the consumption of marita during the marsupial trapping period. The other, in effect since the last fight, has forbidden the cooking and consumption of marita and marsupial together. All three of these taboos are abrogated by spitting out a mouthful of pandanus seeds and by throwing away the tails of the marsupials in the nearby forest. This latter act is also said to insure the future proliferation of marsupials.

After the taboos have been nullified some pandanus oil is rubbed on the legs and buttocks of all persons so that their legs will be strong, and on the bellies of the females so that they may be fertile. The cassowary bone previously used to pierce the fruit is used as a spoon to feed each person his first mouthful of the marita. The consumption of the marita and marsupials is the last ritual act of the day.

These proceedings at the raku have two stated purposes. They are said to enhance fertility, and their performance abrogates a number of taboos. In addition to those restricting the consumption of marita and marsupials by all or some categories of persons, the taboos renounced include those, in effect since the last fight, which have prohibited all men who have worn ringi from sharing with women certain foods including certain species of marsupials and varieties of marita as well as sugar cane, bananas and pitpit having red skins. Also renounced by the ringi men are the absolute taboos against the consumption of certain other foods, notably soft varieties of Dioscoria grown in the wora, the lower part of the territory. The taboos on beating drums and on the consumption of pigs slaughtered in connection with the kaiko of other local populations are also terminated.

It should be mentioned that these taboos (except that against drum beating) are not abrogated for the men who are schooled in fight magic. Fight magic men are burdened with these taboos for life. It further should be mentioned that the taboos against the consumption of snakes, lizards, frogs, and other "cold" animals by all men also remain in effect for life.

It was suggested earlier, in reference to their assumption, that some of these taboos serve to segregate ideologically, those components, both living and dead, of the

total community which are associated with warfare, from those associated with peaceful activities. This segregation, it was suggested, is an aspect of the debtor relationship in which the local population stands in relation to both ancestors and allies from whom they received assistance in warfare. The termination of these taboos and, thus, the partial reintegration of the previously segregated elements is a concomitant of the repayment, at least in part, of the outstanding debts.

Explanations of the significance of much of the ritual could not be elicited from the Tsembaga, but the forms of some of the procedures, particularly those concerned with marita, support the notion of reintegration. Marita is clearly associated with the spirits of the low ground. Indeed, the fruits used in the ritual must be taken either from trees planted by the deceased on low ground or from groves in which lie the remains of the deceased. But before it is placed in the ovens the marita is offered to the smoke woman, a spirit of the high ground in whose name novice shamans had suffered an absolute prohibition against its consumption. The fruit, moreover, is pierced with a cassowary bone before cooking. Cassowaries are associated with the red spirits, for whom norum-kombri, "orchid sp. - cassowary", is often used as a term of address. Marsupials, now for the first time since the last fight cooked with marita, are also associated with the spirits of the high ground,

being regarded as "the pigs of the red spirits."

The relationship of the living to the two categories of spirits seems to undergo transformation in the new reintegration. This is signaled by the ritual consumption of the marita, an act, the Tsembaga say, which is like taking the spirit of the low ground inside of one. This is not said of the consumption of the marsupials. These animals are regarded to be the receipts of an exchange with the red spirits, and this is made explicit in the address preceding the slaughter of the pig dedicated to them. What may be regarded as an analogous communion with the red spirits took place when, antecedent to the ax fight, the fighting men put on ringi, thus taking these spirits into their heads. Performances undertaken now, renouncing as they do taboos which were assumed with the ringi, may be regarded as expunging some of the vestiges of that communion. This interpretation is supported by the address to these spirits when the head of the cooked pig is offered to them: they are asked to take the pig being offered them and leave. The behavior in reference to the spirits of the high places, in short, seems to suggest not a communion, but its opposite: the expulsion of spirits with whom a burdensome communion was previously effected. It further supports the interpretation that the termination of the taboos associated with the wearing of the ringi requires the transformation of the

simple debtor-creditor relationship which has prevailed since the last fight into a relationship which, although obligations remain, is becoming more equivalent. That the ability to transform the relationship from one of debt to one of equivalence depends upon the demographic and ecological success of the local population is apparent in light of discussion earlier in this study.

The number of pigs killed at this time was substantial—the Tsembaga killed thirty on November 1, 1962. Those killed for the spirits of the high ground, in most cases smaller animals, were consumed by the local population. With the exception of the heads and entrails, pork derived from those killed for the spirits of the low ground was carried back to the residences where it was presented to the waiting allies. For the most part this flesh was given unceremoniously by each man to those men among the allies, usually his own affines or non-agnatic cognates, who assisted in the fight because of their ties to him. The belly fat was first removed, however, to be salted for formal presentation.

On the following day, after the salted belly fat was presented to the allies the rumbim was uprooted.¹¹ Both allies and local men were in attendance.

Andik men spells were first made upon the stacked drums, so that they might be beaten and so that they might

sound well, after which they were returned to their owners. Painted stakes, about six inches long, upon which spells had also been made, were then buried near the gate of the enclosure. Now that the rumbim was to be uprooted these would protect the min, the life stuff of the men, barring entrance to the house enclosure of both the spirits of enemies and the corruption which flows from them.

After the stakes were buried, the aname was unceremoniously pulled out. The rumbim was then uprooted by the man who planted it. This task always, it is said, falls to the man who planted it if he is alive, and to his son if he is not. A digging stick upon which andik men spells had been made was used. The address, broken by sobs, recounted the history of the planting and the fight preceeding it. Both categories of ancestors were told that they had been given some pigs, but only a few. Later, at the end of the kaiko, they would be given more. In previous times, informants say, the red spirits were also told that after the kaiko their deaths would be avenged. Since pacification apologies are made to the red spirits because revenge is no longer possible.

While the rumbim was being uprooted, bamboo was heated over a fire. When it exploded the rumbim was torn from the ground and all the men pounded their drums yelled, and stamped their feet. Led by men carrying the rumbim, they charged over

the gate and headed for the territorial boundary. On the way they were joined by groups who had uprooted rumbim at other ringi houses, as well as by a contingent from Tuguma bringing stakes.

While most of the array proceeded to the boundary where the stakes were planted some fight magic men dropped out to dispose of the rumbim and amame elsewhere. These are traditionally taken to shallow places in certain streams where they are placed on flat rocks with their roots covered by water, but with their foliage on dry land. They are oriented so that the foliage points in the direction of the enemy, while the roots point in the direction of the local settlement. Spells are made upon them so that the dessication which, it is said, will overtake the foliage, will go to the enemy, bringing him illness and death. The roots, on the other hand, rot, and from rot comes new life. Since the roots are pointed in their direction it is the local population which benefits in fertility and growth from their decay.

After the stakes had been planted at the boundary and the rumbim and amame disposed of in streams, the procession returned to the dance ground. Dancing, accompanied by drumming and singing, continued throughout the night. The kaiko had begun.

2.4 Kaiko wobar and kaiko de

The year long kaiko is divided into two periods, the first called wobar, the second de. It may be recalled that these are the names of the songs which were sung on the way to the fight ground, wobar during the earlier "nothing fight", and de for the ax fight. During the wobar period of the kaiko only wobar may be sung, during the de period both de and wobar may be sung.¹² The two stages of the kaiko, informants say, recapitulate the two stages of warfare. The earlier, less important, wobar phase continues while work remains to be done on the dance ground, and, more importantly, until there are a sufficient number of large taros and yams in the new gardens to entertain properly. When there are sufficient tubers fit for presentation the rituals inaugurating kaiko de may be performed. The first taro and yams may be harvested about six months after planting, but at least another month is required for them to become sufficient in size and number. The Tsembaga had in late March or early April 1963 sufficient of these tubers to perform the de rituals, but were delayed by a number of extraneous events until early May.

As the two stages of the kaiko recapitulate the two stages of warfare, so do the rituals antecedent to the two stages of the kaiko reverse the rituals undertaken in connection with the two stages of fighting.

In the case of the bow and arrow fight the antecedent rituals, which are minimal, are reversed, according to most informants, as one of the effects of the uprooting of the rumbim. Two informants also state that as part of the reversal procedure the arrows and spears used in the small fight are brought to the raku on the day before the rumbim is uprooted, where they are treated with the ritual marita. I did not witness such a performance, however.

The details of the rituals inaugurating kaiko de need be sketched in only briefly. As always, the shamans contact the smoke woman to ask approval of the spirits, and to ask her to designate the raku at which the pigs should be killed.

Five animals were slaughtered by the Tsembaga, all of which were consumed by themselves. During the night the rumbim that was planted outside the men's house on the night before the ax fight is uprooted. Extraction and disposal spells are then made not only on the usual stakes, rumbim brooms, wild taro leaves, and vine whips but also on bamboo torches which are then lit on fires made inside the ringi houses. The dance ground and the entire residential area are then rid of the spirits of slain enemies and the corruption emanating from them as well. When the men return from depositing the uprooted rumbim and other objects at the border, the fighting stones are removed from the center post of the ringi house or, in the case

of the Tsembaga, from the rafters of men's houses, and placed on the low tables from which they were taken years before during the night before the ax fight.¹³

The lowering of the fighting stones is not accompanied by the immediate termination of remaining taboos. It does not now become possible, for instance, to enter the territory of the enemy or to speak to the enemy, much less make a permanent peace. The lowering of the stones, however, is a necessary prerequisite to making peace at a future time, and is also a necessary prerequisite to the more immediate trapping of eels, a procedure which is antecedent to the final pig slaughter. Eels are said to be the pigs of the low ground, for which pigs of the living will be exchanged. As it was necessary when marsupials, the pigs of the red spirits, were being taken to avoid contact with the spirits of the raua mai, so is it necessary before taking eels, to continue the process of turning away from the red spirits by lowering the stones. It was mentioned previously that hanging the stones signified the assumption of a debt to both allies and ancestors. Their lowering, conversely, signifies that the debt is soon to be paid.

On the following day another ritual is usually performed. The allies assemble on the dance ground, and small trees which were, when the area was cleared, allowed to remain growing for this purpose, are assigned to each group which was

responsible for slaying an enemy in the last fight. After these are rubbed with the fight packages they are uprooted while the men sing welowe, the killing song.

The killers, or, if they are no longer alive, their sons, are then borne around the dance ground on the uprooted trees, and de is sung. All informants agree that this is a celebration of the power of the fight package, and some say that the spirits of the enemy slain actually inhabit the trees which apparently symbolize them. The rite also, of course, honors those men who have killed enemies in the service of the local population.

The Tsembaga chose, in 1963, to forego this ritual. Men said that they would be ashamed to uproot trees after a fight in which they had killed only two of the enemy while losing twenty themselves.

The differences between the style of entertainments of visitors during the wobar and de periods are actually minor. During the latter period there is a second melody at the disposal of the dancers and the food presentations become more elaborate as taro and yams become increasingly available. This distinction becomes blurred, however, if the inauguration of de is delayed. The Tsembaga were including taro and yams in their presentations for more than two months before they undertook the de rituals.

2.5 A kaiko

The occasions on which friendly groups are entertained as well as the year long festival are referred to as kaiko, a term which is also used to refer to the dancing which is one of the features of these events. During the course of the year the Tsembaga entertained thirteen other local groups on fifteen separate occasions, exclusive of the final konj kaiko, "pig kaiko," which terminated the entire festival. On several of these occasions two or more local groups were entertained at the same time, and three groups were invited more than once.

2.5.1 Invitations and preparations

The atomistic nature of the organization of local populations is clearly expressed in the extension of invitations to a kaiko.

Invitations are not extended by a local-population as a whole to another local population as a whole, but rather by one or several individuals in one local population to one or several individuals, either kinsmen or trading partners, in another. Usually the men who have such connections with another group will together decide when to issue invitations to these kinsmen. They may, in their planning, take into consideration commitments made previously by other members of their local population but decisions are likely to be made without the

council of others. Indeed, in instances in which kin or other ties with another group are few, the extension of an invitation may be the decision of a single man who has taken no council but his own.

While invitations are formally extended by individuals to individuals they are, in fact, invitations to entire local populations, for the invited are expected to bring at least some of their co-residents. Indeed, the formally invited men would be ashamed to attend if they could not bring with them dancers in a number commensurate with the size of their local population and with the strength of the relations between their local population and that of their hosts. The invited men gain prestige by making a strong showing, and it is to this end that they themselves often extend invitations to members of yet other local populations, to "help them dance" at the kaiko to which they have been invited.

As the issuance of invitations to a kaiko reflects the atomistic character of local organization, so do preparations for these events. It is the responsibility of those men who have kinsmen and trading partners among the visitors to accumulate the firewood and sugar cane required for their entertainment, and of their wives to harvest and prepare the tubers and green vegetables with which the visitors will be fed. Others may contribute effort or produce to the preparations, but such

contribution is phrased as assistance to those upon whom the responsibility for entertainment falls, and through whom the food presentations are made. While some of those who have no direct ties to the visiting group may assist those who do, it is usually the case that some people take no part whatever in the preparations.

2.5.2 The entertainment

Although days are appointed, temporal arrangements remain vague. The hosts are usually kept informed of delays and revised times of arrival by young men coming in advance.

On the day on which the hosts are reasonably certain that the visitors will arrive extraction and disposal magic is performed on the dance ground. This is usually a perfunctory proceeding, and after the spells are made upon the usual objects the task is turned over to whatever young men happen to be in the vicinity. The object of the extraction and disposal magic is to rid the dance ground of both tukump, the corruption which flows from spirits, and kum, which is similar, but which is introduced into the ground by living sorcerers.

After the dance ground has been treated those men who wish to participate in the dance bathe in streams and then return to the men's houses to adorn themselves. Those who ready themselves for the dance include all or most of the young men

and adolescents, and at least those older men who have direct kinship or trading connections with the visiting group. Other older men without direct connections to the visitors may also participate, either to assist those who do have direct connections, or simply because they wish to dance.

As invited groups receive support or assistance from other groups when they go to a kaiko, so does the host group. On most occasions at Tsembaga young men of Tuguma would swell the ranks of the Tsembaga dancing contingent.

Adornment is painstaking, and men often take hours to complete their dressing. Pigments, formerly earth colors of native manufacture, more recently powders of European origin, are applied to the face in designs which are subject to frequent changes in fashion. Beads and shells are worn as necklaces, and garters of small cowries encircle the calves. The best orchid fibre waist bands and dress loin cloths enriched with marsupial fur and with dyed purple stripes are put on. The buttocks are covered with masses of accordion folded leaves of a rumbim called kamp and other ornamentals. A bustle, made of dried leaves obtained in trade, and which rustles during dancing, is attached on top of the mass.

Most attention is given to the headdress. A crown of feathers, eagle and parrot being most common, encircles the head. The feathers are attached to a basketry base which is

often hidden by marsupial fur bands, bands made of yellow orchid stems and green beetles, or festoons of small cowrie shells. From the center of the head rises a flexible reed, two or even three feet long, to which is attached a plume made either from feathers or an entire stuffed bird. The Lesser Bird of Paradise, the Princess Stephanie Bird of Paradise, the Greater Sickle Bill, and (?) Pescot's Parrot are most common. Plumes, particularly those of the King of Saxony Bird of Paradise and the Racket-tailed Kingfisher, are worn through the pierced septum from which also may be suspended a shell disk and gold lip crescent. Unmarried girls, some as young as nine or ten years of age, also may be adorned.

When their preparations are completed the dancers, both men and girls, repair to the dance ground where they dance for practice or pleasure before the arrival of the visitors and where they may be admired by spectators who are already assembling. These include the local married women and men from many other places who, having heard of the kaiko, have come to watch and to trade.

The approach of the visiting dancers, is signalled by their singing. When they reach a point about one hundred yards from the gate, the local dancers quit the dance ground, and retire to a vantage point just above it where their view of the visitors is unimpeded and where they continue to sing.

The visitors approach the gate silently, led by men carrying fight packages, swinging their axes as they run back and forth in front of their procession in the peculiar crouched fighting prance. Just before they reach the gate they are met by one or two of those locals who have invited them and who now escort them over the gate. Visiting women and children follow behind the dancers and join the other spectators on the sidelines. There is much embracing as the local women and children greet visiting kinfolk. The dancing procession charges to the center of the dance ground shouting the long low battle cry and stamping their feet, magically treated before their arrival both to counteract any kum or tukump which may linger in the ground and to enable them to dance strongly. After they charge back and forth across the dance ground several times repeating the stamping in several locations while the crowd cheers in admiration of their numbers, their form, and the richness of their finery, they begin to sing. Their first song, to the appropriate melody, either de or wobar, should be one composed in honor of the occasion.

While the visitors are thus displaying themselves, fight magic men among the hosts apply magic to the feet of the local dancing contingent that they may dance strongly, and fighting packages are applied to their headdresses, that the beauty of the feathers may attract the fancies of the visiting

girls. Bamboo is heated while the presiding fight magic man, his voice broken by sobs, asks that both categories of spirits help the locals, that their dancing not be outdone by the visitors'. They also ask that visiting girls be attracted by the dancing and the feathers of the locals, but that the local girls remain unmoved by the charms of the visitors. When the bamboo explodes the locals charge onto the dance ground pounding their drums and singing. Their numbers include at first the girls who have ornamented themselves for the occasion. They dance inside the male ranks for a few minutes before retiring to the sidelines. The formations of the locals and the visitors remain separated at first.

It is usually late afternoon when the visitors arrive. Just before dusk the locals stop dancing and assemble the food which has been prepared for the visitors in the middle of the dance ground. It includes bundles of sugar cane, net bags full of cooked tubers, bamboo tubes of greens mixed with marita sauce, and bananas. The visitors are asked to cease dancing and gather around while a presentation speech is made by one of the men responsible for the invitation. As he slowly walks around and around the food which has been laid out in a number of piles, the speechmaker recounts the relations of the two groups: their mutual assistance in fighting, their exchange of women and wealth, their hospitality to each other in times of

defeat. He then points out the piles of food which are being presented to each of the invited men. While the form of the presentation ceremony is corporate, one or sometimes two men speaking for the entire local population about the relationship of the two local populations, the piles of food are presented by individuals to individuals.

The recipients do not make speeches in return. When the speech of presentation is finished they gather their portions and distribute them to those men who came to help them dance, and to their women.

Dancing continues throughout the night around low fires on the dance ground or, in case of rain, in the two large houses at the edge of the dance ground. As the night progresses the formations of visitors and locals becomes more and more mixed as men frequently switch back and forth. By dawn almost everyone has danced with everyone else.

Many of the women and girls retire to women's houses long before dawn. Others, however, remain huddled around the fires where they may watch the dancers, and where they themselves remain under the surveillance of their own menfolk. Opportunities for direct contact with eligible members of the opposite sex of the other group are thus limited. Indirect contacts are, however, made. A visiting girl may talk freely with her cross cousins, either male or female, among the locals, for instance, and may ask one of them to tell a local young

man whom she finds appealing to come to court her on an appointed day. Local girls may not receive suitors from other local populations until the entire year long kaiko is finished, but they may express their admiration for particular young men to their visiting cross cousins who may be depended upon to report their sentiments to the admired men.

On the other hand, it is said that men do not make direct overtures to women. Young men say that a rejection would be bruited about, making them objects of ridicule. A good man, that is, one who dances strongly, whose plume waves bravely, and whose adornment is rich, will attract women. It is for men to entice women, not to approach them.

At dawn the dancing slackens. The dancing ground now becomes a trading ground as men from the Jimi Valley, from across the Simbai River, and from up and down the valley offer their wares. Bird feathers, gold-lip shells, green sea snail shells, marsupial furs, axes, and bushknives are, in respect of value and the frequency of exchange, the most important items entering transactions. Baby pigs, cassowaries and salt are occasionally traded, and a number of minor items, including pigments, tobacco, loose marsupial fur, green beetles and orchid fibre waist bands are also offered. In recent years money, in the form, usually, of one shilling coins, but occasionally in one pound notes, has entered into transactions.

During 1962 and 1963, however, it had not yet become a universal medium of exchange. While it could be exchanged for every kind of commodity it was not always acceptable. If a man was firm in his desire to obtain a gold-lip shell for his Princess Stephanie plume he would not accept money for it. Money, in short, was traded like other items.

The transactions which take place on the dance ground are immediately completed. A man both gives and receives at the same time. They are, moreover, impersonal. The relationship between the parties to a transaction, who may have never seen each other before, may last no longer than the time it takes to complete the exchange. At the men's houses, however, a different kind of exchange takes place. Here men from other places give to their kinsmen or trading partners in the local group valuables for which they do not receive immediate return. Men from north of the Simbai River leave plumes with the Tsembaga, who will, after wearing them, exchange them with Jimi Valley men for shells or axes. Jimi Valley men, conversely, leave shells and axes with the Tsembaga, who will exchange them, at future kaiko or on future visits to the Simbai's northern shore, for plumes, or in earlier times, native salt. It is often months before such transactions are completed, before that is, a man receives a return for a valuable that he has left with a trading partner.

Trading generally lasts for an hour or two. Toward the end some of the young men, although footsore and hoarse, commence to dance again, thus demonstrating their endurance to whatever spectators remain. The dancing is sporadic, however, and ceases altogether by mid-morning. By this time the guests, except those lingering on to visit a little longer with kinsmen, have departed for home.

2.5.3 The kaiko, women and goods

It is obvious that the supra-local kaiko assemblages facilitate mate selection and marriage by providing settings in which are brought together marriageable, or soon to be marriageable, girls and young men. At least seven of the twenty-eight wives and widows of other than Tsembaga origin living on Tsembaga territory during 1962-1963 made their first overtures to the men they married after being attracted to them at a kaiko.

It is also obvious that the kaiko, by providing market-like settings, facilitates the exchange of goods, some of which, particularly axes and salt, are necessary for survival.

The kaiko also facilitates the exchange of goods, and, perhaps, the movement of women, in a less direct and more subtle way. In the last chapter the supra-local exchange system was

described. It was suggested that an exchange procedure in which only two items, in this case salt and axes, critical to either metabolism or subsistence are exchangeable for each other might well be unworkable, since the production of each of the two items would be articulated not to its own demand, but to the limited demand for the item for which it is exchanged. It was further suggested that the introduction into the exchange system of valuables, the demand for which is unlimited, provides a mechanism for articulating the production of each of the two critical items to their own demand. Valuables, thus, although themselves non-utilitarian, are crucial to the provisioning of the population with utilitarian commodities.

That valuables should flow from a locality of greater population increase to a locality of lower population increase was also hypothesized. The accumulation of valuables in the locality of lower population increase, it was suggested, might be used to obtain women from that of higher population increase, adjusting differences in population dynamics between the two localities, and thus contributing to the long term adjustment of population dispersal over the entire area.

The non-utilitarian valuables upon which the Maring exchange system depended most heavily in pre-contact times, were bird feathers, shells, and non-utilitarian "bridal" axes. In 1962 and 1963 the importance of shells and bird feathers

remained undiminished. The demand for shells is created by their place in payments to affines. It is also the case that shells, being durable, may and do form part of the ordinary daily costume. Bridal axes were also in demand because they could be included in payments to affines, and while they did not form part of a man's daily accoutrements, they were carried during visits to friendly groups. Informants say that to appear at the houses of another group bearing only a bridal ax indicated both friendship and reliance upon the host's hospitality, for such implements were fit for neither fighting nor chopping wood. Valuable bird feathers, however, did not, except occasionally in the Jimi Valley, figure in affinal payments, nor, since they are perishable, did they form part of the daily or even the visiting costume.¹⁴ Their use is confined almost exclusively to their display at the kaiko. It may thus be said that the kaiko contributes to the movement of critical commodities, and perhaps to the movement of women as well, by creating a demand for one class of valuables upon which the operation of the exchange system depends.

2.5.4 Ritual and ceremony: the kaiko as display behavior

The term "ritual" has been taken in this study to refer to the performance of conventionalized acts explicitly directed toward the involvement of non-empirical or supernatural agencies in the affairs of the participants. While

they may have social, demographic, nutritional and ecological consequences, the events already described in this study, from the hanging of the fighting stones to the inauguration of kaiko de, are comfortably accommodated by this definition, for each is undertaken explicitly to effect changes in the relationships of the participants with various categories of supernaturals. Together with other events which remain as yet undescribed these rituals form an articulated series through which the changes occur in a certain sequence. Because the relationships among the relevant natural and supernatural entities at the termination of the sequence are such as to permit or even encourage its repetition, the sequence may aptly be termed a ritual cycle.

Kaiko entertainments, like the other events, have a prescribed place in this cycle. They occur only after the uprooting of the rumbim and before certain other events which remain to be described. But these entertainments, unlike others, are not directed toward the involvement of non-empirical or supernatural agencies in the affairs of the participants. In terms of the definition of ritual which has been relied upon in this study, the ritual aspects of the kaiko are minimal and, moreover, are subordinated to a dominant and explicit concern with the relations among the participants. Although they are intrinsic elements in series which may in its totality be

designated a ritual cycle, these entertainments are secular. They are more aptly characterized as "ceremonial" than "ritual."

It has not been necessary to add the burden of a distinction between ceremony and ritual to this study thus far, although many of the events already described have included ceremonial as well as ritual elements. The introduction of such a distinction at this point will be of assistance in elucidating some aspects of the kaiko.

For the purposes of this study the term "ritual" has referred to conventionalized actions the stated purpose of which is to affect the relationships of the participants to non-empirical or supernatural entities or agencies. The terms "ceremony", and "ceremonial", on the other hand, will refer to conventionalized actions manifestly directed toward affecting relationships among the living participants. This difference implies a second one: while rituals may be performed by a single individual in solitude, ceremonies may not. At least two people are required to conduct a ceremony.

These differences alone may be sufficient to distinguish ceremony from ritual. They do not, however, yield an adequate definition of ceremony. To say, simply, that ceremony designates the performance of conventionalized acts directed toward affecting relations among the participants does not exclude certain kinds of interactions better left out. Rape,

murder, warfare, and adoption, for instance, may be highly conventionalized and are certainly directed toward affecting relationships among the participants. Such acts, however, affect relationships through the direct alteration of the physiological, sociological or psychological states of one or more participants by other participants. It is useful to exclude such events from the definition of ceremony, reserving the term, rather, to designate events in which one or more of the participants impart, through sign or symbol, information concerning their own physiological, psychological or sociological states to other participants. It is useful, in other words, to reserve the term ceremony for the designation of communication events.

There are, of course, many kinds of communication events, and no purpose would be served by including them all in the definition of ceremony. But ceremony may be distinguished from other modes of communication by its special language, which is conventionalized display. Put in terms of communications models, if ceremony is regarded as a channel, conventionalized display is the code appropriate to that channel.

A definition of ceremony may now be constructed. For the purposes of this study the term ceremony may be taken to refer to the performance of conventionalized acts of display through which some participants communicate information

concerning their psychological, physiological and sociological states to other participants.

Kaiko entertainments, although embedded in a ritual cycle, may be regarded as ceremonies rather than rituals not only because their most obvious characteristic is display, but because the displays communicate among participants certain information which, given other aspects of Maring culture, can hardly be communicated in any other way.

The notion of display behavior has already been introduced several times in this study. It has been suggested the the "small" or "nothing" fight may be regarded as agonistic territorial display, similar to that which has been observed among species other than man, rather than as sanguinary fighting. It was also suggested that agonistic display is one aspect of stake planting at the boundary.

The messages transmitted through such displays are, obviously, ones of threat. Other messages are transmitted by the displays in which friendly groups participate at kaiko entertainments.

These displays have two main aspects. The first of these, following V. C. Wynne-Edwards, may be termed epigamic. Speaking of non-human species Wynne-Edwards uses this term to refer to "displays that characterize the marital relations of the sexes and typically culminate in fertilisation" (1962:17).

They are, in other words, amatory displays which form all or part of a courtship procedure.

The dancing of males at a kaiko constitutes the first phase of a conventionalized courtship procedure which, if favorable responses are elicited from the female spectators, may continue for some of the participants in other contexts.

Certain information is imparted by the massed dancing of the males. First, it presents to the female spectators larger samples of the males of local populations other than their own than they are likely to see assembled at any other time or place. The males, furthermore, signal by their participation in the dance their general interest in the females as a class. It would be difficult to conceive a more economical means for communicating information concerning the availability of males than the sample presentation of the dance. Through it females are able, on a single occasion, to gain some familiarity with all or most of the eligible males of local populations in which they themselves are not resident, and which they may visit only rarely.

The amatory display of the males does more than present a sample to the females. It also provides a basis for differentiating among the participants. The appearance of the individual males, their dancing and the richness of their adornment, indicates to females their strength or endurance and their

wealth or the wealth of their connections.

Wynne-Edwards suggests that such displays in the animal kingdom are selective mechanisms, since "individuals that were undernourished or depressed would presumably have greater difficulty in achieving mating than the dominant and well-fed .."(1962:251). Whether or not the choices that Maring females make are usually responses to the comparative quality of the performances of the individual males cannot be answered here, for the data are insufficient. A number of men maintain, however, that their wives were first attracted to them because of the admirable figures they cut in the dance. It may be pointed out, moreover, that characteristics displayed in dancing are not irrelevant to more prosaic activities. Endurance or strength is as vital to gardening and fighting as to dancing, and the richness of a man's adornment gives some indication of his ability to pay for the woman whom he may attract. This information, it may be added, is not only communicated to the eligible females. It is also communicated to the male agnates of the eligible females, whose attitudes toward suitors, although sometimes ignored, are germane to all matings.

While it is only the behavior of the men that may be characterized as amatory display, it is also the case, of course, that marriageable females of the hosts and guests are made available for inspection by men at kaiko entertainments.

While the display behavior of the dancing males may elicit overtures from the females, the presence of the females may elicit overtures by men to the male kinsmen of females. A man seeking a wife for himself, his son or his younger brother may approach the father or brothers of a girl who attracts him, and for whom he is either able to exchange a sister or daughter or make substantial payments.

The kaiko, in short, forms part of two procedures which facilitate sexual pairing. First, by providing a setting in which massed amatory display takes place it offers an opportunity for females to invite courtship from specific individuals among a large and perhaps previously unfamiliar sample of available males. Second, it is an occasion upon which large numbers of females are presented for inspection, thus providing a basis for negotiations between males concerning the disposal of females. The two procedures, one involving selection by females, the other by males, are sometimes antithetical, for girls' choices do not always coincide with those of their fathers or brothers, but this need not be considered here.

Following Wynne-Edwards (1962:16), the term epideictic may be applied to the second major aspect of displays at kaiko entertainments. Epideictic displays are those which impart to

the participants information concerning the population's size or density antecedent to behavior which may affect that size or density. Included by Wynne-Edwards are the "dancing of gnats and midges, the milling whirligig-beetles, the manoeuvres of birds and bats at roosting time, the choruses of birds, bats, frogs, insects and shrimps" (1962:16). Epileptic displays usually occur at a conventional time and frequently at a "traditional place" (1962:17).

The specification by Wynne-Edwards, that such displays are antecedent to procedures which "restore or shift the balance of population" justifies the use of the term epileptic in reference to kaiko entertainments. One of the ways of restoring or shifting the balance of population is by adjusting the dispersion of organisms over the land. It must not be forgotten that the occurrence of the kaiko immediately precedes the termination of the truce. After the kaiko the existing pattern of population dispersion may again be tested through renewed hostilities. In anticipation of renewed hostilities it is important for the members of a local population to assess the extent to which it will be supported by its allies. Among the Maring it is not possible to base such assessments upon promises of support from authoritative political leaders, men who can command the performance of others, for such do not exist. The decision to participate in fighting as an ally is at the

discretion of each individual male.

The Tsembaga say that "those who come to our kaiko will also come to our fights." This native interpretation of kaiko attendance is also given expression by an invited group. Preparations antecedent to departure for a kaiko at another place include ritual acts similar to those antecedent to fighting. Fight packages are applied to the heads and hearts of the dancers and gir to their feet so that they will dance strongly, just as, during warfare, they are applied so that they will fight strongly. It has already been indicated that these acts have amatory aspects, but it is also said that dancing is like fighting. The visitors' procession is led by men carrying fight packages, and their entrance upon the dance ground of their hosts is martial. To join a group in dancing is the symbolic expression of willingness to join them in fighting.

The size of a visiting dancing contingent is a product of many factors. Most important of these are the size of the local population to which the invitation has been extended, the number of kin or formal trading connections between hosts and guests, and the extent to which the formally invited men can induce others to support them. The last is itself a product of the relations of the formally invited men to members of their own and other groups.

These are also the factors which most importantly

affect the recruitment of allies in time of warfare. Mobilization to attend a kaiko thus exercises the connections through which mobilization for warfare is accomplished, and the size of the dancing contingent signals the total strength and effectiveness of these connections. The hosts, thus, base their assessment of the extent to which friendly groups will support their belligerent enterprises upon the samples which are presented in the form of dancing contingents. It is, given the absence of authoritative political leaders, and the lack of ability on the part of the Maring to count past their fingers and toes, difficult to imagine how this information could be economically communicated without display.

It is, of course, the case that participation in a dance is different from participation in a fight, and men who may be pleased to attend the former may be reluctant to engage in the latter. Display accommodates deception and dissembling, but so does language and the more specialized codes which depend upon language. Indeed, the ability to transmit lies is common to all means of communication which employ symbols.

In addition to the epigamic and epideictic messages, display at kaiko entertainments transmits other information. Antecedent to the food presentation, for instance, a formally invited man watches his host assemble his portion, thus learning how many men his host has been able to induce to assist

him in this effort. The invited man's followers, from the size of their portions, may estimate the strength of the connections which the man whom they are "helping to dance" enjoys with the hosts. The hosts, at the same time, may assess the influence of the formally invited men by observing the number of people to whom each redistributes the food presented him. The displays, thus, transmit information concerning not only the strength or size but also the structure of the participating groups.

2.6 The termination of the kaiko

With the coming of the "dry" season, in May or June on Tsembaga territory, new gardens are cut. Ordinarily, the greater part of the men's work would be finished by late August, but in 1963 unseasonable rains, falling mainly in the daytime, and heavy overcast seriously impeded burning. Preparations for the konj kaiko, the "pig kaiko," the event which terminates not only the year long festival but also culminates the entire ritual cycle, were, nevertheless, initiated by some men in mid-August, and by early September most other men had followed the initiators.

2.6.1 Trapping eels

As preparations for uprooting the rumbin commence with the trapping of marsupials, the "pigs of the raua mug,"

so preparations for the kōn] kaiko commence with the trapping of eels, the "pigs of the raua mai."

The minimal agnatic groups, either clans or sub-clans, form the trapping units, as they did for the trapping of marsupials, and similar to the trapping of marsupials, the locations in which each agnatic group may place its traps are restricted. While at other times men may place traps anywhere, they now must set them in traditional places associated with their own spirits of the low ground, for it is only with them that pigs may be exchanged.

The personnel participating in the trapping of eels differs to some extent from that involved in taking the marsupials. Fight magic men, who remain for life dedicated to the raua mugi, are precluded from even touching with their hands the cold, wet eels. They therefore take no part in trapping these fish.

The prohibitions which burden the men engaged in eel trapping are similar to those under which they laboured when trapping marsupials. Now, however, it is the high ground, the kamunga, which is to be avoided, and the people suffer no prohibition against marita.

As the flesh of the trapped marsupials are preserved, so, in a sense, is that of the eels. After being taken from the traps they are kept alive in individual cylindrical bark

cages left submerged in the streams. Although they are not fed, some of the captured fish maintain life for as long as two months, apparently subsisting on whatever bits of plant and animal material is carried to them by the current.

As in the case of marsupials and pigs, there is no particular number of eels required for the performance of the rituals in which they figure. A sufficiency of eels seems to be defined, rather, by the toleration of these fish for captivity. As the trapping period continues, the trappers suffer mounting losses among the imprisoned eels, due, perhaps, to possible lowered food intake and lack of exercise. Sometimes, too, in the heavy run-off of water following downpours, both traps and cages are carried away. With each loss there is increased talk of getting on with the remaining preparations for the konj kaiko before all of the eels are lost.

2.6.2 Preparations at the raku and dance ground

By early October 1963 some men, not waiting for the "talk to become one," after being advised by shamans of the wishes of the ancestors, began to make preparations, both at designated raku and on the dance ground, for the konj kaiko, the event terminating the festival and the cycle.

On the dance ground repairs were made to the two houses, and late in the middle of the month the ceremonial

fence, called the pave, was built on the slope above one end of the dance ground. Built of saplings and covered with foliage, this light three sided structure, about fifteen feet high, enclosed an area of about thirty by fifty feet. This area was increased by the incorporation into it of the large men's house enclosure which stood directly above it. The longest dimension of the pave, that facing the dance ground, was broken near its center by a single window about one foot square and approximately four feet above the ground.

By mid-October work had started at the raku of all of the minimal agnatic units. These included sites where the residences of men slain in the last fight had stood, for it was these men specifically to whom pigs were to be dedicated. These raku were in some, but not all, instances separate from those at which pigs were to be killed for the spirits of the low ground. The latter were, for the most part, to be killed at raku which had always been used for this purpose. If the slain men had lived near these traditional sites a single raku might be used for both categories of ancestors.

Anomalies in the general pattern of a separate raku for each of the minimal agnatic units gave, perhaps, some evidence of past or on-going changes in agnatic structure and residence patterns. Three of the adult males of the Wendekai sub-clan of the Merkai clan prepared a raku separate from that of

the other eight adult males. These three had been separated by food and fire taboos from their brothers, but such taboos, it has already been mentioned, split other groups as well, all of which did maintain the use of single raku. Some members of the Aitigai sub-clan of the Tsembaga clan, on the other hand, joined with the Aitigai sub-clan of the Kamungagai clan, as had their fathers, who, they said, had lived sororilocally with the Kamungagai Aitigai. The remaining Tsembaga Aitigai shared a raku with the Tsembaga Wendekai sub-clan and the unsegmented Tomegai clan.

Early preparations at both kinds of raku included the clearing of underbrush and the erection of roofed but un-walled structures for the storage of firewood and vegetables, and for shelter from rain. At those raku at which pigs were to be killed for the spirits of the low ground additional structures were erected. These were timbi houses, named after the trees that formed the centerposts (Myrtaceae, ? Cleistanthus sp.), which, frequently found by wide still places in streams, are said to be koipa mangian's own trees. Timbi houses are round, six to nine feet in diameter, and the timbi centerposts, with some leaves remaining, project several feet above the conical roof. It was in these houses that the eels were to be cooked with pig bellies in one or two earth ovens, depending upon whether food taboos split the group.

The erection of the centerpost is accompanied by a brief ritual, the object of which is fruitfulness. A sleeping mat is laid upon the earth floor of the still roofless timbi house, and valuables, to be offered to koipa mangian, "he who gives us eels," are spread upon it. The butt end of the centerpost is placed upon the mat, and one of the older men, singing in a soft falsetto voice, first cleans moss off its bark with a bamboo scrapper then, with an ax, marks its length with a zig-zag line, representing, informants say, an eel. The debris falls upon the wealth objects, and the song is concerned with the increase of wealth and the thoughts of trading partners. "Let him think of me and send one gold-lip shell. Let him think of me and send one ax, etc." When the work is finished, the moss and bark is gathered up, to be cooked with vegetables and eaten by all but fight magic men to enhance both fertility and growth. The spirits of rot, the fathers and grandfathers of those present who died from causes other than violence, are then addressed by name. They are thanked for the eels, and told that they are now being offered valuables at this place where they, when living, killed pigs, and where those presently living would soon kill more. They are told to accept the valuables and give some to koipa mangian, and asked to look after the women and children, each of whose names are mentioned. The red spirits are then addressed. They are reminded that wealth

was previously given to them, but that now it is being given to "those who gave us eels." They are asked, however, to continue to look out for the men, all of whom are named. All the men and boys then place their hands on the timbi centerpost as it is thrust in the ground. The shells and beads are then hung from a low branch left for this purpose, and the axes are planted in a circle around the base of the post. After the roof is completed, the valuables are returned to their owners.

As in the case of the planting of rumbim and amame, the symbolism of the ritual paraphernalia, particularly, the timbi house itself, seems sexual. Of greater interest is the further adjustment in the relations of the participants with both categories of ancestors. With the hanging of the fighting stones and the taking of the ringi the relationship of men to the red spirits became dominant. This was modified when rumbim and amame were planted, but a heavy debt to both categories of ancestors was acknowledged. When these plants were uprooted a further adjustment between the living and the two categories of spirits was expressed in the abrogation of most of the taboos remaining from the time of the fight in the reestablishment of reciprocity with the red spirits, and, perhaps, in a communion with the spirits of the low ground. A further adjustment takes place with the setting of the timbi centerpost. Reciprocity, to be bound by a forthcoming "pig exchange," is being reestablished,

with the spirits of the low ground.

The red spirits are also addressed during the planting of the timbi. The Tsembaga say that if they weren't they might grow jealous and desert the living, leaving them open to slaughter in the next round of fights. The goal of the rituals through which the Tsembaga and other Marings proceed does not seem to be the replacement of the red spirits by the spirits of the low ground, but rather a redefinition of the balance in their relationships with the two.

2.6.3 The effect of the plans of other groups on the timing of the konj kaiko

The plans of other groups sometimes have an effect upon the timing of the konj kaiko. The Tuguan uprooted their rumbim in 1963, one year later than the Tsembaga. This event had to await the ripening of the pengup variety of marita late in October. It has already been mentioned that men of local populations which have rumbim in the ground may not eat the flesh of pigs killed in connection with the kaiko of other groups. The Tsembaga, who might otherwise have been able to stage their konj kaiko several weeks earlier, were forced to wait until their most important allies and closest neighbors had uprooted their rumbim, thus becoming free to eat pork presented them.

Delays in terminating kaiko for this reason must have been common if not the rule, considering the frequency of fighting throughout the Maring area, and considering the number of groups from which allies were usually drawn. Their consequences in recent years have been trivial. The Tsembaga complained only about increasing deaths among their captured eels. Previous to pacification, however, they may have had more important consequences. In situations in which the kaiko of a pair of enemies were separated by one year such delays may have served to eliminate entirely any period during which one was free to attack while the other was not.

2.6.4 The mamp gunc

When all but the final preparations at the raku are completed some of the young men undergo ritual dedication to the red spirits.

Secluded in the men's house enclosure behind the pave, their hair is worked into constructions called mamp gunc. Round frames, about six inches high, made of the bark of the kirim tree (Lauraceae sp.) are placed on their heads like crowns. The hair which has remained uncut since puberty, is pulled up through the center and down over the sides of the frame, hiding it completely. The melted sap of an unidentified tree called gunc, which gives the construction its name ("head gunc"), and

which, upon cooling, leaves the surfaces hard, is then applied. Finally, the headdress is dyed red, trade pigments now being used.

Only a few of the fight magic men possess the skill of making mamp gunc^ˇ, and the procedure is protracted. The arrangement of the hair over the frame takes almost a day for each novice, and the application of the melted gunc^ˇ, bit by bit with an arrow point, takes another day. It is also highly ritualized, but the details of the rituals need not be discussed here. It is sufficient to say that the red spirits are told that the boys are putting on these "red things" for them and their help is asked in making them shapely, hard and red. All of the remaining ritual procedures have the same goal.

As might be expected of anything associated with the red spirits, the young men assume a number of stringent taboos along with their mamp gunc^ˇ. These proscribe, among other things, sexual intercourse and visiting the wora while the mamp gunc^ˇ remain attached to their heads. More notable, however, are the absolute prohibitions against drinking water, chewing sugar cane, and eating cucumber, paw paw, and hibiscus leaves. These prohibitions lasted, in the case of the Tsembaga boys, for eight days. They did not exert themselves during this period, and the roots and greens which they were allowed to eat evidently contained sufficient moisture to prevent serious dehydration. Some violations did occur. I know personally of two

instances in which gunc^v yu, boys with mamp gunc^v attached to their heads, took liquids. One drank a few sips of coffee, and the other, after complaining of a cough, took cough syrup with a water chaser. Both of these exotic liquids were available only from us, and so uncommon and unfamiliar that the fight magic men had not thought to proscribe them.

When work on their headdresses are finished, the new mamp gunc^v men are "brought out;" that is, they terminate their seclusion by dancing publicly for the local women and whatever visitors from other places may care to watch.

It has already been mentioned that only some of the Tsembaga men took mamp gunc^v at the 1963 kaiko. In fact, only five did so. This was an unusually small number, but it seems to be the case that seldom, if ever, did all young men put them on at the same time.

They are, first, associated with the killing of enemies. Some informants say that they may be made only by young men whose agnates have killed enemies in the last fight. Others say that they may be made if a member of the land-holding group has effected a slaying, while yet others maintain that the mamp gunc^v may be put on if any member of the local population has killed an enemy. It is not possible to derive any rule from what went on among the Tsembaga in 1963, for the proceedings were unusual. The five young men who put on mamp gunc^v either had themselves

or were associated with those who had taken refuge among the Kauwasi. They justified their mamp gunc^v on the basis of the slaying, during the Kauwasi-Monambant fight, of a Kundagai allied to the Monambant.

The Tsembaga who refuged in Monambant, however, said that they had killed no Kundagai, and would await the Monambant kaiko to make mamp gunc^v, for they had helped Monambant kill Kauwasi.

Even in situations in which all young men are related to killers in such a manner as to be eligible to put on a mamp gunc^v, it is unlikely that all would do so. It is said that two brothers, for instance, cannot take mamp gunc^v at the same time, for a man who is wearing a mamp gunc^v cannot assist with the slaughter of the pigs, the gathering of firewood and vegetables, and the other tasks associated with the konj kaiko. Those who do not take the mamp gunc^v at the kaiko of their own local population however, may put them on at the kaiko of other local populations to which one's own has been allied. To qualify to put on a mamp gunc^v at the kaiko of an allied group it seems sufficient to belong to the same local population as any man who has participated in the killing of one of that group's enemies. It is not necessary to be an agnate of the killer.

It is interesting to note that the young men who join in putting on the mamp gunc^v may, although they seldom do, refer

to each other as "brother." It could be said that the mamp gunc^v procedure is a device producing supra-local age classes. The political and structural potentialities of such age classes, if they may be so termed, remain, however, unutilized.

Another kind of group may also be crystallized by, or at least become apparent in, the mamp gunc^v rituals. While there are at the time of most kaiko probably many young men who are eligible to put on mamp gunc^v, there are always certain of them who must do so. These are the young men who have been designated by each of the fight magic men to be heirs to their ritual knowledge. Whenever possible they are the biological sons of the fight magic men. If a fight magic man has no son, he will designate a brother's son, the sons of true brothers being selected before the sons of classificatory brothers.

If a priest is one who performs prescribed rituals at specified times for the benefit of a congregation, it may be said that fight magic men are priests. The putting on of the mamp gunc^v, it may further be said, specifies a group of young men who will inherit priesthood. Hereditary priesthoods, even more than age classes, have served as foci of political activity in many societies. Among the Maring, however, the extent to which ritual knowledge has been converted into secular authority is minimal. Continuity of ritual knowledge is maintained, but the political possibilities of hereditary priesthood

remains, like that of age-classing, potential. It is beyond the scope of this study to discuss the reasons underlying the lack of development of either age-classing or heredity as bases of political organization. It may be suggested, however, that the ritual cycle itself defines sufficiently the tasks that require aggregated effort, and that in groups as small as those of Maring local populations the efforts of entire groups may be mobilized without recourse to the formal structures or positions that could be yielded by age-classing or heredity.

2.6.5 Final preparations

In the last days before the konj kaiko, activity reaches a high pitch. Above ground ovens must be built for pigs to be dedicated to the red spirits and firewood must be gathered at the raku. Women must gather large quantities of the ferns and other greens with which pigs are cooked. Many of the visitors who are to receive pork arrive in advance, for they are expected to help in the preparations. It is also necessary to assemble captured eels at locations convenient to the raku. They are, therefore, deposited in their cages in nearby streams. A new path is then cut from their place of deposition to the raku, and at its terminus a light archway is constructed.

Before the pigs are killed, the ground must again be rid of any corruption deriving from spirits or sorcerers. To

this end, two days before the konj kaiko a number of fight magic men gathered on the government walking track, where they be-spelled large bamboos full of water. These were distributed to representatives of each of the minimal agnatic units to use at the raku and on the roads. While sprinkling the contents of the bamboos over the ground the men recounted, to both the living and the dead, the story of their defeat and departure, and the subsequent pollution of the ground by Kundagai spirits and sorcerers, and announced that they were now counteracting this pollution with magical water.

2.6.6 The abrogation of taboos

On the day before the major pig slaughter fourteen acek konj, "taboo pigs" were slaughtered. Although both categories of ancestors were told in the addresses previous to the killing that the living wished to terminate taboos, the slaughtered animals were cooked in above ground ovens, for the taboos which applied most generally, those arising from warfare, were associated with the red spirits.

With the opening of the oven each individual brushed himself with the gainingai shrub, made the spitting sound and announced separately the taboos which he was terminating. The pig was then eaten by those who had participated in the ritual.

The variety of taboos abrogated was great, and it is convenient to separate them into a number of classes:

1. Mourning taboos

During mourning a woman is separated from non-mourning women by fire taboos, and from men, because the bones of the deceased remain in her house, by taboos against touching, or even conversation. If the deceased was a man, moreover, the woman is burdened with all of the food taboos which he suffered when alive.

Just before the konj kaiko women who have been keeping the bones of deceased persons at their houses bury the remains at the raku, so that the spirits of these deceased may partake of the flesh of the pigs which are soon to be killed. The burying of the bones at the raku effectively terminates the mourning period, and the taboos associated with it are abrogated with the killing of the taboo pigs.

Mourning taboos apply to people other than the women who look after the bones. It is customary for the agnates of a deceased person to give up, as an expression of sorrow and loss, one of the deceased's favorite varieties of each of the major categories of foodstuff (i.e. one variety of taro, one of banana, etc.). These voluntary renunciations are termed moi. If the deceased was a woman, moreover, the men whose pigs she looked after customarily give up the consumption of pork for the duration of the mourning period, and a widower will also often announce that he will neither marry nor engage in sexual intercourse. These restrictions are also abrogated with the killing

of the taboo pig.

2. Taboos arising out of intra-local disputes

Antagonisms between members of the group arising out of serious arguments, disputes and hurts are given symbolic expression in the form of interdining and food sharing taboos known as acek. The principals refuse to eat food cooked over the same fire, and each refuses to eat food grown by the other.

Taboos arising out of a variety of incidents ranging from obscene name calling to homicide were terminated on November seventh with the killing of the "taboo pigs."

3. Taboos arising out of warfare

Some of the taboos arising out of warfare (also referred to as acek) are also terminated with the killing of the taboo pigs. To abrogate the full range of taboos applying to intercourse between the agnatic groups of the slayers and the slain takes four generations. Children of the opposing principals may neither eat foodstuffs raised by their opposites nor share a cooking fire. Grandchildren may eat food grown by each other, but may not eat food cooked over the same fire. Great-grandchildren may, after renouncing the taboo, share the same fire. Individuals who are related through wives or mothers to erstwhile enemies constitute an exception to the general applicability of this rule, but this will be discussed later in another context.

In 1963, young people of the Kamungagai clan terminated the taboo on food grown by the Kekai clan, who had killed a member of their grandparental generation during warfare perhaps fifty years earlier. On the same day, men of the Merkai clan renounced a taboo upon the fires of the Raueng clan of Tuguma, who had killed two members of their great-grandparental generation so long ago that no one could provide information concerning the circumstances surrounding the deaths.

Some of the restrictions on intercourse with their enemies of the last fight, the Kundagai, were also terminated with the killing of the taboo pigs. These were the taboos on walking through Kundagai territory, visiting (but not entering) Kundagai residences, and, of course, talking to and touching Kundagai.

The abrogation of these last taboos at this time was irregular. In pre-contact times they would have remained in effect until peace making ceremonies could be conducted some time in the future. The establishment of a Simbai patrol post and the administration policy of drawing people into control by requiring of them corporate effort made the abrogation of these taboos ex post facto as it was. While carrying cargo for government patrols, for instance, most Tsembaga had crossed Kundagai territory, as most Kundagai had crossed theirs, and in building a bridge ordered by the government across the stream

separating their territories members of the two groups had already been forced into cooperation.

It has already been mentioned that taboos arising out of the warfare of other groups may split local populations. Those Tsembaga who had fought on opposite sides of the Monambant-Kauwasi fight terminated their taboo on each other's foodstuffs with the killing of the taboo pigs. The taboo on each other's fires, however, was to remain in effect until the Monambant terminated their kaiko in 1964.

2.6.7 Taboos, social control, and intergroup relations

Taboos on interdining, food sharing and on other social relations are a pervasive aspect of Maring social and political life. Interpretations of the nature and function of ritual advanced by Bateson (1936), Freud (1907), Gluckman (1962) and Reik (1947), although they cannot be tested, are suggestive concerning the role of taboo in these relations. The extension of interpretations of ritual to an examination of taboos is warranted because taboos, which may be defined as supernaturally sanctioned proscriptions of physically feasible behavior, form a logical pair with ritual; indeed, they may be regarded as "negative rituals." Among the Maring, moreover, the relationship is not only logical, for taboos are also both ritually assumed and ritually abrogated.

Gluckman has suggested that "social rules and values, established by diverse relations, themselves move individuals and sub-groups to dispute with their fellows in their main group of allegiance," and that "ritual operates to cloak the fundamental conflicts which are set up (1962:40)." He does not suggest that rituals settle conflicts. "The whole point of the analysis is that they cannot do so (1962:46)." He suggests instead that conflicts between parties may be concealed by rituals which "in fact may lead to temporary truces." The ability of ritual to perform such a function, Freud's writings suggest, may lie in the nature of ritual itself. In remarking upon the similarity between the obsessional ceremonials of neurotics and the religious rituals of the pious, Freud notes that both represent compromises between opposing forces. At one and the same time they both suppress and give expression to affect which may be dangerous to an individual or to a group.

These formulations suggest that the taboos which prevail within Maring local groups are an important means of social control. Among the Maring these taboos arise out of antagonisms. I have already mentioned the basis of some of the antagonisms giving use to the taboos prevailing among the Tsembaga in 1963. Some were generated by conflicts which are the common concomitants of co-residence: insult, assault, woman-stealing and so on. Others arose out of what Gluckman would call the fundamental

constitution of Maring society, that is, out of diverse affiliations and conflicting responsibilities. Thus, taboos to which all Tsembaga were subject resulted from the Monambant-Kauwasi war of 1955. Maring rules of participation in warfare are such that some Tsembaga men could not avoid fighting on each side and thus fighting each other. The Tsembaga were in exile at the time of the war, and those who were living with the Monambant and Kauwasi had to join, as principal combatants, their hosts, who had provided them with land and shelter. Two Tsembaga men were killed and several were wounded. When, however, the Tsembaga exile ended and they reassembled on their own territory, it was necessary for those who had fought against each other in the Monambant-Kauwasi war to become again members of a single cooperating and coresidential group. It may be suggested, following Freud and Gluckman, that taboos played an important part in this reamalgamation. The taboos served to define areas of behavior in which the anger and bitterness generated by death and injury could be expressed, while permitting cooperation in most of the important tasks of living. In Freud's terms the taboos represented a compromise between the needs to express and to suppress socially dangerous affect. They required or allowed antagonism to be stated frequently and formally in controlled circumstances: by men cooking their food side by side, but over separate fires; by the refusal of one

man to enter another's house; by the refusal to eat food grown by another. It may be suggested that the frequent but relatively harmless statement of antagonism in areas of behavior narrowly defined by taboos inhibited their more generalized, less predictable, and therefore more dangerous manifestation. The supernatural nature of the taboos, moreover, may have relieved tension between antagonists by transferring animus from a mundane to a supernatural plane. These effects of taboo observance, I think, prevented ill-feeling from contaminating all aspects of the relationships of parties between whom grievance lay, and thus permitted their cooperation in important tasks. It was in fact the case that the men who refused to eat each others' food or at each others' fires helped each other in forest clearing and hunting, granted land to each other, assisted each other with affinal payments, and would have, had the need arisen, fought side by side in defense of the common territory.

It is interesting to note that it is to taboo rather than to ritual that the task of expressing and suppressing antagonism is assigned. I suggest that taboo is better fitted to the purpose than ritual, for the very act of expressing antagonism by observing a taboo turns the principals away from each other. Antagonism is thus stated through a means which avoids potentially dangerous confrontations.

This formulation is in some respects applicable to

the relations between hostile local populations as well as to inter-personal relations within local populations. The ritual truce inaugurated by the planting of rumbim is reinforced by prohibitions on all intercourse between the hostile groups. These taboos, while expressing the hostility symbolically, minimize the possibility of actual truce violations. Although no active or conscious cooperation between the groups is facilitated or even allowed by these taboos, they at least make it possible for the members of each group to live in some security.

However, although taboos may play an important part in maintaining order within the local population, obviously there must be some means of abrogating them, otherwise their accumulation would eventually damage the coresidential and cooperating structure which they help to maintain.

The renunciation of taboos involves the killing of pigs. Such slaughter, however, awaits the accumulation of a parasitic or competitive quantity of animals. To sacrifice animals sooner for the purpose of terminating taboos among members of the local group would diminish the quantity of pigs available for emergency and misfortune and it would delay the kaiko. Therefore it awaits the kaiko, when people can afford to put pigs to this purpose. The expressed attitudes and behavior of the Tsembaga suggest that by this time the taboos have fulfilled their function. The antagonisms which gave rise to

them have cooled considerably, and have been replaced by annoyance with the taboos themselves. Informants said that by then they no longer bore any animus toward those with whom their relations were restricted by taboos, but continued to observe the taboos merely because their ancestors would punish them if they did not. With the renunciation of taboos people who had long been separated by them frequently embraced.

The kaiko, then, which is part of a mechanism for regulating relations between groups, may also be part of a mechanism, which also includes taboos, for regulating relations between members of the same local group.

2.6.8 Pigs, eels, and fertility

On the day following the abrogation of taboos, eighty-two more pigs were killed. Of these, fourteen were dedicated to the red spirits, one for each man killed in the last fight, and sixty-eight to the spirits of the low ground.

At former kaiko, informants say, the red spirits were told, when pigs were offered to them, that their deaths would soon be avenged. In 1963, however, they were told that because of the new presence of the government it was now impossible to avenge their deaths by natural means, and they were asked to eat the pig offered them so that they themselves might become strong enough to avenge their own deaths by visiting illness upon their slayers.

Addresses to the spirits of the low ground recounted the story of the defeat, the subsequent depredation of the land and desecration of the raku by the Kundagai, and finally, the return of the people to their own territory. Specifically named ancestors who had been invited to other places to receive sacrifices of pork while the living were in exile were now asked to return to their traditional places on their own territory to receive pig. The spirits as well as the living were thus re-settled upon the territory which they had previously abandoned.

All pigs were butchered and cooked at the raku shortly after their slaughter. Men, usually affines, from other places who were to receive entire pigs were at the raku to cook them themselves. The presentations were unceremonious. No speeches of either presentation or acceptance were made. The recipients, after giving their benefactors the return gift of an ax, bush-knife or shell,¹⁵ simply proceeded to butcher and cook the animals presented them. Those recipients who had been allies in the last fight, however, returned the bellies of their animals to the donors to be salted and publicly presented to them on the following day.

Men who were to receive less than an entire animal did not come to the raku. They received their portions on the following day already cooked.

At each raku at least one, and sometimes two female

pigs dedicated to the spirits of the low ground were further designated "koipa pigs". These animals played a part in a ritual which the Tsembaga regard to be of great importance.

As the koipa pigs were killed, the names of specific spirits of rot were called out, and they were asked to take this pig and pass it on to koipa mangian, "the man who gives us eels."

The koipa pigs having been killed, the eels were brought up from nearby streams by processions of young men and boys who carried the cages, decorated with timbi leaves, along the newly cleared paths. Women and girls awaited them at the light archways, made of timbi and other plants, at the termini of these "roads of koipa mangian" on the edges of the raku. The males and females then proceeded together to the bodies of the slain koipa pigs, where the eels were removed from their cages. Holding them by their tails, women, children and unmarried young men flailed the dead pigs with the eels until the eels too were dead.¹⁶ The bodies of the dead pigs were then rubbed with the eels. Informants say that the shoulders of the participants should also be rubbed with the eels, but this was not observed.

The eels were then hung, along with shell valuables and beads, on the center post of the timbi houses, that wealth might increase. Later in the day the valuables were returned

to their owners, and as night fell the bellies of the koipa pigs were placed in the earth ovens inside the timbi houses along with the eels. When the ovens were opened in the morning, if the food was well cooked (as it invariably was), it was said that koipa mangian had come in the night and eaten, and that the people might now partake of the oven's contents so that they, their pigs and their gardens would be fruitful. The spirits of rot were addressed first, being told that the living have given them many pigs, and now that they had eaten their fill they might return to their houses, the large trees in the low altitude primary forest. They were asked to care for crops, pigs, and people so that these might be fertile and fast growing and were promised that when the crops come up they would be fed. They were finally told to take the contents of the ovens and give them to koipa mangian. Everyone, with the exception of fight magic men, terminated their taboo on the consumption of eels by eating from this oven.

The purpose of this ritual is made explicit both in the addresses to spirits and in the statements of informants, all of whom agree that the performance is undertaken to insure the fertility and growth of people, pigs and gardens and the increase of wealth in the coming years.

It is significant that this ritual occurs more or less concurrently with the final fulfillment of obligations

incurred during the ritual cycle just ending, and with the termination of the taboos associated with these obligations. The slate has been, or is being, wiped clean. The local population now stands, or will shortly stand, in a relationship of equivalence or reciprocity rather than obligation to the spirits and allies, and the commencement of a new cycle is being effected.¹⁷

A Maring ritual cycle may be regarded as a series of adjustments in the relations of the people to two generally antithetic sets of spirits. The dominance of the red spirits is continually tempered as the debtor relationship is transformed into one of reciprocity. With the lowering of the fighting stones the way is paved for the reestablishment of reciprocity with the spirits of the low ground and the implication of koipa mangian in future fertility and prosperity.

Each adjustment in these relationships, from the hanging of the fighting stones to the rituals commencing the new cycle, requires the slaughter of pigs. That the size and rate of growth of the pig herd serves as an index to the well-being of the human population has already been pointed out. For a local population to retain its territory after warfare obviously indicates its viability in opposition to similar local aggregates. For it to accumulate sufficient pigs to fulfill its obligations indicates its viability as an ecological and demographic unit as well.

2.6.9 The distribution of pork and the surviving pigs

A total of ninety-six pigs were killed in connection with the rituals of November seventh and eighth 1963. Their total live weight is estimated to have been between 13,500 and 17,000 pounds, yielding between 6,750 and 8,500 pounds of edible flesh.

The flesh of animals dedicated to the red spirits, contributing between 1900 and 2400 pounds of pork to the total, was retained by the Tsembaga, as were the entrails, heads and sometimes other parts of some of the animals dedicated to the spirits of the low ground. Exact calculation is impossible, but it may be estimated that the Tsembaga kept for themselves approximately one third, or between 2275 and 2635 pounds, of the pork resulting from the slaughter of their animals. This estimate of eleven to thirteen pounds of pork available for every Tsembaga man, woman, and child may be lowered by about a pound per capita in consideration of the presentations made to my household. Consumption continued for five days, the flesh being prevented from turning by being suspended over the fire.

The remaining 4475 to 5965 pounds of pork were given to members of other local populations in at least 163 separate presentations in amounts ranging from several pounds of fat or flesh to entire animals. While members of seventeen other local populations were among the recipients, the Tuguma,

Aundagai, Kauwasi and Monambant received much the greatest part of this flesh.

The recipients, of course, redistributed their portions to members of their own and other groups. Almost all Tuguma, Aundagai, Kauwasi and Monambant, totaling in population about 2,000, must have received some Tsembaga pig, and it is not unlikely that over 3000 people eventually received portions from the Tsembaga slaughter.

Seventy-five animals survived the slaughter of November seventh and eighth. Of these, forty were infants and juveniles, twenty-five were adolescents (ninty-six to 120 pounds) and ten were adults (120 to 200 pounds). Of the adults, four survived sacrifice only because they had escaped to the forest and remained marked for imminent killing, two were being saved for the Tuguma kaiko, one belonged to a young man who was away at work and would be killed upon his return, and two were spared because, having just littered, they were thin, and therefore considered to be unfit for sacrifice. Of the adolescent animals, at least four were being held for presentations to affines, with whom food taboos still prevailed at the termination of the kaiko. While those who had refuged in Kauwasi and Monambant formally abrogated the taboos on each other's food stuffs, those who had Kauwasi or Monambant parents or grandparents were to maintain these taboos until the Monambant uprooted their

rumbim. The Kauwasi finished their kaiko a year before the Tsembaga commenced theirs. Several of the other adolescent animals, informants said, were to be killed for the uprooting of the rumbim in Monambant two or three months after the Tsembaga slaughter.

In short, at least fifteen of the surviving pigs were scheduled for slaughter in the near future, and the surviving herd might better be regarded as comprising sixty animals averaging sixty-one to seventy-six pounds each.

2.6.10 Payments of wealth

The konj kaiko is the occasion for wiping the slate clean of obligations to the living as well as to the spirits, and in addition to the pork distribution, twenty-four presentations or exchanges of valuables took place, at the Tsembaga konj kaiko.

Fourteen presentations of valuables, ranging in quantity from six to forty-two items,¹⁸ were made to affines for living wives or for living children that their wives had born. Two death payments were also made to affines. In one instance the brother of a woman dead over twenty years was given thirteen objects. In the other a young man made a payment for the death of his brother to his mother's clan. In addition, three exactly equivalent exchanges of valuables took place in reference

to old Tsembaga women. These exchanges between the women's sons and their brother's sons terminated the series of payments and non-equivalent exchanges which had commenced shortly after the marriages many years earlier.

Other kinds of payments also took place. Two men who had not done so previously made presentations of valuables to men who had given them land during the exile of 1953-1956, and two presentations were made in appreciation of certain services rendered. In one of these the recipient was being rewarded for carrying home from the battle ground the corpse of the donor's father. In the other a man made a small presentation to the local government-appointed head man for bringing food to his wife when a government medical patrol ordered her into the Simbai patrol post infirmary.

In one instance members of one clan "bought out" the claims of another in a young girl. Upon the death of her father, a member of the Tsembaga clan, her mother had taken up residence with her own brothers, members of the Kamangagai, also one of the clans comprising the Tsembaga local population. Members of her deceased father's clan, wanting eventually to exchange her for a woman for one of their own boys, but recognizing that her mother's clan had rights to her because they had raised her, made a substantial payment (nine items) for her to her mother's brothers and mother's brother's sons.

Seventeen of the twenty-four transactions were between Tsembaga and members of other local populations. I know of no instance in which a man obligated to a member of another local population did not succeed in making the payments expected of him, although in one case the amount was thought by the donor to be almost shamefully small.

It has already been suggested that the ability to stage a kaiko indicates the viability of the local population as an ecological and demographic unit. By fulfilling their affinal and other obligations at the konj kaiko through presentations of items of wealth, the members of a local population demonstrate that they comprise a viable unit in the supra-local exchange network as well.

2.6.11 The pave

The pig festival comes to its climax with the ceremonial presentation of salted pig belly and the breaching of the pave, the ceremonial fence.

Many members of other local populations had been among the Tsembaga while the pigs had been slaughtered, and during the following day many more people poured in, both in dancing formations and as individuals, from all friendly groups. By mid-afternoon the dance ground was packed with spectators and dancers; attendance may well have exceeded one thousand people.

Late in the afternoon the heroes' portions of salted pig belly were presented. All of the Tsembaga, with the exception of married or widowed woman and infants in arms, assembled inside the pave enclosure and the packages of salted fat were heaped behind the window. Several men climbed to the top of the structure and from there proclaimed one by one to the assembled multitude the names and clans of those being honored by presentations. As his name was called, each honored man charged toward the pave window swinging his ax and shouting. His supporters, yelling battle cries, beating drums, brandishing weapons, followed close behind. At the window the mouth of the honored man was stuffed with cold salted belly fat by the Tsembaga whom he had come to help in the last fight, and who now also passed out to him through the window a package containing additional salted belly for his followers. The belly fat hanging from his mouth, the hero now retired, his supporters close behind him, shouting, singing, beating their drums, dancing. Honored name quickly followed honored name, and groups charging toward the window sometimes became entangled with those retiring.

Between twenty-five and thirty men were publicly honored by presentations from the pave. Their number did not include all of those who assisted the Tsembaga militarily in the last fight, but rather those members of other groups to whom Tsembaga

were directly connected through kinship or trade, and through whom support had been mobilized, as well as others who had sustained wounds and the sons of those slain. A rough order of precedence prevails, with the wounded and sons of the slain being called first. To be called last is sometimes considered an insult by the recipient, and the Tuguma who found himself in this position refused his portion. Although the Tsembaga kaiko was unmarred by such a conflict, it is also the case that members of one local population may become angered if members of another are called before them. Vayda was witness to such a development in 1962 at the kaiko of the Kandambent-Namikai, at which the members of the Fungai-Korama group not only refused their pig belly but departed early.

The presentations having been completed, the visitors resumed dancing. The Tsembaga, however, still remained inside the pave enclosure, a section of which they now began to push down. As it fell the men, led by those wearing mamp gunc, charged through the breach pounding their drums. They were followed by the unmarried girls. As they emerged the Tsembaga became a dancing formation, one of the many of the dance ground.

Breaching the pave and subsequently dancing with contingents of friends and allies expressed, it may be suggested, breaking through the confines of debt and taboo which had long separated them from other groups. ¹⁹

All that now remained to be done to terminate the kaiko was to uproot the root of the daua variety of rumbim which was planted by the gate when the dance ground was built. This was quickly done, and one of the fight magic men, running, carried it off the dance ground dangling from a string. All the Tsembaga followed him to the bluff where it was disposed of a short distance away. This site overlooks enemy territory and it was in the direction of the enemy that the rumbim root was thrown. Then they removed leaves of the rumbim variety, kamp, from their buttock coverings and threw them after the exhumed root calling out the names of enemy men and yelling "we have finished our kaiko, we are here." Dancing continued through the night, and next morning, after a massive trading session, the crowd departed and the five young men, without ritual, cut off their mamp gunc. The kaiko was finished.

3.0 The termination of the truce and the establishment of peace

With the termination of the kaiko truces which have prevailed since the last fight are also terminated, and in former times warfare usually broke out again in short order. The fighting in late 1952 or early 1953, for instance, began within three months of the end of a Tsembaga kaiko.

There is, however, a means for reestablishing a truce without fighting, and this truce, moreover, terminates in a peace making procedure.

The wreckage of the pave is not cleared away but is, rather, allowed to rot. Its complete dissolution is said to take about three years, about the length of time, it may be noted, that it takes to raise a pig to full size. If fighting has not broken out by this time all adult and adolescent pigs are killed and rumbim and amame are planted. The pig herd is again allowed to reach the limits of toleration, but before the uprooting of the rumbim, peace making ceremonies are jointly held by the erstwhile enemies.

Another rule may be stated here: If a pair of antagonists are able to proceed through two ritual cycles without the resumption of hostilities, they may make peace.

Only few such events have taken place within the memories of even old men, and data concerning the details of the procedure are deficient. Informants do agree that the two sides, after each consults its own ancestors and offers them sacrifices of pig, convene at their common border where they exchange pig livers. Only those whose mothers, or in the case of a long standing enmity, those whose grandparents were members of the enemy group may eat these pig livers. The interdining taboos for others are abrogated over four generations as described earlier.

Women are also exchanged or promised at this time. These women are explicitly regarded as wump, planting material,

through which the slain can be replaced, and the children they bear are named after those whom their brothers, fathers or grandfathers have killed. Ideally one woman should be given for each of the slain, but the Tsembaga say that this will not be possible when peace is made with the Kundagai for the deaths have been too many. They add that many women bear more than one child, however, and it will not take many years for all the slain to be replaced by children bearing their names.

The peace-making procedure, thus, not only terminates the old enmity. It also, through the requirement that women be exchanged, establishes ties between former enemies. The number of new ties established by marriage is likely to be directly correlated to the severity of the former enmity, as measured by the number of deaths each of the participants has suffered at the other's hands, even when the ideal of one woman for each dead man cannot be realized.

4.0 Summary

In this chapter the means by which the duration of the ritual cycle is regulated and the festival which is the cycle's culmination have been described and discussed.

In an earlier chapter it was argued that ritual restriction by the Tsembaga of pig slaughter and consumption during non-festival periods largely to contexts of misfortune and emergency is advantageous since it tends to insure high

quality protein to a people who achieve nitrogen-balance at a low level when they may be under physiological stress.

However, during "good periods," times when misfortune and emergency are infrequent, the ongoing demands for ritual slaughter are exceeded by the natural increase of the pig population. While the possession of some pigs is advantageous to their human keepers, the possession of many pigs becomes disadvantageous because of the excessive labor requirements and destructive abilities of large numbers of pigs.

The kaiko, or pig festival, however, takes place when the mutually beneficial relationship between pigs and people (protein, tuber conversion and sanitary services in exchange for care and feeding) is changing to one of either parasitism (excessive labor demands of pig husbandry) or competition (destruction of crops by pigs). The kaiko may be regarded as a homeostatic element in what has been described as a system because its inauguration is a response to system-threatening increases in the values of one or both of two pig-related variables, and because it functions to return the values of these variables to unthreatening levels.

Metrical estimates based upon field data were presented for the first of these variables, the energy demands of pig husbandry. These requirements were compared to estimates, also based upon field data, of the ability of the human population

to meet them. From this comparison an estimate of maximum pig population size, the size beyond which energy demands upon humans would be system-destroying, was estimated.

No metrical estimate could be presented for the system-destroying value of the second of the pig related variables, the destructiveness of the animals. It was suggested, however, that the number of pigs sufficient to perpetrate an intolerable amount of destruction is inversely related to the density of the human population.

It may be said that ritual demands for pig sacrifice, both those associated with misfortune and emergency and those associated with the kaiko, regulate the relationship of pigs and people in a manner which tends to provide to the people sufficient pigs for sanitary services, the conversion of sub-standard tubers, and emergency protein supplies, while protecting them from possible parasitism or competition from the animals. Ritual, in short, maintains the size of the pig population within what may be referred to as a "range of viability" for the system as a whole. The upper limit of this range is set by the number of pigs "sufficient" to stage the kaiko, i.e. the maximum number of pigs which can be tolerated by the human population. Because the upper limit is likely to remain lower than the carrying capacity of the territory it has further been suggested that the kaiko, and the ritual cycle of which it is

a part, helps to maintain adequate lengths of fallow in the secondary forest and to preserve the virgin forest over areas which, although marginal, could probably support cultivation.

The length of time which is required for the pig herd to reach an intolerable level determines the length of the ritual cycle, which, in turn, further regulates relationships among autonomous local human populations. Aggression by one local population against another is limited to one endeavor during the course of a ritual cycle, and the dispersal of the total regional population over the land is regulated through rituals which take place at specific points in the ritual cycle. Warfare, which if unimpeded could threaten the survival of the small Maring groups, is thus kept within tolerable limits, but at the same time the reallocation of land among the small local populations, presumably an unavoidable concomitant of differences in their demographic fortunes, is provided for.

Peace making is also provided for through procedures which have a particular place in the ritual cycle. One aspect of these breach-healing procedures, furthermore, shows homeostatic characteristics: the number of new ties established between the erstwhile opponents is directly related to the extensiveness of their grievances, since the number of women exchanged is, at least ideally, directly related to the number of deaths incurred as a result of the enmity.

Various other events which form elements of the kaiko have been discussed in relation to their roles in intra- and inter-group relations.

It has been suggested that interdining and food sharing taboos contribute to the maintainance of order within the acephalous Maring local populations, and that taboos on social intercourse may serve to insulate the members of antagonistic local populations from each other. It was further suggested, however, that the indefinite proliferation of such taboos might damage the structure which they maintain. Their abrogation is provided for within the kaiko.

An important role in the movement of goods, beyond that of providing a market-like setting for trade, has also been imputed to the kaiko. It was suggested that the unlimited demand created by kaiko display for certain non-utilitarian valuables is a necessary element in the self-regulating exchange system by which the total supra-local population is provisioned with crucial utilitarian items. It was further suggested that the exchange system may even have contributed to long term adjustments in man-land ratios by moving women from high to low population increase areas.

The kaiko entertainments themselves were interpreted as epigamic and epideictic display behavior. Most attention was given to its latter aspect. While reallocation of land

through fighting involves primarily the territories of the principal combatants, participation in the process is supra-local, involving the support of each antagonist by allies. Through kaiko displays information is transmitted between participating groups concerning the extent of support in forthcoming attempts to adjust or maintain the existing pattern of population dispersal.

It need hardly be mentioned, finally, that the massive pig slaughters which culminate kaiko serve not only to reduce pig herds which are of burdensome size, but also yield large quantities of pork which are widely distributed among a people who are usually in low nitrogen balance.

The role of the ritual cycles of the Maring in inter-local relations bears upon recent discussions of areal integration in Melanesia. These discussions have focused mainly upon the ways in which the movement of goods either in trade (Schwartz, 1962) or in ceremonial exchanges (Bulmer, 1960; Salisbury, 1962) bind together groups which recognize no common superordinate authority. That the exchange system of the Maring, in which the kaiko is implicated, operates, like those described by other authors, to integrate all or many of the groups in an area has been implicit in this chapter. The ritual cycles of the Maring, however, provide more than a means for elaborating the relationships which arise out of economic interdependence

or for formalizing in ceremonial exchanges non-economic interdependence. When attacks may be launched, land annexed, affiliation of personnel changed, and truce or peace established are all specified in terms of the completion of events which form parts of the ritual cycle. It has been shown, in turn, that the completion of these ritual or ceremonial events reflects the state of the relationships of the local population to both human and non-human components of their environment. Events in the cycle, furthermore, particularly during the kaiko itself, serve to assemble, bind together, and transmit information among the autonomous supra-local aggregates which will participate together in the exercise of force. In short, the ritual cycles of the Maring provide both a means for aggregating groups of supra-local magnitude for forceful enterprises and a set of conventions which govern these enterprises.

The numbers of persons whose activities are articulated through the ritual cycle of any local population are substantial. It was estimated that over 1000 persons were present at Tsembaga for the culmination of the kaiko, and the groups from which dancing contingents were entertained during the course of the festival totalled in population over three thousand. Tsembaga pork, it was estimated, also reached three thousand people. Simply in terms of the numbers of people involved, the aggregations formed by ritual cycles rival some of the hierararchical

structures of Polynesia. The Polynesian chiefdoms may also be rivaled in the frequency with which the activities of large numbers of people are mobilized. Information presented by Marshall Sahlins (1958:132) concerning ceremonial food redistributions in Polynesia, for instance, indicates that these events may not have occurred more often on some islands than once a year. While the kaiko of any local population of Maring occur with less than annual frequency, it is not unlikely that in most years a local population would be the beneficiary of a distribution emanating from someone else's kaiko.

There are, of course, important differences between the organizations of Polynesia and the organization of the Maring. In the hierarchical, centralized organizations of Polynesia system-regulation is accomplished through the activities of discrete authorities, chiefs, to whom flows information concerning system-endangering changes in the values of variables which form components of the system, and from whom flow directives meant to return these values to safe levels. Among the Maring, system-endangering changes in the values of variables trigger directly, and more or less automatically, ritual mechanisms which return the values of the variables to safe levels. In short, the locus of the ordering function in the Polynesian organization is in a discrete human authority, the chief, while among the Maring it is in ritual. But in light of the fact

that the activities of large numbers of people are articulated within both the highly centralized Polynesian organization and the extremely acephalous organization of the Maring we may ask anew what are the factors which account for the development or evolution of these two types of organization; in what ways might they affect differently the ecosystems in which they exist; what precisely are the differences in their capacities for articulating the activities of large numbers of people; where lie their comparative strengths and weaknesses. Similar questions have been posed by Sahlins (1963) and Schwartz (1962).

One other aspect of the material presented in this chapter remains to be discussed briefly. Functional analysis indicates that the ritual cycle is of critical importance in the adjustment of the Maring to their environment in that it constitutes a homeostatic mechanism, or a set of articulated homeostatic mechanisms, in what has been described as a system or set of systems. It must not be forgotten, however, that the Tsembaga and other Marings are not necessarily aware of the empirical consequences which this study has imputed to their behavior. Most of the events described in this chapter were explicitly undertaken by the Tsembaga to adjust their relations with two categories of spirits. Fighting involves, in the view of the Tsembaga, the assumption of debts to both ancestors and allies, debts which must be discharged by presentations of pig

at various events in the kaiko before the lands abandoned by enemies may be annexed, before the people, pigs, and gardens may be ritually refertilized, and before warfare may be resumed. Yet the behavior of the Tsembaga appropriate to their relationships with the natural and supernatural entities by which they understand themselves to be surrounded is also appropriate to the empirical relationships in which the anthropologist understands them to participate. Put slightly differently, their behavior in reference to their "cognized environment" is appropriate in their operational environment. Their understandings do not merely constitute a model, accurate or inaccurate, of the world around them; they form part of the mechanism which elicits from them behavior which contributes to their survival in highly specific ways. Their understandings, in short, play an important part in their adjustment to their environment.

FOOTNOTES TO CHAPTER V

1. These are generally first payments to affines. Subsequent payments usually take place at the kaiko. If, when a man takes a wife, a kaiko is to take place within a year or two even the first payment is likely to be delayed until the Kaiko.
2. There are two cyclical rituals which take place during the rumbim truce. The first of these, occurring a year or two after the planting of the rumbim, is concerned with transplanting koni kump amame, pig belly amame, a ceremonial plant, from the men's houses to the women's houses. Each land-holding group kills one pig at this time. Some time later new young men are "struck" by the shamanistic spirit, the smoke woman. Several pigs are also killed on this occasion. Neither of these events, however, constitutes an important demand upon the pig herd.
3. The term "parasitism" is used here, sensu latu, to refer to a relationship between two or more individuals through which one or more are benefited or supported at the expense of others to whom their return is significantly less than equivalent, or to whom injury is done in the process, or both.
4. In a later publication (Brookfield and Brown, 1963:59) the same authors revise their estimate of the pig population at the time of the pig ceremony downward to approximately one pig per capita of human population. This approximates the Tsembaga figure of .83 pigs per capita.
5. During their exile many Tsembaga fled to the Jimi Valley where they took refuge with the Monambant and Kauwasi local populations. These groups were enemies of long standing, and while the Tsembaga were in residence, fighting between them broke out. The Tsembaga not only fought in the ranks of their hosts but, as residents, fought as principal combatants and two were killed. At the time of the Tsembaga kaiko in 1962-1963 those who had refuged in Kauwasi and those who had refuged in Monambant were still prohibited from eating any food grown by each other. Those who had taken refuge elsewhere were also effected by taboos growing out of the battle between the Monambant and Kauwasi. An individual who had taken refuge elsewhere could consume foodstuffs grown both by those who had refuged among the Monambant and the Kauwasi, but he could not share cooking fires with both. If, for instance, he shared cooking fires with those who had gone to the Kauwasi he could at no time eat food cooked over the same fire as food eaten by one

who had stayed with the Monambant. These taboos split all three land holding groups, three of the five clans, and even four sub-clans.

6. This procedure was modified in Tsembaga in 1962. When they were returned from their exile by the Australian government the Tsembaga built no ringi houses because, informants say, the government had imposed peace and ringi could no longer be worn. The fighting stones were hung in men's houses, and it was there that the heads, hearts and lungs were cooked.

7. Spell casting seems to follow invariably a conventionalized pattern. Each phrase is fully formed by the tongue and lips, but no sound whatever is made. After the silent enunciation of each phrase the kunda yu, "magic man," blows on the object to be bespelled. Each phrase is usually repeated three times, and after each repetition a different part of the object is blown upon. When the spell is completed the magic man spits on the object, also usually, three times. Spells, so far as I know, never include invocations to sentient supernatural agencies. The words themselves are thought to be powerful, and it is they themselves which, after being formed in the mouth, are blown onto the object to be bespelled. The spitting at the end, informants say, rids the mouth of any last vestiges of the words, which, if swallowed could, being powerful, produce illness.

The phrases themselves usually deal in analogies. To be applied to the head of a stubborn pig is the following spell, for example: "River Jimi turn/ Ears turn/ River Simbai turn/ Ears turn." This may be more freely translated as "As the River Jimi turns, so may your ears turn to hear (obey) me." I have collected no "extraction and disposal" spells, but would expect that they follow this pattern.

Spells are usually obtained from parents, but may sometimes be obtained in exchange for valuables. Almost everyone knows some garden, pig, and curing spells. Fight magic and andik men spells are, on the other hand, known by a few people. The latter types are considered to be very valuable, but dangerous to their owners, who assume with knowledge of them a number of food taboos for life.

8. This is the only context of which I have knowledge in which raua are attributed to trees.

9. I did not witness this part of the ritual in Tuguma in 1963. I have, however, seen similar performances in other contexts on several occasions.

10. The power of at least some taboos, like the power of spells, thus seems to be found in the words with which it is assumed. Such taboos seem similar to oaths.

11. This ritual was performed only seven days after our arrival among the Tsembaga, and I was permitted to watch only from a distance. It was also not possible for me to attend its performance at Tuguma. This account depends in part, therefore, upon informants' statements.

12. De and wobar refer to melodies, for each of which there are standard refrains but innumerable verses, with new ones constantly being composed or imported. Not all of these are in the Maring language; many of those sung to the wobar melody are in Karam, while some of the de verses are in Narak. The de refrain, moreover, is reported word for word by Luzbetak (1954) in his description of a pig festival among the Nondugi people of the eastern New Guinea highlands.

13. I was at the Simbai patrol post recuperating from illness when kaiko de was inaugurated by the Tsembaga. This brief sketch is based upon informants' accounts.

14. Less valuable bird feathers may form part of daily or visiting dress. Men will frequently wear a single parrot or eagle feather, for instance.

15. This cannot be regarded as payment in any strict sense. A single wealth object may be traded for an infant animal. A full grown pig is worth many times as much. It is not possible to be precise, since full grown pigs are not traded.

16. Eels are hard to kill, and some of them were beaten with sticks as well.

17. It has not been the purpose of this study to discuss the symbolism which may underlie Maring ritual objects or performances. A brief excursion into this area is, however, warranted because it may throw additional light on the structure of the ritual cycle.

What follows, it should be made clear, is my interpretation. The possible symbolic significance of what I had observed did not occur to me until long after I had left the field, and it has not been possible, therefore, to learn to what extent these notions are in error, or even, perhaps, made explicit by the Tsembaga.

It may be that the entire eel ritual symbolizes the pro-creative act, to which it bears some detailed correspondances.

The young men and boys first gather the captured eels, which are said to be the pigs of koipa mangian, a spirit who lives in streams and who, like the water in which he lives, is explicitly associated with fertility. They carry the eels up a newly cut path through an archway where they are met by women. It is not far fetched to regard this as sexual penetration. It is further not implausible to regard the flailing of the carcasses of the female pigs with the eels as orgasm and fertilization, with the pigs representing the female contribution to the embryo and the eels the male. Gestation is perhaps symbolized by hanging the wealth (so that it may increase) with the eels in the timbi house, and by cooking overnight the eels with the pig bellies.

It is also significant that the path up which the young men carry the eels must be a new one. This suggests defloration.

The ritual, in total, seems to me either to be to symbolize a process of cosmic procreation, a new fertilization of both the human population and those populations of plants and animals upon which the human population most heavily depends. As such, the place of this ritual in inaugurating a new ritual cycle becomes apparent.

18. The term "item" refers here to wealth object. Included are gold-lip shells, green sea snail shells, axes, bushknives, cowrie shell bands, trade beads, and fur headbands. These items may be considered to have equivalent values, not because there are standardized rates of exchange between one and others, but because the values of each seem to fluctuate within similar ranges.

19. In light of the previous day's eel ritual, it may have symbolized the rebirth of the local population as well.

CHAPTER VI

CONCLUSION

This study has been concerned with the ways in which ritual is implicated in the relationships of a congregation with its environment. The details of the argument have been summarized at the end of each chapter, and I will not reiterate them. Some remarks of a more general nature are, however, warranted here.

This study may be characterized as "ecological", since it has been concerned more with the relations of a group to its environment than with relations within the group. Many approaches within anthropology are designated ecological, however, (Helm: 1962; Vayda and Rappaport: in press), and it would be well to make explicit that which has been implicit throughout this study.

Despite the importance imputed to ritual, which is, as defined in this study, so far as we know a specifically human phenomenon, the frame of reference within which it and other components of culture have been viewed has been borrowed from animal ecology. The Tsembaga, designated a "local population," have been regarded as a population in the animal ecologist's sense: as a unit composed of an aggregate of organisms having in common certain distinctive means whereby they maintain a set of shared trophic relations with other living and non-living components of the biotic community in which they together exist.

Tsembaga territory, moreover, has been regarded as an ecosystem, a demarcated portion of the biosphere that includes living organisms and non-living substances interacting to produce a systemic exchange of materials among the living components and between the living components and the non-living substances.

This demarcation was guided by particular analytic goals but it is not completely arbitrary. The ecosystem is discriminated here in terms of trophic exchange, and the Tsembaga alone among human aggregates are directly involved in trophic exchanges with the non-human entities with which they share their territory. Conversely, the Tsembaga are not directly involved in trophic exchanges with non-human entities existing within the territories of other local populations. This demarcation is not unduly anthropocentric, for the cycling of materials in which trophic exchanges result is highly localized in tropical rain forest communities.

The relations of the Tsembaga with entities external to their territory have also been considered. Neighboring human groups are as significant to the Tsembaga as such other components of their environment as the secondary forest in which they plant their gardens and the primary forest in which they trap marsupials. As they participate in a set of trophic exchanges with members of other species in their immediate or

territorial environment, so do the Tsembaga participate in a set of exchanges involving genetic materials, personnel, services and goods with members of other local human populations living on other territories.

The concept of the ecosystem, however, which provides a convenient frame or model for the analysis of inter-specific trophic exchanges occurring in limited geographical areas does not, it seems to me, comfortably accomodate intra-specific exchanges taking place over wider areas. These are more appropriately seen within the framework of a regional population model. The relations of the Tsembaga to the total of other similar local human populations in their vicinity resembles the relations of local aggregates of other animals to the totality of their species occupying a more or less continuous area. It is for this reason that the term "local population", rather than simply "population" has been used in reference to the Tsembaga. The term "population" or "regional population" has been reserved for the more inclusive aggregate composed of the Tsembaga and their neighbors. This larger aggregate resembles what geneticists mean by the term population. I take this to be an aggregate of interbreeding organisms persisting through time, and either living or capable of living in isolation from similar aggregates of organisms of the same species. This is the unit which geneticists see to evolve, and this is the unit

which persists through long periods of time while its constituent sub-units (such as the Tsembaga) are more or less ephemeral.

Some confusion seems to exist in the literature in the use of the term "population". The aggregates of organisms discriminated from the same continuous mass by the criteria of participation in a set of trophic exchanges on the one hand and of interbreeding and isolation on the other, will frequently be different, and the unit referred to is often not made explicit. This is due, in part, to the ambiguity and vagueness of the phenomena themselves. Such ambiguity and vagueness certainly exist within the phenomena under study here, and for this reason it has been suggested that the larger aggregate consisting of the Maring and their neighbors only "resembles" the population of the geneticist. The extent to which this aggregate is isolated from others is slight and whether it would be capable of surviving in total or near total isolation is to be questioned. Furthermore, it is through this larger unit that adjustments in the dispersal of the sub-units, such as the Tsembaga, over the total area occupied is effected. This would seem to have more to do with the trophic than with the genetic requirements of the population. Despite the difficulties in bounding or even defining this larger aggregate, however, it is clear that the Tsembaga depend for their physical survival upon their relations with other of the sub-units composing it. Ecology, in

a broad sense, is concerned with all of the mechanisms by which populations maintain themselves and persist through time, and crucial supra-local relations in which the Tsembaga participate were therefore considered here.

As ritual has been regarded as part of the means by which the local population maintains itself in the ecosystem in which it participates, so has it been regarded as part of the distinctive, conventionalized means by which the more inclusive regional population disperses itself over the land, reproduces, provisions its parts and communicates information among them. As such, ritual and ceremonial behavior seem to have functional counterparts in the conventionalized behavior of other species (Wynne-Edwards 1962, 1965). The formal aspects of ceremonial, moreover, bear a close resemblance to behavior widely found among non-human forms throughout a number of phyla.

The material relations of organisms or aggregates of organisms to components of their environments are regarded in ecological study to be systemic or at least possibly systemic. The method of functional or cybernetic analysis, which has as its goal the elucidation of systemic relations and homeostatic mechanisms, is therefore appropriate to their study. Events or entities deemed to be relevant were treated here as variables in a system, and values, or ranges of values, in most

instances based upon data collected in the field, were assigned to these variables when it was possible to do so.

It might be well to pause here and call attention to the reliability of the values assigned to the several variables. Appropriate cautions were issued or implicit in the course of discussion as the values were assigned, and the methods by which the values were derived have been spelled out in appendices. It should nevertheless be stated again that the measuring techniques were sometimes crude, and in some instances statistically insufficient. It should be kept in mind that these data result from the efforts of an anthropologist without special training in such fields as botany, nutrition, and surveying. To point this out is neither to defend nor to denigrate the worth of the data. It is simply to characterize them, and to draw attention to the need, if ecological studies are to show increased refinement, for anthropologists to be supported by personnel with training in other fields.

The ecological relations of the Tsembaga have been treated in this study as a system, or set of interlocking systems, in which ritual forms an integral part. It should perhaps be made clear that no suggestions have been made in this study concerning the origin of these rituals. As Durkheim pointed out in 1895:

To show how a fact is useful is not to explain how it originated or why it is

what it is. The uses which it serves presuppose the specific properties characterizing it but do not create them. The need we have of things cannot give them existence, nor can it confer their specific nature upon them. It is to causes of another sort that they owe their existence (1938:90).

It may be mentioned, in regard to their origin, that ritual components formally similar to those of the Tsembaga are found among other New Guinea highland groups. Massive pig slaughters are, of course, widespread, and such elements as "red spirits", ceremonial fences, and structures resembling timbi houses have been reported for a number of groups. (Bulmer 1965; Luzbetak 1954; Read 1955; Reay 1959; Newman 1964). The ritual use of Cordyline fruticosa is also extremely widespread, being found as far away as the Philippines (H. C. Conklin, personal communication). The way these components are arranged in particular events and in particular ritual cycles seems to show, however, considerable variation. The data are not sufficient, but it may be suggested, in the light of the functions of ritual among the Tsembaga, that ritual regulation may be widespread in New Guinea, and that variations in ritual may be the result of changes brought about by differences in the ecological circumstances of various populations. "Cultural drift", a process analagous to gene drift, may of course be involved, but it is not implausible to suggest that as variables and the relations

among them vary so do the mechanisms which regulate them.

A related point should be made explicit here. This study has been concerned with aspects of Tsembaga and Maring environment, physiology, demography, psychology, economic, social and political structure, and religion: phenomena falling into classes which have frequently been assigned to several "levels". Some social scientists have argued strongly that events or processes occurring in each level are essentially autonomous in respect to events and processes occurring on other levels, and that explanations which cut across levels are either reductionistic or reifying.

The notion of levels has been a useful device for organizing science, dividing the study of nature, so to speak, among the various disciplines. The sociologist O. D. Duncan has recently recognized the importance of the concept of levels in the sociology of science stating, somewhat pejoratively, that "its major contribution to the history of ideas has been to confer legitimacy upon the newer scientific approaches to the empirical world that, when they were emerging, had good use for any kind of ideological support. (1961:141)."

Duncan is perhaps too harsh. In addition to its usefulness in the organization of science, the concept of levels may also be of use in the ordering of data, particularly when ontological explanations are sought. But it is, at best, only

one way of ordering data. The concept of the system, which presupposes the interdependent variation of a number of elements without consideration of their ontological status, is another. Systems discovered in or constructed out of relationships observed in nature may, and frequently do, cut across levels, and the question of level autonomy is irrelevant to them.

While the frame of reference of this study has been taken from animal ecology, and while the method of the study has been that of functional analysis, the focus has been upon ritual, and "manifest" and "latent" functions have been suggested for various ritual and ceremonial events. Some of these proposals, particularly those concerned with the role of ritual and taboo in the containment of conflict, have been in the nature of post facto interpretations of observed or reported events and are probably unamenable to empirical validation. As such, they are vulnerable to the criticisms leveled against "classical" functional analysis by such writers as Carl Hempel (1959). But these suggestions have been only incidental to the main concern of this study. The emphasis here has been on the homeostatic function of ritual.

Religion as a homeostatic mechanism has recently been discussed by Miller (1964). Arguing against a growing tendency to discriminate in human phenomena separate and independent "systems" (e.g., cultural system vs. social system, religious

system vs. secular system), he states that "Cultures are the viable systems for study, and are the only wholes we can isolate. Cultures have a 'command pattern', a structure, which is extended throughout the system.....and keeps it viable as a system moving through time (p. 94, his italics)". "Command" is earlier defined as "the locus of the ordering operation in a self-organizing system", and is identified by Miller as religion.

That ritual and the understandings that elicit ritual behavior comprise the "locus of the ordering operation" in the systemic relationships with which this study has been concerned does not need further reiteration. The examination of the role of ritual among the Tsembaga would suggest disagreement only with Miller's assertion that "cultures are the viable systems for study and are the only wholes we can isolate." Culture has been regarded here not as itself a whole, but as a part of the distinctive means by which a local population maintains itself in an ecosystem and by which a regional population maintains and coordinates its parts and distributes them over the available land. That which is regulated by the command pattern of belief and ritual does not consist merely of the interrelations of other components of the culture. It consists also of interactions between organisms. It does not seem improper to refer to the aggregate composed of the Maring and some of their

neighbors as a "ritually regulated population." Not all of the organisms subject to ritual regulation, moreover, are human. Relationships between many components of the flora and fauna are affected in important ways. As it is appropriate to term the Tsembaga and surrounding people a "ritually regulated population", so may it be appropriate to refer to the systems in which the constituent local populations participate as "ritually regulated ecosystems."

In the first chapter it was argued that the application of a model borrowed from animal ecology in no way impedes the study of ritual. This in itself hardly serves as a warrant for the procedure. The application, however, of common concepts, approaches and principles to a wide range of seemingly disparate phenomena may permit generalizations of broader scope and applicability than are permitted by separate and special explanatory procedures. It has been to this end that ritual has been set in a frame of reference which may also accommodate the behavior of animals other than man. Although some suggestions have been made, no such cross-cultural or cross-species generalizations have been advanced, for this study has been population-specific. But it may have at least become clear that in the details of man's participation in the biotic communities in which he has his being there is much to illuminate not only his social, economic and political organization, but his religion

as well. The study of man the culture bearer cannot be separated from the study of man, a species among species.

APPENDIX I

TABLE 11

Rainfall - Tabibuga and Dikai (Tsembaga Territory)

Month	Tabibuga			Dikai (Tsembaga Territory)			
	Lowest Monthly Rainfall 1959-1963 Points	Highest Monthly Rainfall 1959-1963 Points	Average Monthly Rainfall 1959-1963 Points	Monthly Rainfall Dec. 1, 1962 - Nov. 30, 1963 Points	Monthly Rainfall Dec. 1, 1962 - Nov. 30, 1963 Points	Number of Days Rain Fell	Number of Days Sun Shone
December	664	1626	1226	1626	1879	29	18
January	550	2167	1216	586	770	22	27
February	365	2001	1386	365	676	14	28
March	1420	1823	1511	1432	1106	incom- plete	incom- plete
April	568	2044	1437	568	1171	26	20
May	391	1410	832	391	873	18	20
June	199	799	507	779	900	24	21
July	260	1211	589	410	703	18	24
August	338	873	637	733	1495	28	24
September	610	1401	897	1401	2020	26	20
October	676	1769	1107	1769	1919	27	23
November	974	1734	1086	943	1877	21	18
	Lowest Yearly Total	Highest Yearly Total	Average Annual Total	Annual Total	Annual Total		
Totals in points	11003	14068	12888	11003	15389	253+	243+

(1 inch = 100 points)

APPENDIX II

TSEMBAGA SOILS

Data on soils are scanty. One hundred eleven samples were taken from various locations on Tsembaga territory. These were, unfortunately, delayed in transit for almost one year, during which time they were damaged. Only nine could be salvaged. The results of their analysis by Dr. Hugh Popenoe, Director, Department of Soils, University of Florida, are presented in Table 12 below.

Dr. Popenoe's discussion of these results may be summarized as follows:

The fact that the pH values of the soils are low, although the nutrient contents are high in comparison to them, would indicate that the samples are probably very high in organic materials.

In most tropical forest soils high organic matter contents are found in the top soil, in the surface litter and A horizons, below which the organic material diminishes and the mineral content increases. Samples 2, 3, and 4 constitute an example of this point. Although sample 3, from the A horizon (gi miña: black earth) which terminates at a depth of only six inches has a low pH, its nutrient content is much higher than

that of either sample 2 or 4, which were taken from the B horizon (miña añengi: red earth) at the same site (sample 2 was taken from the same boring).

The nutrient contents of all three of these samples is low, although that of sample 3 is adequate for crop production. Since, however, this is the top soil, and fertility is mostly tied up in the organic fraction, these nutrients would, according to Dr. Popenoe, probably be lost in a year or two of heavy cropping. (Street and Clarke question this point.) The surface litter from this location was among the samples lost. In this location it was 1 to 1½ inches in depth, and if it were of a richness comparable to either sample 42 or 69, it would enhance fertility, at least in the short run, considerably. The site from which these samples were taken was a newly cut but not yet burned garden in secondary forest estimated to be twenty to twenty-five years old.

Sample 13 is top soil, and also would be impoverished after a year or two of cropping. (This sample was taken about one year after this garden had been abandoned following two years of cropping. Its poverty as compared to sample 3 cannot, however, necessarily be ascribed to gardening, since the sites are separated by over 1000 feet.)

Sample 42 is sufficiently rich to support a permanent agriculture if no water table or erosion problems exist. Sample 69 is also very rich. (Both of these samples are of surface litter, however, and are only 1.2 inches in thickness. It is doubtful whether this would be sufficient for permanent cultivation.)

Sample 74, which was taken from the B horizon in a garden abandoned two years earlier after two years of cropping, is very poor.

Sample 89 appears to be "the best general soil" for agriculture. Despite the fact that this sample came from the B horizon, it is quite high in nutrients, and might support a "very good agriculture."

Dr. Popenoe concludes that "in general the soil samples appeared to be very low in nutrients and for these soils one might suggest that the crop rotation or swidden cycle helps to maintain the fertility of the soil for crop production."

TABLE 12

Tsembaga Soils

Sample Number	Swidden Number	Year Planted	Altitude	Ground Name	Vegetation when sample taken	Depth	Horizon	Native soil type	pH	CaO ppm	MgO ppm	P ₂ O ₅	K ₂ O	NO ₃	O.M.
2	68B	1963	4400	Tipema	Advanced Second forest (not yet cut)	Below 6"	B	añengi (red)	5.2	619	218	Trace	24	very low	
3	"	"	"	"	"	1"-4"	A	gi miña (black)	4.5	1029	880	0.5	501	very high	
4	"	"	"	"	"	4"-7"	B	?	4.4	208	382	1.0	232	very high	
13	Oa	1960	"	Gomrup	Young second growth trees and grasses	1"-4.5"	A	gi	4.8	833	428	1.0	459	very high	
42	25A	1961	4800	Yindokai	Sweet potatoes secondary growth	0-1.2"	litter surface	ñeñun	5.1	8928	3676	14	666	very high	high
67	---	1958	4200	Gerki	Imperata; few trees	1.2"-3.4"	A	gi	4.6	645	382	1.0	146	very high	
69	19A	1962-1963	5000	Tendopen	Crops; grasses, mostly Imperata	0-1.2"	litter surface	ñeñun	5.2	7526	702	6	542	very high	high
74	---	1959	4400	Gomrup	Few trees, advanced secondary forest	Below 10"	B	añengi	5.0	99	498	Trace	73	very low	
89	---	1943	3500	Porakump		Below 8.1"	B	añengi	5.3	4995	1562	2.5	792	very high	high

APPENDIX III

FLORISTIC COMPOSITION OF PRIMARY FOREST

A. Low altitude high forest (wora geni), 2200' - 4000'

Low altitude high forest survives only in remnants. These are limited in size (the largest covering less than five acres) and are found only in special locations, such as on the crowns of knolls and on the saddles of ridges. The removal by man of the primary forest from adjacent areas has resulted in the increased penetration of sunlight into the lower strata of the remnants of this association. This has undoubtedly had an effect upon the floristic composition of these strata. It may be that the composition of the lower strata has also been affected by the absent-minded hacking of those who walk through with ax or bushknife in hand.

No forest census was undertaken in the low altitude high forest. In one knoll top location 3.2 acres in area the presence of A stratum trees was noted, however. These included six native taxa in at least four families as follows: nun (Fagaceae, Quercus sp.); banc^v, (Magnoliaceae, Elmerrillia papuana); kinde (Sapindaceae); ana (Sapotaceae, Planchonella sp.); tuem (unident); and dambi (unident). Other common A stratum trees noted elsewhere in the low altitude high forest included

Spondias dulcis, Pangium edule, Aleurites moluccana, Araucaria hunsteinii, Eugenia spp., Ficus spp. and representatives of the Lauraceae family

B. High altitude high forest (kamunga geni), 4500' - 6000'

The entire area above a line ranging from 5000' to 5500' is under unbroken high forest. Both the structure and composition of this association are easier to observe than in the lower altitude remnants. A forest census was undertaken at Tendopen, altitude 5000', on a plot 200 x 17 feet. The survey is summarized in Table 13. Because of the difficulties in securing adequate botanical samples from the large trees, most of the components of the A stratum remain unidentified.

TABLE 13

Survey of High Forest at Tendopen

Altitude 5000'

(Survey Plot 3325 sq. ft.; 200' x 17')

Native Name	Spec. No.	<u>"A" Stratum</u>		Native Category	Identification	Comments
		Circumf.*	Lowest Branch (est.)			
dukumpina	256	6'2"	50'	apuñ		
munduka	93	7'3"	60'	apuñ	Dilleniaceae, Dillenia sp.	
yangra		7'	70'	apuñ		Buttress Roots

Table 13, continued:

Native Name	Spec. No.	Circumf.*	Lowest Branch (est.)	Native Category	Identification	Comments
dumbi		3'	60'	apuŋ		
yimboka		5'6"	70'	apuŋ		Buttress Roots
yimunger		2'5"	60'	apuŋ		
dupai	381	5'6"	40'	apuŋ	Lauraceae, Litsea sp.	
mifingambo	334	3'	50'	apuŋ	Rubiaceae, sp.	
yendek	286	6'	60'	apuŋ		Buttress Roots

Total A Stratum: 9 Trees

"B" Stratum

rama	143	3'	25'	apuŋ	Urticaceae, sp.
todomane	76/84	1'8"	15'	apuŋ	Theaceae, Ternstroemia, sp.
ger	365	3'	25'	apuŋ	Euphorbiaceae, Codiaeum variegatum (L)
kina	223	2'6"	15'	apuŋ	

Total B Stratum: 4 Trees

"C" Stratum
(Circumference over 6")

dimbi (2 spec.)		8"			
aimam	238	6"	15'	apuŋ	Araliaceae, Boerlagiodendron, sp.

Table 13, continued:

Native Name	Spec. No.	Circumf.*	Lowest Branch (est.)	Native Category	Identification	Comments
wombo (2 spec.)		6"	15'	apuŋ		
ameŋgi	152A	6"	15'	apuŋ		
ringanč (5 spec.)	238	12"	10'	apuŋ	Moraceae, Ficus trachypison	
tandomane	76/84	9"	12'	apuŋ	Theaceae, Ternstroemia sp.	
dupai	381			apuŋ	Lauraceae, Litsea sp.	
koib	245	6"	20'	apuŋ	Anacardiaceae, Semecarpus, prob. magnificans	
rambai		6"		apuŋ		
da	404/312	6"	8'	apuŋ	Lauraceae, Cryptocarya	

Total C Stratum: 16 Trees

"D" and "E" Strata

I. Other varieties of trees, circumference under 6" (N.B. species found in A, B, and C Strata not reported here even if present)

tamp apuŋ

mambruŋ apuŋ

II. Shrubs, Grasses, Vines, etc.

Form

koringi 109 pikai Urticaceae, Ground
Elatostema sp. shrub

Table 13, continued:

Native Name	Spec. No.	Circumf.	Lowest Branch (est.)	Native Category	Identification	Form
anjomar	83			pikai	Zingiberaceae, Alpinia sp.	Ground shrub
teraipindpinda	134			bep	Polypodiaceae, Dennstaedtia sp.	Ground shrub
kabaŋ bep	213			bep	Cyatheaceae, Cyathea rubiginose (Brause) Domin.	Supported on tree branches but rooted in ground
dongai	137			bep	Marattiaceae, Angiopteris sp.	Ground shrub
morameka	113/259			gaua	Piperaceae, ?Piper sp.	Climbing vine
kriŋa	182			gaua	Pandanaceae, Freycinetia sp.	Climbing vine
gaŋiŋgai				pikai	Urticaceae, Elatostema sp.	Ground shrub
mopaka	263			gaua	?Moraceae, Ficus sp.	Climbing on mundoka (Dillenia)
✓ mocam	129			pikai	Araceae, Aglaonema sp.	Climbing vine
tiwaka				gaua		Ground shrub Climbing on dukumpna, climbing vine

Table 13, continued:

Native Name	Spec. No.	Circumf.	Lowest Branch est.	Native Category	Identification	Form
terai	134			gaua	Polypodiaceae, <i>Dennstaedtia</i> sp.	Fern vine, climber on dukumpi climber vine
kwiop	4/48			bep	Polypodiaceae, <i>Polypodium</i> sp.	Growing on small rambai tree, fern vine - climber vine
yindim				bep		Ground shrub
kwiopmai				gaua		Climber fern - climber vine

* 3' above ground, or above buttresses

Other A stratum trees noted outside of the survey area included, in addition to many native taxa for which identifications could not be obtained, representatives of at least seven families. These are summarized below:

TABLE 14

Identified A Stratum Trees Noted Outside
Survey Plot, Tendopen

Family	Genus and Species	Native Name
Euphorbiaceae	Macaranga sp.	konjenipai
Fagaceae	Quercus sp.	nun
Lauraceae	Breilshniedia sp.	kom
Lauraceae	Cryptocaria sp.	kauit
Lauraceae	Cryptocaria sp.	da
Lauraceae		boko
Lauraceae		gumbian
Magnoliaceae	Elmerrillia papuana	banc [✓]
Myrtaceae	Eugenia sp.	apeŋ
Myrtaceae	Eugenia sp.	nonomba
Rubiaceae		miñingambo
Winteraceae	Bubbia sp.	ruiman

The floristic richness of the B and C stratum is also hardly illustrated by the census. Elsewhere between five and six thousand feet representatives of the Cunoniaceae, Guttiferae, Leguminosae, Melastomaceae, Myrtaceae, Palmae, Pandanaceae, Podocarpaceae, Rutaceae, and Saurauiaceae families were noted, as well as additional native taxa among the Euphorbiaceae, Lauraceae, Moraceae and Urticaceae.

Noted elsewhere in the "D" and "E", or ground strata were members of the following families: Balsamiferae, Compositae, Orchidaceae, Polygonaceae, Rubiaceae, Tiliaceae, Violaceae, and Umbellaceae, as well as further representatives of families found on the survey plot.

Among large climbers noted between five and six thousand feet were Anonaceae, Pandanaceae, Rubiaceae and Moraceae species. Strangling figs were prominent among the latter. The small climbers included members of the Convulvulaceae, Ericaceae, Flagellariaceae, Gesneriaceae, Passifloraceae, and Rosaceae, as well as the families found in the survey plot. Ferns, particularly Asplenium, Lycopodium, and Nephrolepis are abundant among the epiphytes, as are several native taxa among the Orchidaceae, and epiphytic Araceae are present. Mosses cover the lower trunk of many B and C stratum trees and are present in patches on the trunks of the larger trees.

C. Moss forest (kamunga geni) 6000' - 7000'

Among the tallest trees in the moss forest are members of the Lauraceae, particularly species of Litsea and Cryptocarya, as well as Eugenia, with occasional individuals attaining an

estimated height of one hundred to one hundred twenty-five feet. In addition to the Lauraceae and Myrtaceae, Guttiferae, Loganiaceae, Melastomaceae and Moraceae are well represented among the trees. An Astronia (Melastomaceae) species is particularly abundant. A wild Musa sometimes achieves a height of sixty or seventy feet, and above 6500 feet two native taxa of Pandanaceae, probably separate species of the genus Pandanus, become plentiful. Both attain heights of over eighty feet. Elatostema remains abundant on the ground, where representatives of the Chloranthaceae and Marantaceae families, as well as various ferns, particularly Dawsonia and Polypodium, are common. Vascular epiphytes and climbers are less common than in the high forest, but epiphytic mosses are much more luxuriant, completely covering the lower trunks of most trees to a depth of one inch or more.

APPENDIX IV

ESTIMATING YIELDS PER UNIT AREA

In the cases of both taro-yam and sugar-sweet potato gardens figures are based upon the harvesting records of three gardens. This was necessary because the period of field work, fourteen months, was considerably shorter than the life of any garden, figured from planting to abandonment. Moreover, harvesting records could not be commenced immediately upon arrival amongst the Tsembaga: it was necessary first to win the confidence and cooperation of the people. Harvesting records, thus, commenced on February 14 and terminated on December 14, 1963.

There was, thus, a two-month period of the year for which no records were compiled.

For the first twenty-three weeks of both the taro-yam garden and the sugar-sweet potato garden harvesting figures from the garden of Morump and Mer at Torpai (3900-4000 feet) were used. This was a mixed garden, resembling taro-yam gardens more closely than sugar-sweet potato gardens. It would have been preferable to use, for the sugar-sweet potato gardens, figures from a true sugar-sweet potato garden but, as has already been mentioned, no true sugar-sweet potato gardens were

being made in 1963 because the reduction of the pig herd was imminent. The expedient settled upon, however, that of using the Torpai garden figures for both types of gardens, is not misleading. The two are very similar until the tubers ripen. Some adjustments were made, however. While all of the Torpai harvesting figures were used directly for the taro-yam garden, some of them were halved for the sugar-sweet potato garden computation. These included the figures for kwiai (Setaria palmaefolia), ira (pumpkin), yibona (gourd, ? Lagenaria), cenmba (Rungia klossi), and miscellaneous greens. It is perhaps the case that a further adjustment should have been made for pika (cucumber). In any event, these are low calorie foods and, with the exception of cucumber, the yields were small. For the period from the twenty-fourth week after planting until the sixty-sixth week, figures are based, for the taro-yam garden on the garden of Morump and Mer at Kakopai (3800 feet), and for the sugar-sweet potato garden on the garden of Walise and Pambo at Timbikai (4400-4500 feet). Both of these gardens were planted late in the 1962 planting season, and harvesting records exist from the first extraction of the root crops. The Torpai records also include the first extraction of root crops, so it was possible to fit both the Timbikai and Kakopai records to the Torpai record. It

would seem, to put it a little differently, that both Timbikai and Kakopai were planted in late August or early September of 1962, while Torpai was planted in late June of 1963. The nine week gap, thus disappears.

The period from the sixty-seventh week after planting until abandonment is represented, in the case of the taro-yam garden, by the garden of Walise and Pambo at Tipema (4000-4100 feet), and for the sugar-sweet potato garden by the garden of ^VAcimp and Avoi at Unai (4100-4200 feet). In gardens of this age it is not possible, however, to discover signs indicating the age to within a few weeks, and it may be that nine weeks or more of harvesting figures are lost. The gardens, that is, may have been not sixty-seven but seventy-six or even more weeks of age when records commenced. It is quite clear that they were not under sixty-seven weeks of age at the commencement of record-keeping because of the great disparity in root crop production in the last month for which records were kept on Kakopai and Timibikai, and the first month for which records were kept on Tipema and Unai. (The per-acre sweet potato yield, for instance, for the last month of Timibikai production was 638 pounds. The first month of Unai records showed a yield of only 158 pounds per acre.) This is not an infallible indication, for sweet

potato harvesting drops off quite rapidly in any garden when a younger garden begins to produce in quantity. Unfortunately, the data are not sufficient, because of the nine-week hiatus, to know exactly how rapidly.

Despite the possibility of the record being short of some weeks of harvesting figures, no adjustments were made. The Unai and Tipema figures were accepted, that is, as if they did in fact represent harvesting between the 67th and 110th weeks after planting. This has probably resulted in an underestimate of the production for the period. The magnitude of such error, however, in comparison with the total yield of the garden during its entire life cannot be too great.

An additional underestimation results from the fact that my departure from the field terminated in advance of the complete abandonment of the gardens. Some sugar cane and bananas were surely harvested after December 14. Again, the amounts were without doubt insignificant compared to the total harvested during the earlier life of the gardens.

These possible underestimations in regard to the harvesting from gardens over sixty-seven weeks of age are, in a sense, corrective. Both Tipema and Unai are on the government walking track and convenient to later gardens of both Ačimp and

Avoi on the one hand, and Walise and Pambo on the other. They were, therefore, during the period after the sixth-seventh week, harvested more intensively and for a longer period than would have been the case had they been in less convenient locations.

Additional errors may have been introduced by some of the adjustment factors employed. These include factors for non-weighed harvesting, percentage of edible portion, and calories per pound of edible portion. All weighing took place at the women's houses. Some food, however, was consumed without being brought home. Bananas, for instance, are a frequent noon-time snack, and often a tuber is thrown on a fire in the garden at mid-day. On some occasions, moreover, an earth-oven is made in the garden and a full meal is taken there.

Most importantly, the "refreshers," sugar and cucumber, are eaten in the garden during the working period. It was my impression that twice as much sugar was consumed away from the women's houses, where weighing took place, as at the houses. This impression is based upon observations made without a scale, and may be high.

Finally, some foods, notably bananas, sugar, pitpit and greens, were sometimes brought directly to men's houses for consumption, without having been first weighed.

It will be noted that the factors for non-weighed harvesting differ between the earlier stages and the final stage of the gardens. This is because much of the consumption represented by non-weighed harvesting occurs in the course of work, and little work takes place in old gardens.

The edible portion factors were worked out by tests in the field. The samples were small, and there are considerable problems involved in working out edible portions. Even within single varieties of single species there is variation between specimens of different sizes, ages, etc. The edible portion factors determined by tests, however, accorded fairly well with figures found in the literature.

Similar problems may be raised concerning the caloric values assigned to the various crops. These, too, vary within single named varieties of different ages, sizes, or provenience. Caloric values, like other food values, were taken from a literature in which there is often wide disagreement. Where it was possible, the values adopted were those used in other studies, notably that of Hipsley and Clement (1947) in nearby or similar environments. One of the chief virtues is comparability. Sources for the values are listed in Appendix IX.

All gardens have some idiosyncratic features. The gardens from which yield figures were derived are no exception.

Tipema, which represents the 67th to 110th weeks of the taro-yam garden, happened to be totally without Xanthosoma, which is generally planted in wet areas at the bottom of slopes. At Tipema, however, the government walking track forms the lower margin of the garden, and acts as a kind of drainage ditch, rendering an area which would ordinarily be planted in Xanthosoma unsuitable for this crop.

It should also be mentioned concerning Tipema that although the amount of kwiai which was present was extraordinary, it may have been further overestimated. Such an overestimation would make little difference in the total caloric figure, however.

It was already mentioned, in respect to the sugar-sweet potato gardens, that cucumber may be overestimated. A further inaccuracy, or inconsistency at least, lies in the banana figures. While it is the case that more bananas are harvested after the sixty-seventh week than before it, the ratio in most cases would not approach the approximately $5\frac{1}{2}$ to 1 indicated here. With increasing altitude, fewer bananas are planted, and maturation is slower. Timibikai, which is about 300 feet higher than Unai, exemplified this general trend.

APPENDIX V

ENERGY EXPENDITURE IN GARDENING

A. Method:

For the purpose of estimating the amount of energy expended in producing an acre of garden, persons of known body-weight were observed in the performance of each of the gardening procedures. The times necessary to accomplish the various tasks were recorded. These were converted directly into time per unit area, in the case of garden making. In the case of harvesting they were converted first into time per weight of harvested material. Since yields per unit area were known, it was then possible to convert the time per weight figures into time per unit area figures.

Since the body-weights of all persons observed were known, a caloric expenditure per unit of time could be assigned to their efforts in various tasks by reference to Rates of energy expenditure under varying conditions of activity and body size (adults), a table compiled by Hipsley and Kirk (1965:43) upon the basis of observations and gas exchange measurements made among the Chimbu, a highland New Guinea people. This table summarizes caloric expenditure per minute for persons of

various body weights and ages performing twenty-six different tasks.

It could not be assumed, of course, that corresponding procedures of Tsembaga and Chimbu are equally strenuous. Before values from Hipsley and Kirk's table could be adopted, therefore, evaluations had to be made of the level of effort required in the performance of the various tasks. Such an evaluation was arrived at by counting the number of hand movements per minute and by considering other factors, notably the bulk and weight of the materials manipulated. This usually permitted the acceptance of values for particular procedures determined by Hipsley, but in some cases direct adoption was not warranted. Fence making, for example, is not particularly heavy work among the Chimbu, who use much lighter timber than do the Tsembaga. Observation of the procedure among the Tsembaga led me to select Hipsley and Kirk's values for heaviest work rather than the value they present for fencing.

B. Problems with the method:

Several problems with the method are, perhaps apparent, but should nevertheless be made explicit.

It may be questioned, first of all, whether the application to the Tsembaga of figures compiled upon observations

of the Chimbu is justified. It may be noted that the Chimbu live and work in a higher, cooler environment than do the Tsembaga. No adjustment has been made for temperature differences, and it may be that the caloric expenditure values assigned to the Tsembaga for various tasks are therefore slightly high.

The Chimbu, moreover, are larger people than the Tsembaga. While Hipsley and Kirk's figures do include values for body weights within the Tsembaga range, it is possible that some further adjustment would be desirable.

The nutritive statuses, furthermore, of the Chimbu and Tsembaga differ. Venkatachalam (1962:10 ff) indicated that the Chimbu suffer more severely from certain dietary deficiencies than do the Tsembaga. These deficiencies may have affected the values which Hipsley and Kirk derived.

Despite these difficulties, the use of values derived from observations made upon another New Guinea population seemed preferable to the use of less detailed tables based upon observations of European populations. It may be suggested, however, that anthropologists who are concerned to estimate energy expenditure should, if at all possible, arrange to have tests made upon the populations with which they are working.

C. Inter and intra individual consistency

An additional problem is raised by the possibility that the ranges of performance by various Tsembaga in the several tasks involved in gardening were greater than were reflected by the samples upon which evaluations were based. Samples were small. In the case of fence making evaluations are based upon observations of only two workers, for example. For other activities the samples were larger, although always of limited size. There are, however, indications that differences in the performances of various actors or single actors at different times was not great. This is most clearly exemplified in the clearing of underbrush, a highly standardized task, since the composition and density of herbacious undergrowth is similar on most plots in which gardening takes place. The operator removes this material by both uprooting it and by cutting it as close as possible to the surface of the ground with a bushknife. Only on sites on which kunai (Imperata cylindrica) is prevalent is the procedure different. Because its sub-surface structure is rhizomatous, and because the edges of its leaves are razor sharp, no attempt is made to uproot this grass. Where it is plentiful the gardener simply cuts as close to the surface as possible. Such sites are rare, however. On only six out of 381 sites examined was kunai common.

Observations were made upon seven individuals clearing underbrush on three separate days. The results are summarized below in Table 15.

Several remarks are in order concerning the results of this limited sampling. First, if the performances of Avoi, who is elderly and frail, and of Mer, who was by his own statement hurrying, are eliminated the tempo of performance by various actors is quite uniform. Second, the tempo of single actors through time are also quite consistent. It may be mentioned that periods of rest during the course of the work are uncommon, except for a protracted break around midday.

In the case of only one of the workers, Wale, was the area cleared per unit time actually measured by chain and compass. Over a period of two hours Wale cleared at the rate of 210 square feet per hour. Wale, it may be pointed out, is a very small woman, and the larger, stronger men are able to clear larger areas in the same amount of time. I estimated by eye that Nimini cleared about 250 square feet an hour, and that Meñ, an exceedingly muscular man, was working at about the rate of 300 square feet an hour.

A comparison of the energy performances of Wale, Nimini and Meñ may be made by referring to the energy expenditure values

assigned to various activities by Hipsley in his study of the Chimbu. For an individual of Wale's size, medium-heavy garden work, such as the clearing of underbrush, requires the expenditure of 2.35 calories per minute or 141 calories per hour over basal metabolism. A person of Nimini's size, on the other hand, expends energy at the rate of 2.62 calories per minute, or 157.2 calories per hour. At these rates Wale is expending .67 calories to clear one square foot of underbrush, and if the estimate of 250 square feet per hour in Nimini's case is accurate, he is expending .63 calories per square foot. Meñ expends energy at the rate of 3.28 calories per minute over basal metabolism in this task. If the estimate that three hundred square feet are cleared hourly by Meñ is accurate, he is expending .66 calories per square foot.

Harvesting of sweet potatoes shows similar consistency in energy expended per pound of tubers. In a garden about one year of age, Koi, 4' 5½" tall and weighing eighty-seven pounds was timed over a period of eighty-five minutes. Her work involved about seventy-five hand movements per minute during the entire harvesting period, and yielded twenty-three pounds two ounces of tubers. The value assigned her efforts were 1.60 calories per minute, or 5.9 calories per pound of tubers harvested.

Acimp and Walise were also observed in sweet potato harvesting. Their efforts showed slightly poorer results: 6.3 and 6.9 calories expended per pound of sweet potatoes harvested. The tempos at which they worked were similar to that at which Koi worked, but the gardens were somewhat older, fourteen or fifteen months, than the year old garden in which Koi was observed. Yields were, perhaps, beginning to fall off slightly. Informants say that in younger gardens return for work is greater, but no figures were obtained, unfortunately, for sweet potato harvesting in gardens under one year in age.

The data are insufficient, but it may be that the evenness of the tempo both through time and between individuals represents an approach to some sort of energy optimum in which accomplishment (e.g. square feet of land cleared) is maximized in relation to energy expenditure. A much larger set of observations run over persons representing a full range of body sizes would be a worthwhile undertaking. It is possible that such a study would not only yield insights into optimal tempos for particular tasks, but also optimal body sizes for particular tasks or complexes of tasks. It may well be, for example, that the extra energy expended by a 150 or 160 pound man in clearing underbrush would not be matched by additional accomplishment.

The caloric expenditure, that is, might rise well above .66 per square foot. This might illuminate a possible selective factor which has generally been ignored in discussions of evolution, and might have particular relevance to pygmy populations.

D. Comparison of crops:

It may be mentioned that the estimation of the energy expenditure in various procedures involving different crops provides an additional dimension for comparing their desirability to the gardener. For example, the cost of harvesting sweet potatoes, which we take to be 5.9 calories per pound, may be compared to the cost of harvesting Xanthosoma, only 1.1 calories per pound. Using a value of 681 calories per pound for sweet potatoes (see Appendix IX) and 658 calories per pound for Xanthosoma, the ratio of gross energy yield to energy input in sweet potato harvesting is 116:1, while the ratio of gross energy yield to return in Xanthosoma harvesting is 393:1. If corrections are made for the yield of tubers fit for human consumption the disparity between sweet potatoes and Xanthosoma is even greater. Thirty to fifty percent of the sweet potatoes are of small size (under four oz.) which, while edible, are considered unpalatable, being mostly skin. Small Xanthosoma

tubers, having a thinner skin and a rounder shape, are considered to be quite acceptable.

There are at least thirty-eight named varieties of Dioscoria in five different species grown in Tsembaga gardens, and there is a considerable range in the depth at which the tubers mature. The extraction of some types require that holes three to four feet deep be dug, and even the shallow varieties demand for their harvesting excavations of twelve to eighteen inches. While in some instances fifteen to twenty pounds of tubers may be obtained from a single plant this is rare, and it is clear that in terms of energy expenditure the harvesting of yams is less rewarding than is the harvesting of any other root crop. The figure of ten calories per pound, an estimate, is probably too low. The advantage of the Dioscoria, however, aside from their storageability, is just that they do mature at greater depths than do other root crops. Forming as they do a deep lying stratum of edible material which does not impede the development of other more shallow strata they provide the gardener with the opportunity to increase his per acre yield. This advantage of Dioscoria may be sufficient to offset the costliness of harvesting them.

It may be mentioned that it is not only in harvesting

that various crops may have differing energy characteristics. In mixed swiddens of either the taro-yam or sugar-sweet potato types weeds are much more of a problem than they are in the single species stands of Xanthosoma, which are planted at the lower, wetter margins of gardens of both kinds. The broad leaves of these plants generally shade out any other species which may attempt to establish themselves in their immediate vicinity. When the size of the energy expenditure in weeding is examined this difference is seen to be of considerable importance.

E. Energy expenditure in various tasks:

An examination of the amounts of energy expended in various gardening tasks, and their comparison, is also illuminating.

The clearing of underbrush requires considerably more effort than the clearing of second growth trees. Previous to the introduction of steel, moreover, the disparity between energy expenditure in these two operations must have been greater, for while stone axes are quite efficient for felling second growth trees they are poor implements for clearing underbrush. Before the introduction of the bushknife, underbrush was cleared

by laying a pole of three or four inches diameter on the ground, pulling the weeds over this pole and chopping them with an ax. The indication is that the bushknife, at least as far as reduction of energy expenditure in gardening is concerned, was a more important introduction than the ax. (The ax, of course, is additionally more useful in chopping firewood).

The amount of energy expended in fencing, about forty-six calories per linear foot, goes far to explain why the cultivations of a number of gardeners are clustered, and the cost of transporting foodstuffs from the gardens to the houses provides a strong indication as to why the scattering of gardens concomitant to the increasing size of the pig herd is accompanied by a scattering of residences. As noted in Table 5 a reduction of garden to house food transportation by 80% would improve the energy ratio of sugar-sweet potato gardens from 15.9 to 18.4:1, and that of the taro-yam gardens from 16.8 to 20.6:1. It should be mentioned that it is not only food which is carried from the gardens to the houses but also firewood, for swiddens are the most important sources of this important commodity. (When trees are cut to make a garden some of the logs are split and stacked to dry for fuel. After the abandonment of gardens, pollarded trees are frequently felled for fuel.)

F. Comparison with other areas:

Harris, in the unpublished paper already referred to, has assembled estimates of the energy ratios characteristic of several non-mechanized agricultural systems. The Tsembaga ratios, 16.8 to 20.6:1 and 15.9 to 18.4:1, although high, fall within an expected swiddening range. Harris' estimates for swiddening in other areas include Dyak (Borneo) rice swiddens. 10:1 Tepotzlan (Yucatan) maize swiddens, 13:1 on poor land, 29:1 on good land.

Other agricultural systems may be much more efficient: Harris estimates, on the basis of Fei's (1945) data, that energy ratios in wet rice paddies reach 53.5:1 in Yunan. Harris points out that wet rice agriculture is not always so productive, however. Gerieri (Gambia) swamp rice cultivation shows an energy ratio of 11:1 (Haswell, 1953), which is about the same as the energy ratio (10.7:1) derived for their "savannah hoe cultivation" of other grains. Dyak wet rice cultivation, according to Harris, shows an energy ratio of 14:1.

Furthermore, a direct comparison of Tsembaga and Yunan figures may be misleading. Well over ninety percent of the Tsembaga diet is taken from the swiddens, and the energy expenditure figures presented in Table 5 would include some casual

hunting. On the other hand, rice accounts for only seventy percent to eighty percent of the Yunan diet, and we have no estimate of the efficiency of the processes involved in other aspects of the food quest.

Despite the Yunan estimation, it may be possible to say of Tsembaga gardening that although it seems to be characterized by comparatively low yields per unit of area, it shows at the same time comparatively high yields per unit of energy input. This characteristic of Tsembaga swiddening accords well with another of its aspects, i.e., that of disturbing as little as possible the secondary forest community in which the gardening takes place.

High return on energy input may be a characteristic of swiddening in general. Concerning the shifting cultivation of maize by the Amahuaca in eastern Peru, Carneiro says, "all in all, then, Amahuaca shifting cultivation is, in spite of its rudimentary form, thoroughly capable of producing the food abundantly, reliably, and with relatively little expenditure of labor" (Carneiro 1964:18). Concerning Hanunoo dry rice cultivation, Conklin (1957:152) suggests an adjusted value of 2.5 kilograms of unhusked rice (caloric value 3600 calories/kg.) as the return per man hour of labor. He notes, "This rough

estimate compares favorably with labor cost figures for rice production under the best conditions elsewhere in the tropics." Both Carneiro's and Conklin's statements are, admittedly, based upon only partial quantification of the relevant variables, but both are sophisticated and experienced field workers and their remarks are suggestive.

TABLE 15

Clearing Underbrush - Time and Motion Study

Worker's Name	Sex	Estimated Age	Weight lbs.	Time	Hand Movement	Time	Hand Movement	Time	Hand Movement	Comments
Akis	M	20	88	10:37- 10:43	296	11:14- 11:23	250	12:14- 12:20	248	Only one 3 minute break during period. Next longest break: 15 seconds. No breaks longer than 20 seconds during working period. Slower than other workers because of short breaks, and slower strokes. Longer strokes than any of the others. No breaks longer than 20 seconds during working period.
Acimp	F	50	85	10:55- 11:01	244	11:30- 11:36	209			
Avoi	M	55	94	11:02- 11:07	177	11:50- 11:56	190			
Meñ	M	28	120	6 min.	233					
Wale	F	35	76	9:53- 9:59	246	10:58- 11:06	260			
Nimini	M	18	96	6 min.	246					
Mer	M	40- 45	94	6 min.	316					

APPENDIX VI
SECONDARY GROWTH

Chain-transit samples of second growth composition (ringopwai) were taken in six producing gardens between 3400 and 4800 feet in altitude. A total of twenty-one arboreal species was noted, with four to ten species in individual gardens. The most common species were gra (Dodonaea viscosa), specimens of which were in total the most numerous, but which were represented in only four out of six of the gardens, and pokai (Alphitonia iacana), somewhat less numerous than gra but appearing in all gardens. Also common was gapni (Homolanthus sp.), which appeared in five out of six gardens and was almost as numerous as pokai. These three species accounted for forty-three percent of the sample, which included 117 specimens. Table 16 summarizes the composition of the sample. At least eight of these trees, kobenum, kamakai, ganč, gonwant, gum, non, ringanč, and yingra also occur in the primary forest.

There are some differences between gardens in the composition of the arboreal component of their early fallow associations, but it is not possible for me to state to what extent these differences are a function of altitude or of other

factors, such as local edaphic conditions, proximity to virgin forest, or length of the previous fallow.

Figures in Table 16 should not be taken to indicate differences in the prevalence of trees in the various gardens. There are differences, but they are not reflected in the sample.

The speed with which individual trees grow, and the prevalence of trees on the plot varies, roughly, inversely with altitude. More second growth trees appear on lower altitude gardens, and grow faster than in the higher altitude gardens, although this correlation is sometimes masked by local conditions. In one garden at 3600 feet not included in the sample, the average height of second growth trees was estimated, less than eighteen months after planting, to be twelve to fourteen feet, and they were close enough together for their crowns to have almost formed a continuous canopy. This garden, except for some bananas which remained to be harvested, had been abandoned between fourteen and sixteen months after planting. It seems probable that it was the density of the secondary growth which forced this early abandonment. Secondary growth in the higher altitude gardens seems to achieve somewhat less height and considerably less density in similar lengths of time. It is perhaps for this reason that they usually remain in production longer,

sugar and pitpit, as well as bananas being taken in some cases more than twenty-four months after planting in gardens between 4500 and 5000 feet in altitude.

While the development of the arboreal component of the secondary growth may be a direct function of altitudinal differences with attendant variations in temperature and edaphic conditions, it might also be a difference in planting patterns at different altitudes. In the higher altitude gardens there is heavier planting in sweet potato. The presence of sweet potato is said to inhibit the growth of weeds, and it may inhibit the growth of young trees as well. Moreover, the techniques for harvesting sweet potato may result in the accidental removal of young trees.

The floristic composition of the herbaceous component of the second growth previous to the abandonment of the gardens shows about the same richness but somewhat less inter-garden variation than the arboreal component. The composition of the sample collected by the same chain transits is summarized in Table 17.

The sampling technique is less likely to reveal uncommon herbaceous types than arboreal types, and the overall floristic composition of the herbaceous component of early

secondary growth must be richer than the sample reveals. The predominant species, however, are certainly represented. Three types that did not show up should be mentioned. These are ambek (Solanum nigrum), mañyump (Cyathea sp.), and kangup (Cyathea sp.). Ambek appears very early in newly burned gardens and, being edible, is harvested. Mañyump, an edible fern appearing in gardens below 4000 feet, is also harvested. Kangup, also an edible tree fern, appears in gardens as well as ringopwai above 400 feet, is also allowed to mature, and is eventually harvested. Kangup and mañyump are protected, particularly when they appear in pandanus groves.

Edible mushrooms of several named varieties may also be considered to be part of the fallow, appearing on rotting logs and stumps of the cut duk mi.

Kunai (Imperata cylindrica), a notorious pest, is relatively rare in the sample. Prevalence of this grass on a site indicates deflection from a succession leading to an arboreal climax to a succession leading to a stable grassy disclimax, which it dominates. Its rarity in Tsembaga gardens indicates that such a disclimax is not being induced on the sites sampled. Less precise observations made on other gardens indicates that what is true for the sample is true for Tsembaga gardens generally.

The floristic richness of the ringopwai association increases rapidly with age. A survey of an area of several acres at 4800 feet, part of which had been planted three and a half, and part of which had been planted four and a half years previously, showed 118 native named types, most of which represented species. All the arboreal species present were probably reported, but it is possible that a good many less obvious herbaceous species were not.

The arboreal component of this association consisted of at least thirty-six named native types in thirty-two genera and twenty-two families. At least eighteen of these types are also found in the virgin forest and it is possible that at this early age secondary growth already begins to bear a floristic resemblance to the virgin forest characteristic of its altitude. A contrasting survey at lower altitudes of sites which had lain fallow for a similar length of time was not, however, conducted. The composition of the arboreal component of this association is presented in Table 18. Many of the trees on this site were twenty feet high, and diameters estimated at three to four inches were the rule. They were scattered over the area, their crowns not touching. This site was close to the settlement, however, and it is likely that the formation of a canopy was

being suppressed by pigs who, in their rooting, continually destroyed the seedlings appearing in the spaces between the well established specimens.

A census of trees on an 11,010 square foot site at an altitude of 4200 feet which had last been cultivated twenty to twenty-five years earlier, and which was about to be cultivated again is summarized in Table 19. This association seemed less varied than the three to four year old association discussed above. Only twenty-six native named types were noted. Resemblance to virgin forest, however, seemed to have increased; at least eighteen of the twenty-six are also found in the geni.

The large number of the tree fern yimunt (Cyathea angiensis) is unusual. Single species stands of yimunt, or associations approaching single species stands, are regarded by the Tsembaga as indicative of poor soil. The gardeners, however, informed me that the soil was good on this site, and soil sampling showed no special deficiency. There are indications that at an earlier stage in the fallow development on this site, Cyathea shared dominance with the quick-growing types gra (Dodoneae viscosa) and pokai (Alphitonia iacana), which were, at the time of the census, quite obviously being suppressed. Two of the four gra present were moribund.

The structure of this twenty to twenty-five year old secondary forest differed markedly from the structure of the three to four year old association. The sizes of individual specimens are indicated in Table 19. The crowns of the larger trees formed an unbroken canopy over the entire area, so that the ground layer of shrubs, grasses and creeping vines was, except for an occasional sunbeam, in shade.

A further idea of the association is, perhaps, conveyed by the density of trees over six inches in circumference: there were ninety-four square feet per specimen. This seems typical. In intervening spaces, in addition to the sapling types listed in Table 19, rather large yikon (Piper sp.) bushes, or shrubs, were present on the site. Density of undergrowth was not, however, sufficient to impede rather extended visibility five to six feet above the ground.

TABLE 16

Trees Appearing in Tsembaga Gardens Prior to their Abandonment

Family	Genus & Species	Native Name	Gardens and Altitude						Total
			Porakump-3400'	Tipema-4000'	Tapipe-4100'	Unai-4400'	Timbikai-4500'	Bokandipe-4800'	
Cunoniaceae	Caldcluvia sp.	bokanc ^v					2		2
Cyatheaceae	Cyathea angiensis	yimunt		3				6	9
Euphorbiaceae	Homolanthus sp.	gapni	1	2	7	1	1		12
Fagaceae	Quercus sp.	noŋ						1	1
Guttiferae	Garcinia sp.	gum						1	1
Melastomaceae	Melastoma malabathricum	wopkai		2			1		3
Moraceae	Ficus puncens	kobenum					3	2	5
"	Ficus trachypison	ringant				1			1
Rhamnaceae	Alphitonia iacana	pokai	3	1	2	3	4	2	15
Rubiaceae	sp.	ganč ^v		2	1				3
Sapindaceae	Dodonaea viscosa	gra	6		1	3	12		22
Saurauiaceae	Saurauia sp.	gongo		3			1		4
Solanaceae	Solanum sp.	gon		3				7	10
Sterculiaceae	Colona scabra	kamkai		2	1			2	5
Ulmaceae	Gironniera sp.	penda				1	1	2	4
"	sp.	dima		2					2
Urticaceae	Procris sp.	pent pent			2				2
Verbenaceae	Geunsia farinosa	gonwanč ^v						1	1
Unidentified		beknan		2					2
"		mopo					1	2	3
"		yangra	1		5		3		9
Total specimens in sample			11	22	19	9	29	26	116
Total named types represented			4	10	7	5	10	10	21

TABLE 17

Herbs Appearing in Tsembaga Gardens Prior to their Abandonment

Family	Genus & Species	Native Name	Gardens and Altitude						Total
			Trees	Porakump-3400'	Tipema-4000'	Tapipe-4100'	Unai-4400'	Timbikai-4500'	
Balsaminaceae	Impatiens platypelia	korambe		1				1	2
Compositae	Blumea balsamifera	kwirañ	1	25	10	19	16	13	84
"	Microglossa pyrofilia	ringop gaua		1					1
Cyperaceae	Scleria sp.	riai	1		4		1	1	7
Gramineae	Coix lachrimajobi	koŋgun	1	1	12		18	2	34
"	Imperata cylindrica	korndo	1	2	1	1		4	9
"	Isachne myosotis	piŋgo	1					10	11
"	Ischaemum digitatum	bombak				1	1	3	5
"	Paspalum conjugatum	tamo		4	7			4	15
"	Phragmites karka	yamboč						2	2
"	Polytoca aerophylla	wandama						8	8
"	Setaria palmaefolia	korami	3	8	12	4		1	28
Orchidaceae	sp.	tiokum	1		1				2
Rosaceae	Rubus moluccanus	kurkur			1			2	3
Ferns	Cyclosorus ?truncatus	aruk		3			3		6
"	Diplazium sp.	raŋgi lopa					1		1
"	Nephrolepis schlechteri	noma punt mai		1					1
"	Pteris sp.	bor		10			12		22
"	"	Kembor	6	2	1	2			11
Total specimens in sample			15	58	50	43	54	32	252
Total names types represented			8	11	10	8	8	7	11

TABLE 18

Arboreal Component, Secondary Growth,

Pra and Gerki, 4800-5000 Feet

Two-Three Years after Abandonment

Family	Genus and Species	Native Name
Dilleniaceae	Dillenia sp.	munduka
Ebenaceae	Diospyros sp.	wonom
Ericaceae	Rhododendron macgregorii	mer
Euphorbiaceae	Breynia sp.	nommanč
	Glochidion sp.	mbarmban
	Homolanthus sp.	gapni
	Macaranga sp.	apapa
	Mallotus sp.	gongenaga
	Phyllanthus sp.	yuarundo
Fagaceae	Quercus sp.	noŋ
Guttiferae	Garcinia sp.	gum
Leguminosae	Desmodium sequax	koraindindiye
Moraceae	Ficus sp.	bangambai
	Ficus sp.	danje
Myrtaceae	Cleistanthus sp.	timbi
	?Decaspermum necrophyllus	jijimbint
	Octamyrtus durmanni	
	Eugenia sp.	ankunung
	Eugenia sp.	tandapa
Palmae	Licuala sp.	morapmai
Podocarpaceae	Podocarpus sp.	minjaun
Rubiaceae	Mussaenda pondosa	goimbambo
	Psychotria sp.	yuaroro
Sapindaceae	Dodonaea viscosa	gra
	Mischocondon sp.	birpi
Saurauiaceae	Saurauia sp.	rokunt
Solanaceae	Lycianthes sp.	kapaŋ
	Solanum sp.	gon
Theaceae	Ternstroemia sp.	tondamane
Thymelaeaceae	Phaleria nisidae	pukuna
Ulmaceae	Gironniera sp.	penta
Urticaceae	?Leucosyke sp.	nangrek
	Maoutia sp.	nongamba
	Procris sp.	pent pent
Verbenaceae	Geunsia farinosa	gonuant
Unidentified		kumpunai

Total tree species represented: thirty-five

TABLE 19

Census of Trees,

Twenty to Twenty-Five Year Old Second Growth

Tipema, Altitude 4200 Feet

Plot size: 11,010 Square Feet

Family	Genus & Species	Native Name	No. Spec. above 6" circumf.	Largest Spec. circumf. at 3'	Largest Spec. Height Est. Feet
<u>Specimens 6" circumferences or larger</u>					
Casuarinaceae	Casuarina papuana	ndumi	4	3'	60-70
Cunoniaceae	Caldcluvia	bokanč	2	1'6"	30
Cyatheaceae	Cyathea angiensis	yimunt	54	1'8"	25
Ebenaceae	Diospyros sp.	wonum	4	1'5"	30
Euphorbiaceae	Homolanthus sp.	gapni	1	1'4"	25
"	Mallotus sp.	gimbint	2	9"	20
Moraceae	Ficus puncens	kobenum	4	7"	25
"	Ficus trachypison	ringanc	6	1'	20
Myrtaceae	Eugenia sp.	tandapa	1	6"	12
Ochnaceae	Schuermansia meningsii	arare	1	1'3"	20
Rhamnaceae	Alphitonia iacana	pokai	3	2'6"	50
Rubiaceae	Psychotria sp.	bourai	1	4"	20
Sapindaceae	Dodonaea viscosa	gra	4	1'	35
Saurauiaceae	Saurauia sp.	gongo	15	2'6"	35
Solanaceae	Solanum sp.	gon	2	2'	35
Urticaceae	Missiessya sp.	yamo	5	1'3"	25
"		rama	2	10"	20
Unidentified		mopo	4	2'6"	35
"		karinganč	1	3'1"	50
"		marmar	1	7"	15
Total specimens 6" circumference or above:			117		

Other named types present, under 6" circumference

Melastomaceae	Melastoma malabathricum	wopkai
Moraceae	Ficus calopilinia	murunga
	Ficus wassa	kundua
Unidentified		dukumpias
"		punt
"		rangan
Total named tree types:		26

APPENDIX VII

TABLE 20

Commonly Propagated Plants, Tsembaga

Family	Genus and Species	Native Name	Life Form	Use	Where Planted
Acanthaceae	Graptophyllum sp.	yaur	Bush	Landscaping	At houses and raku
Anacardiaceae	Mangifera indica	wowi	Tree	Food (Fruit)	wora
Araucariaceae	Araucaria hunsteinii	yuk	Tree	House protection	At houses and raku
Cruciferae	Roripa (1) nasturtium aquaticum	gonbi	Herb	Food (Leaves)	Shallow stream beds
Euphorbiaceae	Aleurites moluccana	kaba	Tree	Food (Nuts)	Close to houses in wora
"	Codiaeum variegatum	ger	Bush	Boundary mark	On boundaries
Gnetaceae	Gnetum gnemon	ambiam	Tree	Food (Leaves)	wora
Gramineae	Bambusa forbesii	kinjen	Reed	Roofing (Leaves)	kamunga-wora amaj & wora
"	Bambusa sp.	muḡ(2)		Building	Near houses
Leguminosae	Erythrina sp.	yaur	Tree	Food (Leaves)	Near houses
Liliaceae	Cordyline fruticosa	rumbim(3)	Small Tree	Boundary marker and ritual	Boundaries, raku, houses
Moraceae	Ficus wassa	beka (kundua)	Tree	Food (Leaves, Fruit) Fibre Pith	wora
"	Artocarpus sp.	mokoi	Tree	Food (Fruit)	Below 3800'
Myrtaceae	Cleistanthus sp.	timbi	Tree	Ritual	Near wora raku
Palmae	sp.	bina	Tree	Bows, arrows spears	wora
Thymelaeaceae	Phaleria sp.	pukna	Tree	Fiber, pith	Near houses
Urticaceae	Oreocnida sp.	rumen	Bush	Forms hedge	House, raku, Boundaries
Zingiberaceae	Amomum cf. polycarpum	gunuma	Reed	Ritual, Food (Fruit)	Boundaries, Houses, raku
Unidentified		tup kalom	Bush	Dye, Red	Near houses
"		tup rungi	Bush	Dye, Black	Near houses

Footnotes

- 1) European watercress introduced circa 1957
- 2) Many named types, probably species
- 3) Many named types, horticultural varieties

APPENDIX VIII

NON-DOMESTICATED RESOURCES

Information concerning non-domesticated materials utilized by the Tsembaga is presented below. It need hardly be mentioned that these lists cannot be regarded as exhaustive. Each item is listed in the association in which it is most commonly, although not in all cases exclusively, found. Each item is followed by one or more code letters indicating the use or uses to which it is put by the Tsembaga. A key to these code letters follows the Tables.

Bird identifications were made by Dr. Ralph Bulmer, and are tentative.

TABLE 21

Non-Domesticated Resources

Most Commonly Found in the Kamunga Geni Association

(Primary Forest, 5000-7000')

Life Form	Family	Genus & Species	Native Name	Uses
Flora:				
Trees	Anacardiaceae	Semecarpus ?Magnificans	kuip	M
	"	?Pentaspadon or Rhus sp.	karinganc ^v	TFn
	Cunoniaceae	Caldcluvia sp.	bokanc	B
	Euphorbiaceae	Macaranga sp.	kondenpai	Fl (smoked)
	"	Codiaeum variegatum	ger	R
	Fagaceae	Quercus sp.	nun	B

Table 21 continued:

Life Form	Family	Genus & Species	Native Name	Uses
Trees	Guttiferae	Garcinia sp.	gun	R
	"	Garcinia sp.	tandapa	T
	Lauraceae	Breilschmiedia sp.	kom	RF1
	"	Cryptocarya sp.	kauit	RD
	"	Cryptocarya sp.	da	R
	"	Litsea sp.	dapai	RO
	"	?	krim	DTS
	"	?	boko	R
	"	?	gumbian	R
	Leguminosae	Albizzia sp.	kanam	RT
	Loganiaceae	Fagraea racemosa	borumoi	S
	Melastomaceae	Astronia sp.	kukair	RS
	Moraceae	Ficus calopilina	muruj	XM
	"	Ficus dammaropsis	tim-nai	Ff
	"	Ficus trachypison	ringanc	BS
	"	Ficus sp.	gimbo-ndum	XS
	Myrtaceae	Eugenia sp.	nonomba	RD
	"	Eugenia sp.	apej	TD
	"	Decaspermum sp.	dam nene	B
	Palmae	Calamus sp.	kumbaka	T
	"	?	kumur	BSFs
	Pandanaceae	Freycinetia sp.	korainga	T
	"	Pandanus sp.	buk	T
	"	Pandanus sp.	pima	Bff
	"	Pandanus sp.	taba	Ff
	"	Pandanus sp.	tumbama	BT
	Rubiaceae	?	ganč	R
	"	?	miñin gambo	M
	Rutaceae	?	kondup	RF1
	Theaceae	Ternstroemia sp.	todomane	B
	Ulmaceae	?	dima	T
	Urticaceae	?	rama	F1
	Winteraceae	Bubbia sp.	ruimam	D
	Unidentified		aimenga	MD
	"		amengi	T
	"		air	T
	"		koro	B
	"		munr	RS
	"		gambo	TM

Table 21 continued:

Life Form	Family	Genus & Species	Native Name	Uses
Trees	Unidentified		nokopač	M
	"		nombon	X
	"		tingia	T
Shrubs & Herbs	Chloranthaceae	Chloranthus sp.	korap	RF1
			korap muna	
	Cyatheaceae	Cyathea sp.	nongam	D
	Gesneriaceae	Cyrtandra sp.	welence	RF1
	Gramineae	Bambusa sp.	koa	TD
	Marantaceae	Phrynium sp.	mingin	BS
	Marattiaceae	Angiopteris sp.	dongai	R
	Palmae	?	mandinga	BS
	Piperaceae	Piper sp.	kere kere	R
	"	Piper sp.	čerap	S
	Pittosporaceae	Pittosporum undulatum	anbungai	M
	Rutaceae	Evodia anisodora	tumbup	A.
	Tiliaceae	Microcos sp.	ninkmai	Fl
	Urticaceae	Elatostema sp.	gaññai	Fl
	Zingiberaceae	Alpinia sp.	banangoi	RDS
	"	Alpinia sp.	pup-laka	BS
	Unidentified		kopenğa	XFl
	"		bingo	Fl
	"		morno	M
	"		gon-bi	Fl
	"		pup	M
"		tok-mai	O	
"		kwipo		
"		nink amp	RF1	
Vines	Cucurbitaceae		gambroŋgin	T
	"		yibona	FlT
	Ericaceae	Dimorphanthera sp.	ayuk	BS
	Gesneriaceae	Aeschynanthus sp.	koramb	BOS
			andika	
	Monimiaceae	Palmeria sp.	kep ndim	Fl
	Pandanaceae	Freycinetia sp.	kriņa	XS
	"	Freycinetia sp.	kwiŋgaka	O
	Piperaceae	Piper sp.	morameka	RF1
	Urticaceae	Elatostema sp.	ap	M
"		čembamai		
"	Pipturus sp.	deraka	RS	

Table 21 continued:

Life Form	Family	Genus & Species	Native Name	Uses
Epiphytes	Cyatheaceae	Daysonia sp.	ka rawambo	O
	Lycopodiaceae	Lycopodium sp.	ap dingambe	R
	Orchidaceae	Dendrobium sp.	kanj-kai	O
	Polypodiaceae	Polypodium sp.	kwiop	Fl
Birds		Greater Sickle-Bill	karanc	WF
		Epimachus pastobus		
		Six Plumed Bird-Of Paradise	kiawoi	WF
		Lorakeet sp.	kokorapo	WF
		Brush Turkey	komami	F
		Princess Stephanie Bird-Of-Paradise	kombom	WF
		Gardener Bower Bird	kombek	WF
		Megapode	korange	F
		Rail Rallicula sp.	kuņa	F
		Megalurus timoriensis	kwimin	F
		Manucode	mungunc	F
		Haryopsis sp.	binan	WF
		Cassowary	miamia yonge, kombri	WFT
		Oreopsitticus	jimbunĸ	WF
		?	guĸ	F
		King of Saxony Bird-Of-Paradise	nomapunt	WF
		Lorikeet	penjenjiga	W
		Magnificent Bird-Of-Paradise	pienmai	WF
		?	rakenambo	F
		Superb Bird-Of-Paradise	yenandiok	WF

Fungi:

At least 8 native taxa, all unidentified, all used for food

Fauna

Marsupials (ma): At least 16 native taxa, all unidentified, used for food, ornamentation, fibre, hides; some are wealth items

Rats (koi): At least 6 native taxa, all used as food by women and children

Insect larvae (tuma): One native taxon, found in stumps, highly prized food.

TABLE 22

Non-Domesticated Resources

Most Commonly Found in the Wora Geni Association

(Primary Forest, 2200-4000')

		Tsembaga		
Life Form	Family	Genus & Species	Native Name	Uses
<u>Flora:</u>				
Trees	Anacardiaceae	Mangifera sp.	wowi	Ff
	"	Spondius dulcis	aipan	R
	Araucariaceae	Araucaria hunsteinii	juk	T
	Casuarinaceae	Casuarina papuana	jimi	ASB
	"	Casuarina sp.	kepir	ASB
	Euphorbiaceae	Aleurites moluccana	kaba	Fn
	Flacourtiaceae	Pangium edule	topia	R
	Leguminosae	Erythrina sp.	yaur	F1
	Magnoliaceae	Elmerrillia papuana	banc	R
	Pandanaceae	Pandanus sp.	miyom	B
	Sapindaceae	Planchonella sp.	ana	A
	Vitaceae	Leea sp.	bebon	B
Shrubs	Amaryllidaceae	Crinum sp.	yimane	T
<u>Fauna:</u>				
Birds		Cacatua galerita	akaka	FOW
			kawia	FOW
			gim-nda	FOW
			gorembale	FOW
			guiomp	F
			rutioka	F
		Lesser Bird-Of-Paradise	yambai	FOW
Marsupials (ma):	At least 6 native taxa, all unidentified, used for food, hides, fibre, ornamentation and wealth objects.			
Rats (koi):	At least 1 native taxon, used as food for women and children.			
Snakes (noma):	At least 2 native taxa, used for food.			
Lizards (tuma):	At least 1 native taxon, used for food and hide.			

TABLE 23

Non-Domesticated Resources

Most Commonly Found in Ringupwai (Secondary Growth) Associations

Tsembaga

Life Form	Family	Genus & Species	Native Name	Uses
Flora:				
Trees	Cyatheaceae	<i>Cyathea angiensis</i>	yimunt	Fl
	"	<i>Cyathea</i> , new species	kangup	Fl
	Ebenaceae	<i>Diospyros</i> sp.	wonum	M
	Euphorbiaceae	<i>Breynia</i> sp.	non-manč	R
	"	<i>Phyllanthus</i> sp.	dikambo	B
	"		jimbonk	RM
	Melastomaceae	<i>Melastoma malabathricum</i>	wop-kai	X
	Moraceae	<i>Ficus</i> sp.	danje	T
	Palmae	<i>Licuala</i> sp.	moropmai	T
	Rhamnaceae	<i>Alphitonia iacana</i>	pokai	BM
	Sapindaceae	<i>Dodonaea viscosa</i>	gra	B
	"	<i>Mischocodon</i> sp.	birpi	B
	Saurauiaceae	<i>Saurauia</i> sp.	rokunt	B
	Solanaceae	<i>Lycianthes</i> sp.	kapaŋ	R
	"	<i>Solanum</i> sp.	gon	RM
	Ulmaceae	<i>Gironniera</i> sp.	penta	B
	Urticaceae	<i>Missiessya</i> sp.	yamo	FlSM
	Verbenaceae	<i>Geunsia farinosa</i> Bl.	gon want	M
	Unidentified		yent	B
"		rangan	T	
"		kop	X	
"		mar-mar	B	
Herbs & Shrubs	Acanthaceae	<i>Rungia klossi</i>	tok-mai	Fl
			čemba	
	Araceae	<i>Aglaonema</i> sp.	mocam	RD
	"	<i>Alocasia</i> sp.	gump	S
	Commelinaceae	<i>Commelina</i> sp.	komerik	Fl
	Compositae	<i>Bidens pilosa</i>	womemuk	MO
	"	<i>Blumea</i> sp.	gumbandi	M
Cyatheaceae	<i>Cyathea rubiginosa</i>	kabaŋ bep	Fl	
Gramineae	<i>Bambusa forbesii</i>	kinjen	B	

Table 23 continued:

Life Form	Family	Genus & Species	Native Name	Uses
Herbs & shrubs	Gramineae	<i>Coix lachrymajobi</i>	kongun	OA
	"	<i>Imperata cylindrica</i>	korndo	B
	"	<i>Miscanthus floridulus</i>	ripa	T
	"	<i>Phragmites karkar</i>	yamboč	M
	"	<i>Setaria palmaerolia</i>	korami	Fs
	Orchidaceae	? <i>Calanthe</i> sp.	korndo tiokum	SR
	"	<i>Spathoglottis</i> sp.	korndo tiokum	SR
	Piperaceae	<i>Piper</i> sp.	yikun	RD
	Polypodiaceae	<i>Dennstaedtia</i> sp.	terai	Fl
	Urticaceae	sp.	nent	M
	Zingiberaceae	<i>Costus</i> sp.	monomp	B
	"	<i>Riedelia</i> sp.	yenjim	M
	"	<i>Cyclosorus</i> sp.	aruk	Fl
"	<i>Diplazium</i> sp.	rangilopa	Fl	
Unidentified		rum-rena	Fl	
Vines	Asclepiadaceae	<i>Hoya</i> sp.	koiwundo	SB
	Gesneriaceae	<i>Aeschynanthus</i> sp.	yimbunk	SB
	Liliaceae	<i>Smilax</i> sp.	gum mbiogun	T
	Melastomaceae	<i>Medinella</i> sp.	aikumbindi	B
	Moraceae	<i>Ficus</i> sp.	mopakai	SB
	Pandanaceae	<i>Freycenetia</i> sp.	kwingaka	O
	Passifloraceae	<i>Adenis</i> sp.	akar	SB

Fungi (bai): At least 7 native taxa used as food.

Fauna:

Snakes (noma): At least 4 native taxa, all used for food, one for hide (phthon).

Insects (bang): At least 8 native taxa, 7 used for food, 1 for medicine, 1 for ornament.

TABLE 24

Non-Domesticated Resources

Most Commonly Found in Streams and on Stream Banks

Tsembaga

Life Form	Family	Genus & Species	Native Name	Uses
<u>Flora:</u>				
Trees	Myrtaceae	Cleistanthus sp.	timbi	R
	Unidentified		pima	R
			kumbent	
Bushes,	Moraceae	Ficus andenosperma	anjai	Fl
shrubs,	Myrtaceae	Eugenia sp.	druo	R
herbs	Urticaceae	Laportea sp.	čeṇan gumiṅga	Fl
<u>Fauna:</u>				
Marsupials (ma): At least 3 native taxa, used for food.				
Birds (kabaṅ): At least 3 native taxa, one of which are ducks, used for food.				
Frogs (kamp): Many taxa, used for food by women and children.				
Crabs (korapa): One native taxon, used for food.				
Fish: Two native taxa, <u>kobe</u> ; eel, and <u>tuoi</u> ; catfish, both eaten, <u>kobe</u> also used in rituals				

TABLE 25

Non-Domesticated Resources

Commonly Found in Two or More Associations

Tsembaga

Life Form	Family	Genus & Species		Uses
Flora:				
Trees	Araliaceae	Boerlagiodendron sp.	aimam	B
	Dilleniaceae	Dillenia sp.	munduka	SB
	Euphorbiaceae	Homolanthus sp.	tup kalom	X
	Leguminosae	Desmodium sequax	korai	O
			jijie	
	Meliaceae	Chisocheton sp.	birpi	Fn
	Moraceae	Ficus puncens	kobenum	Flf
	"	Ficus wassa	beka	XFlf
	Myrtaceae	Descapermum necrophyllus	jinjimbint	R
	Thymelaceaceae	Phalerium nisidai	pukuna	X
	Urticaceae	Maoutia sp.	nongamba	X
	"	Oreocnida sp.	rumem	B
	Unidentified		membra	B
	"		dukump-na	Flf
	"		piya	B
	"		punt	B
	Herbs & shrubs	Gramineae	Bambusa sp.	waia
Lycopodiaceae		Dimorphanthera sp.	koropi-mai	M
Zingiberaceae		Alpina sp.	anjomar	S
"			gaunai	M
Unidentified			mi-munga	M
Vines	Convolvulaceae	Lepistemon urceolatum	apop	SB
	Cucurbitaceae	?Trichosanthes sp.	jen	Ff
	Flagellariaceae	Flagellaria indica	goŋ	SB
	Polypodaceae	Dicranopteris pinearis	mombo	B
	Zingiberaceae	?Alpinia sp.	cawaka	SB
	Unidentified		mundunt	SB

Table 25 continued:

Life Form	Family	Genus & Species	Native Name	Uses
Fauna:				
Birds		Red and white flycatcher, <i>Pelteps montanus</i>	binjaka	F
		Bosbook owl, <i>Ninox cheomacha</i>	memlo	F
		Black chat, <i>Saxicola capratta</i>	mimom	F
		Giant frog mouthed owl, <i>Fudargus papuensis</i>	momin	F
		Whistler, <i>Pachycephala ?schegegia,</i> <i>?modesta</i>	namenapo	F
		Grass finch, <i>Lonchura spectabilis</i>	duj	F
		Fantail sp. or spp.	jolmbalen	F
		Rhipidura sp. or spp.		F
		<i>Ptilinopus</i> sp.	gondamamp	F
		Friar bird, <i>Philemon</i> sp.	gorwa	F
		White Night Bird	rumngup	FOW
		Honey eater, <i>Melipstes fumigatus</i>	ringonk	F
		?Wren babblers, <i>Crateroscelis</i> spp.	rep	F
		?Scrub wren, <i>Sericornis</i> spp.		F
		Small frog mouthed owl	ringo	F
			pekump	
		<i>Aegotheles</i>	ro	F
		Night jar owl	rokump	FOW
		Owl	rikaiokai	F
		Pidgeon,	ruru	F
		<i>Gymnophaps albertisii</i>		
		Sparrow Hawk, <i>Accipiter</i> sp.	ćićip	F
		Bosbook owl, <i>?Ninox novai</i>	tokono	F
		<i>Pitta</i> sp.	welendemai	F
		<i>Ifrita kowaldi</i>	wombombo	F

Table 25 continued:

Life Form	Family	Genus & Species	Native Name	Uses
Birds		Green Parrot	yiki yaki	F
		Unidentified	yimbi	F
		"	yimbump	F
		"	dambai	F
		"	rembun	F

Marsupials (ma): At least 3 native taxa, used for food, fibre, ornamentation and wealth objects.

Rats (koi): At least 1 taxon, used as food by women and children.

Wild pig (konj): 1 taxon, used as food.

Snakes (noma): At least 2 taxa used for food.

Uses of Plants and Animals

A. AGRONOMIC--This category includes plants used to protect other plants, or improve their yields; plants that are sometimes planted to improve the associations which develop on abandoned gardens; and indicator plants, that is, plants whose achievement of a particular stage of maturation or a particular stage in a reproduction cycle serves as a signal to undertake one or another subsistence activity.

B. BUILDING MATERIALS--Plants which are used in the construction of quasi-permanent structures, usually houses and fences.

D. DRESS--Plants which are used without processing as part of the costume; usually leaves used as coverings for buttocks.

F. FOOD--This includes only materials which are customarily ingested by humans. It does not include materials habitually consumed by livestock and wild animals but not human beings.

In the case of plant foods, the part of the plant which is used is designated by a small letter: f-fruit; l-leaf; n-nut; r-root; s-stem.

M. MEDICINAL, HYGIENIC, COSMETIC--This category includes materials which are used in any procedure "magical", "religious", or empirical, the aim of which is to cure an existing physical disability. Also included are any materials expended in procedures which produce or maintain personal cleanliness, and materials which are used as cosmetics.

O. ORNAMENTATION--This includes items which are worn on the person as adornment, but which do not, like cosmetics, lose their physical properties after a single wearing.

W. WEALTH OBJECTS--Items (most importantly feathers and furs) which may be exchanged for steel tools, shell objects and, in former times, stone axes.

R. RITUAL--This category includes all materials which are used in rituals with the exception of those included in category M.

S. SUPPLIES--This includes materials which are used once then discarded, e.g. leaves used for temporary packages, vines used to tie firewood, leaves used in earth ovens. Items included in categories B,D,F, and M are excepted.

T. TECHNOLOGICAL--Materials out of which are made tools, weapons or containers which are used continually or frequently.

APPENDIX IX

THE TSEMBAGA DIET

1.0 Measurement of the nutritive value of Tsembaga intake
derived from plants

Fruits and vegetables comprise approximately ninety-nine per cent by weight of Tsembaga intake.

1.1 Total intake, by weight, of the Tomegai:

All vegetable foodstuffs brought home to the four hearths of the Tomegai clan were weighed daily, by named variety, from February 14, 1963 to December 14, 1963. For the purpose of estimating intake the figures from March 11 to November 8, a period during which both the pig and human populations were relatively stable, form the basis of the estimate.

From the gross weights brought home, two deductions were made. First, the harvester was asked to set aside the ration for pigs. The weight of their ration was subtracted from the gross weight, leaving weight available for human consumption. Second, a factor for waste in preparation was subtracted from the remaining amount. The values assigned to waste are in the case of each item based upon tests run in the field. The figures remaining after the two deductions indicate total weights of edible portions brought to the houses.

To these figures are added values for the consumption of vegetable foods away from the house. These values are based upon observations of people eating on the paths, in the bush and in the gardens. The resulting figures are taken to be total weight of edible portion available for human consumption.

The procedures for obtaining this final figure may be summarized in the following equation:

(Gross weight brought home plus estimated weight consumed away from home) - (pig ration plus waste) equals total weight of edible portion available for consumption by humans.

These figures are tabulated below in columns 1-5 of Table 26.

TABLE 26 Total Intake of the Tomagal Clan (16 Persons, 13 Pigs. March 11, - November 8, 1963)

Crop	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Total Weighed Mar. 11-Nov. 8 lb.	Ration for Pigs Mar. 11-Nov. 8 lb.	Available for Humans Weighed Mar. 11-Nov. 8 lbs.	Edible Portion Factors %	Edible Portions for Humans Mar. 11-Nov. 8 lbs.	Calories/lb. Edible Portions	Authority	Calories, Human Intake	Percent protein Edible Portion	Authority	Protein ingest- ed by humans, minimum lb.	Protein ingest- ed by humans, maximum lb.	Factors for additional intake %	Total estimated caloric intake	Total estimated Protein intake minimum lb.	Total estimated Protein intake maximum lb.	Fat %	Authority	Total: Fat Intake lb.	Calcium mg./lb.	Authority	Total Calcium intake, mgm
Roots																						
Sweet potato	9944.50	5554.22	4390.28	80	3512.23	681	3	2391828.63	.9-1.7	5	31.61	59.71	5	2511420.08	33.19	62.70	.3	5	10.53	68	3	2188.16
Xanthosoma	1505.50	14.50	1491.00	80	1192.80	658	3	784862.40	1.4-1.9	5	16.70	22.66	5	824105.52	17.54	23.79	.2	5	2.39	177	3	2029.84
Colocasia	3834.75		3834.75	85	3159.54	658	3	2078977.32	1.4-1.9	5	64.23	60.03	5	2182926.19	46.44	63.03	.2	5	6.32	177	3	5591.43
Manioc	1349.25	1106.39	242.86	80	194.29	593	3	115602.55	.7-1.2	5	1.36	2.33	5	121382.68	1.43	2.45	.3	5	.58	114	3	221.16
Yam	1942.50		1942.50	85	1641.60	486	3	652017.68	1.9-2.0	5	25.49	26.83	5	684818.58	26.76	28.17				45	3	738.45
Total roots								6023288.58														
Legs																						
Banana	1682.50	54.90	1627.60	70	1139.32	427	3	486489.64	1.1	3	12.53	12.53	20	583787.57	15.04	15.04	.5	1	5.70	36	3	410.04
Artocarpus	105.50		105.50	50	52.75	295	1	15561.25	1.0	1	.53	.53		15561.25	.53	.53	.6	1	.32	168	1	87.36
Marita	861.50		861.50	43	370.45	762	7	282282.90	3.7	7	13.71	13.71	25	289339.97	17.14	17.14	14.0	3	5.19			
Total trees								784333.79														
Misc. Garden																						
Corn	8.50		8.50	29	2.47	463	6	1143.61	3.7	6	.91	.91	5	1150.79	.96	.96	4.3	1	1.06	32	1	.64
Peas and beans	4.75		4.75	95	4.51	460	3	1584.60	8.1	3	.37	.37		1984.60	.36	.36	3.9	3	1.76	136	6	5.44
Pumpkin	234.25	33.26	200.99	68	136.67	200	3	27334.00	1.5	3	2.05	2.05		27334.00	2.03	2.03				91	3	23.76
Gourd	13.75		13.75	68	9.35	154	1	1439.90	1.3	1	.11	.11		1439.90	.12	.12	.2	1	.02	54	1	4.86
Total Misc. Garden								31901.91														
Leaves																						
Hibiscus	1373.75		1373.75	95	1305.06	136	3	177488.16	5.7	2	74.30	74.30	2	181037.92	75.87	75.87	.3	4	1.92	1685	4	21989.25
Bunga kloss	316.75		316.75	95	300.91	136	3	49923.76	3.8	2	11.43	11.43	2	41542.24	11.66	11.66	.3	4	.90	1685	4	5055.00
Sweet potato leaves	138.25		138.25	95	131.34	218	5	28432.12	3.6	5	4.73	4.73	2	29204.76	4.82	4.82	.7	5	.92	340	5	445.40
Assorted others	244.50		244.50	95	232.28	136	3	31590.08	3.8	2	8.83	8.83	2	31921.89	9.01	9.01	.3	4	.70	1685	4	3909.20
Total leaves								278634.12														
Grasses and Inflowers																						
Fitpit-dieg variety	1142.00		1142.00	60	456.80	104	4	47507.20	4.1	2	18.73	18.73										
Fitpit-dieg, trimmed	124.75		124.75	95	118.51	104	4	12325.04	4.1	2	4.86	4.86	2	48457.34	19.10	19.10	.2	3	.91	95	3	433.20
Fitpit, all other var.	816.25		816.25	60	489.75	104	4	50854.00	4.1	2	20.08	20.08	2	12471.54	4.96	4.96	.2	3	.14	95	3	112.10
Fitpit, all other var. trimmed	61.75		61.75	95	58.66	104	4	6100.64	4.1	2	2.41	2.41	2	6222.65	2.46	2.46	.2	3	.12	95	3	51.50
Setaria	692.75		692.75	17	117.77	101	8	11994.75	1.4	8	1.65	1.65	2	7808.15	1.68	1.68	.6	8	.71	95	8	111.15
Setaria, trimmed	61.75		61.75	95	58.66	101	8	5924.90	1.4	8	.72	.72	2	3889.16	.73	.73	.6	8	.35	95	8	31.50
Total Grasses and Inflow.								134706.53														
Refreshers																						
Sugar cane	3368.00	249.50	3118.50	30	935.55	263	3	246049.65	.4	3	3.74	3.74	200	738148.95	11.22	11.22				45	3	420.75
Cucumbers	216.50	10.60	205.70	95	195.42	50	3	9771.00	.6	3	1.17	1.17	50	14656.50	1.36	1.36				104		202.80
Total Refreshers								25820.65														
Totals, all sources								7502685.58			302.33	354.50		8412483.06	324.91	379.69			41.52			44547.54

Authorities:

- (1) FAO Nutritional study No. 11
- (2) Hamilton, 1955
- (3) Hipsley and Clements, 1947
- (4) Hitchcock, H. 1962
- (5) Messal and Barreau, 1956
- (6) Osmond and Wilson
- (7) Peters, 1958
- (8) Wenham, K., Department of nutrition, University of Hawaii, Personal communication

It may be that some of the difficulties in the derivation of quantities of edible portion available for human consumption are apparent. It is well, nevertheless, to make them explicit.

In common with the attempt to estimate garden yields, there is the problem of estimating the weights of foodstuffs consumed without having first been brought to the houses. Values were assigned on the basis of observations made without the benefit of scales. The quantities consumed away from the houses are not large in any event, and it is therefore not likely that misestimation resulted in an error of more than one percent to two percent except in the cases of sugar cane and cucumbers, where error could have been greater.

The values assigned to the pig ration reflect the weight of foodstuffs explicitly set aside for them. Women were frequently observed however, feeding the pigs tid-bits from the portion set aside for humans. No deductions were made from the human portion for these morsels. The daily human ration is, therefore, represented as slightly higher, in comparison to the ration set aside for pigs, than it actually is.

The percentage values assigned to waste were based upon a limited number of tests in each case, and the amount of waste varies even within particular varieties of the same

species with the age, freshness, size, etc., of specimens. The values assigned by me on the basis of tests do, however, approximate standard values found in the literature.

1.2 The value of food ingested:

Nutritive values derived from the literature were assigned to each item. Wherever possible, values used by other New Guinea workers were adopted to facilitate comparability. In most cases these workers adopted values derived from samples taken from the general area in which they worked. Other things being equal, it seems methodologically preferable to accept values derived from the analyses of New Guinea specimens rather than values taken from specimens grown elsewhere. In some instances the values used may be high. The caloric value for sweet potato, for instance, derived from Hipsley and Clements (1947), is 681 per pound of edible portion. Other authorities record considerably lower figures. It is upon the basis of Hipsley and Clements' values, however, that the Chimbu, Busama, Kaiapat, Patep and Kavataria diets were evaluated, and the adoption of the same values, so far as possible, facilitates comparisons within Australian New Guinea. It may be, however, that these values should be adjusted in any comparison with nutritional data collected in other parts of the world.

Nutritional values are summarized in columns 6, 9, 17, 20 of Table 26. The sources from whom the figures were adopted appear in adjacent columns.

1.3 Nutritional values of individual intakes

The sample for which quantitative consumption data were collected consisted of sixteen persons for a period of 246 days. Not all sixteen were present every day, and on some occasions visitors were fed. A record was, therefore, kept of who ate at each hearth every day. The persons fed fell into a number of different age and sex categories, each of which had a different intake. The problem of assigning values to the intake of each age-sex category is theoretically amenable to simple solution: one simply measures the quantities served to persons of each category. Among the Maring such a procedure was not practical. It would have required first that the observer be on hand with a portion scale while the food was being consumed, and left-overs may be eaten late at night or early in the morning, when tubers may also be cooked for later consumption as between-meal snacks. Unless the observer takes up more or less permanent residence next to the larder of a single household, some of this consumption is bound to escape his attention.

As an alternative, ratios for the quantity of intake of persons in the various age and sex categories were

devised. These were based upon suggested caloric allowances published by Venkatachalam (1962:10), following Langley (1947:134). The following daily caloric allowances are proposed by Venkatachalam and Langley for the categories included in the sample:

Adult males	2500
Adult females	2100
Adolescent females	2050
Children 5-10 years	1300
Children 3-5 years	1200
Children 1 year	850

The ratio of these values was assumed to reflect the comparative ingestion of persons in the various age-sex categories. An adult female for instance, was assumed to eat $21/25$ as much as an adult male. A child 5-10 years of age was assumed to eat $13/25$ as much as an adult male, and so on. The problems of such a procedure are clearly understood. It is no doubt the case that actual practice deviates from ideal apportionment patterns. The procedure is adopted as the lesser of the possible evils: I believe greater error would have resulted from an attempt to estimate the comparative sizes of actual portions.

The suggested caloric values were divided by 100. The resultant figures may be referred to as "trophic units." An adult male represents twenty-five trophic units, an adult female twenty-one, etc. These were then multiplied by the

number of consumer days in each category, yielding the number of trophic unit days in each, and a total of trophic unit days for the entire sample was taken. The total values of the several nutrients were then divided by the total number of trophic unit days to arrive at a trophic unit day value for each nutrient. From this, the daily intake of each nutrient for each category of persons was derived.

2.0 Comparison of Tsembaga and other New Guinea diets

The Tsembaga diet may now be compared to the diets of other New Guinea peoples.

Table 27 below compares the Tsembaga diet to that of five other New Guinea groups. The figures published for Busuma, Kaiapit, Patep and Kavataria are total per capita figures. No breakdown by age or sex categories is provided. It was, therefore, necessary to determine overall per capita figures for the intake of various nutrients by Tsembaga. The usefulness of such figures is limited to purposes of comparison. For purposes of evaluation, separate figures by age and sex category are preferable.

TABLE 27

Comparative Values of Six New Guinea Diets

Place	Source	Daily Caloric Intake	Daily Protein Grams		Calcium Grams	Total Daily Intake Grams	
			Veg.	Animal			
Busama	Hipsley and Clements 1947	1223	14.4	4.7	19.1	.5	794
Kaiapit	"	1609	21.7	3.1	24.8	.6	1013
Patep	"	1904	22.3	2.1	24.4	.6	1387
Kavataria	"	1600	22.4	18.4	41.3	.3	1256
Chimbu	Venkatachalam 1962	1930	20.8	?	20.8		1627
Tsembaga min.			34.7	?	34.7		
Tsembaga max.		2015	46.8	?	46.8	1.2	2287

The information summarized in Table 27 suggests the marked superiority of the Tsembaga diet over those of the other groups. The differences between the Tsembaga and several of the other groups are so large, however, that they are suspect. The size of the disparities becomes increasingly apparent when gross intake is compared. Langley reports Busama intake to be 794 grams per day (1947:112-115). Tsembaga intake was almost three times as great. Langley states that there was a food shortage at Busama at the time of the survey, but no mention is made of a food shortage at Kaiapit, where the reported daily intake was only 1013 grams, less than half that of the Tsembaga.

The methods employed by the New Guinea Food Survey expedition in 1947 are not made fully explicit, so it is impossible to judge whether different procedures led to different results. My belief is nevertheless, that figures for Busama, Kaiapit, Patep, and Kavataria, which were derived from a limited number of visits to houses at meal times, do not adequately represent per capita consumption in those communities. With the exception of Patep, they seem much too low.

The Chimbu figure lends support to the Tsembaga figure. Much of the difference in the weights of Tsembaga and Chimbu intakes lies in the availability to the Tsembaga of greater amounts of non-starch vegetables. It is in this difference that the qualitative as well as quantitative superiority of Tsembaga diet over Chimbu lies. Apparently absent from the diet of the latter are the leaves of Hibiscus manihot, the most important source of both protein and calcium for the Tsembaga. It is probably altitudinal limitations which deprive the Chimbu of these valuable greens.

APPENDIX X

CARRYING CAPACITY

1.0 Carrying capacity formula

Carneiro's formula for carrying capacity may be repeated here.

$$(1) \quad P = \frac{T}{R + Y} \times Y$$

Where:

- P = The population which may be supported
- T = Total arable land
- R = Length of fallow in years
- Y = Length of cropping period in years
- A = The area of cultivated land required to provide the "average individual" with the amount of food he ordinarily derives from cultivated plants per year

2.0 The values of variables T and R

The total area of arable land is not easy to determine in terrain as rugged as that occupied by the Tsembaga. The difference between orthographic and surface areas is substantial, due to both general and localized sloping. A calculation for Tsembaga territory is presented here.

Tsembaga territory comprises, in total, 2033 acres by orthographic measurements made on an aerial photograph. The total territory may be divided into a number of areas in terms of altitude, past use, vegetation cover, and agricultural potential. These discriminations are summarized in Table 28.

TABLE 28Tsembaga Territory, Arable and Non-arable Land

Area	Total Acreage	Arable	Non-arable
High altitude high forest, Jimi Valley	343	100 †	243
High altitude high forest, Simbai Valley	602	200 †	402
Secondary forest, (gardened areas) Simbai Valley	1019	864	150
Low altitude forest remnants	28		28
Grassland	41		41
Totals	2033	1164	864

These figures require some comment.

The 100 † acres estimated to be arable in the Jimi Valley and the 200 † acres estimated to be arable in the high altitude virgin forest in the Simbai Valley were not measured. These figures represent estimates, based upon walks through the areas, of the comparative size of areas under high forest and non-arable moss forest. The border between these areas is indistinct. The area under high forest in the Simbai Valley seems never to have been gardened, and no gardening has been undertaken by Tsembaga in the Jimi Valley area for many years.

The figure for grassland includes only the one extensive area noted in chapter III. Allowance has been made for other, smaller grassy areas in the figure for non-arable land within the secondary forest. Similarly, the figure for low

altitude forest includes only areas of three to four acres or more. Smaller patches, like the smaller grassy areas, are included in the figure for non-arable land within the secondary forest. This latter figure is an estimate which allows for stream beds, rocky areas, gullies and slopes over 43° , as well as for the small grassy areas and small patches of forest. The figure of 150 acres is probably conservative.

The areas tabulated above are orthographic areas.

The terrain however, is very rugged. The general slope in the gardenable areas is about 20 degrees. This increases surface over planimetric area by a factor of 16.15:15. The intricate dissection of the terrain by streams and spurs projecting from the mountain wall further complicates the surface and increases its area, but there is no means for judging by how much. It will be assumed here that slopes in other directions approximate the general slope. Surface area will thus be taken as $16.15^2:15^2$, or 116.48% of orthographic area. Arable surface is summarized in Table 29.

TABLE 29

<u>Arable Land Area Corrected for Slope, Tsembaga Territory</u>	
<u>Location and Association</u>	<u>Acreage</u>
Simbai Valley secondary forest and gardens	1002
Simbai Valley high forest	235
<u>Jimi Valley high forest</u>	<u>116</u>
Economic Population density, total arable area:	97 p.s.m.
Economic Population density, secondary forest and gardens:	124 p.s.m.

It is not the case, however, that all areas are equally productive. In an earlier section it was shown that the sweet potato gardens which are planted at higher altitudes in the secondary forest produce only 92.6% as many calories (4,418,215) in the twelve months of maximal production as do the taro-yam gardens planted at lower altitudes. An adjustment must be made for this difference. Again, however, a distinct boundary between the two zones cannot be drawn, for the region between 4000 feet and 4400 feet altitude is transitional. Six hundred fifty acres will be assigned to the lower zone and three hundred fifty-two acres to the upper, slightly less productive, areas.

It is reasonable to expect that gardens which might be cut in the high altitude virgin forest, would, in the long run, show even lower productivity than those in the upper portion of the secondary forest. It will be assumed here that the diminishment in productivity would be of an order similar to that between the lower two zones. Arable land in the virgin forest will be regarded as 92.6% as productive as land in the upper portion of the secondary forest. Differences in lengths of fallow, as well as differences in yields, must also be considered. In an earlier section a value of fifteen years was adopted for the lower secondary forest zone and twenty-five years for the upper secondary

forest zone. It is reasonable to expect that fallows on gardens cut in the virgin forest between 5200 and 6000 feet would be even longer. A figure of thirty-five years will be assumed here.

Three land classes have now been distinguished, differing both in productivity and length of fallow. They are summarized in Table 30:

TABLE 30

Tsembaga Arable Land Classes

Class	Acres	Productivity	Frequency of Use
I	650	1.000	15 years 1.000
II	352	.926	25 years .6
III	351	.857	35 years .43

These productivity and frequency of use factors permit the areas included in the three classes to be reduced to equivalent figures. Areas in Classes II and III, that is, may be expressed in terms of equivalent amounts of Class I land.

3.0 The value of variable A

The value for A, the amount of land required for the "average individual", is a function of the age-sex composition of the particular population under study. The figure used here is based upon the age-sex composition of the Tsembaga in 1963.

If there were changes in the proportions of persons in the various age-sex categories, each of which have different trophic requirements, there would be a change in the value of A.

3.1 Values for variable A, pig population at minimum

Actual measurements, based upon chain and compass mapping, are available for total acreage in production when the pig population was at a maximum. The areas of the gardens of the Tomegai clan are also available for 1963, when the herd was reduced to a minimum. These and other figures permit the determination of variable A for the Tsembaga when their pig herd was at a minimum in three ways. All three calculations will be made here as a check upon each other.

(A) The total annual caloric requirements of the entire population, with the pig herd at a minimum, may be divided by the annual per-acre yields of taro-yam gardens. The production of taro-yam gardens, rather than sugar-sweet potato gardens, may be taken because, as it has already been mentioned, virtually no separate sugar-sweet potato gardens are planted when the pig herd is at its minimum. Actual weighings have demonstrated that 85.0% of the total caloric yield of the taro-yam gardens is harvested during one twelve-month period. It is this figure, 4,418,215 Calories, which is, accordingly, used in this calculation.

Total Tsembaga consumption is tabulated in Table 31 below. The number of trophic units represented by categories not included within the Tomegai clan, from whom all consumption data was gathered, are derived from Langley (1947:134).

TABLE 31

Total Annual Caloric Requirements, All Tsembaga

Age	Sex	Trophic Units	Daily per capita intake	Number of persons in category	Total daily consumption of category
Over 50	male	20	2060	8	16,480
	female	16	1648	12	19,776
21-49	male	25	2575	49	126,175
	female	21	2163	40	86,520
15-20	male	29	2987	11	32,857
	female	20.5	2112	7	14,784
10-15	male	22	2266	15	33,990
	female	21	2163	8	17,304
5-10	male,				
	female	15	1339	25	33,475
0-5	male,				
	female	10	1030	29	29,870
Total daily consumption					411,231 Cal.
Total annual consumption					150,089,315 Cal.
Total Trophic Units: 4042					

The amount of acreage (Gs) which must be put into production annually to fulfill Tsembaga trophic requirements may be solved for by the following simple equation:

$$(2) \quad Gs = \frac{Ct - Co}{Ca}$$

Where

- Ct = Total Caloric requirements, Tsembaga
 Co = Calories available from old gardens,
 (15% of total)
 Ca = Caloric yield per acre, taro-yam gardens,
 24-76 weeks after planting

$$Gs = \frac{150,089,315 - 22,513,389}{4,418,215}$$

A value may now be assigned variable A through solution of the following equation:

$$(3) \quad A = \frac{Gs}{P}$$

Where

P = Total Tsembaga population (204 persons)

$$A = \frac{28.87}{204}$$

$$A = .142 \text{ acres}$$

(B) The acreage per "trophic unit" placed in production by the Tomegai clan in 1963 may be calculated from the total area they placed in production in 1963 by solution of the following equation:

$$(4) \quad Ua = \frac{Gn}{U}$$

Where:

- Ua = Acreage per trophic unit
 Gn = Acreage put into production by the
 Tomegai, 1963 (3.07 acres)
 U = Total trophic units, Tomegai clan (313)

$$Ua = \frac{3.07}{313}$$

$$Ua = .0098 \text{ acres.}$$

If the acreage per trophic unit is then multiplied by the total trophic units of all the Tsembaga, a figure for minimal required acreage is obtained.

$$(5) \quad 4042 \times .0098 = 39.61 \text{ acres}$$

$$A = \frac{39.61}{204}$$

$$A = .194 \text{ acres.}$$

(C) Another calculation may be made by extending a comparison of the acreages placed in production by the Tomegai in 1962 and 1963 to the acreage of all of the Tsembaga.

The following areas are known by measurement:

G1 = Total acreage put into production, 1962

Gt = Acreage put into production by Tomegai, 1962

Gn = Acreage put into production by Tomegai, 1963

To solve for total acreage put into production in 1963, (Gs)

the following ratio may be used:

$$(6) \quad G1:Gs = Gt:Gn$$

Correction must be made for the differences in the ratios of sugar-sweet potato gardens to taro-yam gardens in the two years. This may be accomplished by using the factor which converts class II to class I to land.

Tomegai gardens, 1962 (actual measurement)	
Area in acres, sugar sweet potato gardens:	
2.56 corrected:	2.37
Area in acres taro-yam gardens	<u>2.27</u>
Total acreage corrected:	4.64

Tomegai gardens, 1963 (actual measurement)	
Area in acres, sugar-sweet potato gardens:	
.19 corrected:	.18
Area in acres, Taro-yam gardens:	<u>2.89</u>
	3.07

All Tsembaga gardens, 1962 (actual measurement)	
Area in acres, sugar sweet potato gardens:	
19.34 corrected:	17.91
Area in acres, taro-yam gardens:	<u>27.84</u>
Total corrected:	45.75

Values are now available for solution of ratio (6).

$$(6) \quad 45.75:Gs = 4.64:307$$

$$Gs = 30.27$$

$$(7) \quad A = \frac{30.27}{204}$$

$$A = .148 \text{ acres.}$$

The discrepancy between calculations 1 and 2 is .052 acres per person, in aggregate 10.74 acres, or approximately 27%. Discrepancies of this magnitude are, perhaps, to be expected when values rest in part upon measurements undertaken in terrain as broken as that occupied by the Tsembaga and upon the extension of measurements of intake, themselves subject to some imprecision. It is probable, however, that this discrepancy

has its basis not so much in errors in measurement as in actual differences in gardening practice. Calculation C bears out this interpretation. It will be noted that the Tomegai clan comprises 313 "trophic units", 7.77% of the total of 4042 "trophic units" for the entire Tsembaga. In 1962, however, Tomegai gardens comprised 4.55 acres (corrected) or 9.94% of the total of 45.75 acres (corrected) put into production by all Tsembaga. The discrepancy between 7.77% and 9.94%, approximately 22%, corresponds closely to the discrepancy between calculations B and C, and may cancel it out. It may be, that is, that the Tomegai regularly put larger than average amounts of land into cultivation, or at least did so in 1963 as well as 1962. This would not affect the reliability of derivation C, nor would the reliability of derivation A be affected unless it could be shown that the Tomegai eat more than other Tsembaga, and that there has therefore been an error made in extending Tomegai trophic requirements to the entire local population. There is no reason to believe this. Tomegai adult males are slightly below (approximately 3 kg) the average weight of all Tsembaga adult males, and the average weight of Tomegai adult females falls almost exactly on the average for the Tsembaga adult females as a whole. Moreover, the Tomegai do not seem to be either more or less active than other Tsembaga.

Their greater than average acreage in cultivation in 1962 cannot be explained, secondly, by the possession of a greater than average number of pigs by the Tomegai, since this was not the case. The ratio of pigs (of 120-150 pound size) to people for all the Tsembaga in 1962 was .83:1. The ratio of Tomegai pigs to Tomegai was .81:1.

Another explanation might have to do with land quality. There is no reason to believe, however, and considerable reason to reject, the notion that Tomegai gardens were on poorer than average land in 1962 or, as a rule, at other times.

Two explanations may be suggested. First, Tomegai male gardeners included six men making all their gardens and one man making half his gardens with the four Tomegai women and the one Tomegai adolescent girl (whose gardening activities may be counted as half that of an adult woman). This ratio of 6.5 male gardeners to 4.5 female gardeners exceeds the average, which is approximately 6.7:5.7. It is likely that with more males engaged in clearing more acreage will be put into production.

Second, the discrepancy may be due to sampling error. It is not likely that any group of ten or eleven gardeners will put into production the same amount of acreage as any other group of similar size, even within the same local population. The

Tomegai may be particularly industrious (although it didn't seem so) or it may be that the measurements were taken in years when their acreage under production exceeded the average because of such considerations as the configuration of the land on the sites they were gardening.

It is probable that errors in measurement, sampling error and differences in actual practice have all contributed to the discrepancy between calculations 1 and 2. The indication is, however, that a value of .194 for variable A is too high; and that more realistic values are derived in the two other calculations. Both extremes, however, will be used in further calculations.

3.2 Value for variable A, pig population at maximum

Since actual measurements were made of the total area put into production when the pig population was at its maximum, no estimate need be made. The amount, 47.18 acres, has already been introduced in previous calculations, where an adjustment to reduce it to its class I equivalent, 45.75 acres, was made.

The formula solving for variable A may now be applied for acreage per capita under production when the pig population is at maximum.

$$(8) \quad A = \frac{45.75}{204}$$

$$A = .224 \text{ acres}$$

4.0 Estimation of carrying capacity for humans

Values for all variables are now available and we may now solve for the maximum number of human beings which could be supported on Tsembaga territory by using formula (1).

4.1 Carrying capacity of secondary forest areas

Separate calculations will be made for the maximum number of people which could be supported on areas either under cultivation or under secondary forest at the time of field work when (1) the pig population is at minimum, (defined as the ratio pigs: people = .23:1, pigs averaging 60-75 pounds) and (2) when the pig population is at maximum (defined as the ratio pigs: people = .83:1, pigs averaging 120-150 pounds).

4.1.1 Carrying capacity, pig population at minimum

Three values for variable A were derived. Calculations will be made using all three values.

$$(1) \quad P = \frac{\frac{T}{R+Y} \times Y}{A}$$

$$P = \frac{T \text{ class I} + (T \text{ class II} \times .926 \times .6)}{\frac{(R + Y)}{A}}$$

a) $A = .142$ acres

$$P = \frac{650 + (352 \times .926 \times .6) \times 1}{\frac{14 + 1}{.142}}$$

$$P = \frac{\frac{846}{15}}{.142}$$

$$P = \frac{56.40}{.142}$$

$P = 397$ persons

b) $A = .148$ acres

$$P = \frac{56.40}{.148}$$

$P = 383$ persons

c) $A = .194$ acres

$$P = \frac{56.40}{.194}$$

$P = 290$ persons

4.1.2 Carrying capacity, pig population at maximum

Only one value for variable A will be used, since it was obtained by actual measurements.

$$P = \frac{\frac{T}{R + Y} \times Y}{A}$$

$$P = \frac{56.40}{.224}$$

$P = 251$ persons

4.2 Carrying capacity, land under high forest

Estimates will be made for (1) pig population at minimum and (2) pig population at maximum.

4.2.1 Carrying capacity, pig population at minimum

$$(1) \quad P = \frac{\frac{T \text{ class III}}{R + Y} \times Y}{A}$$

$$P = \frac{\frac{351 \times .857 \times .43}{14 + 1} \times 1}{A}$$

a) $A = .142$ acres

$$P = \frac{\frac{129}{15}}{.146}$$

$P = 60$ persons

b) $A = .194$ persons

$$P = \frac{\frac{129}{15}}{.194}$$

$P = 44$ persons

4.2.2 Carrying capacity, pig population at maximum

$A = .224$ acres

$$P = \frac{\frac{129}{15}}{.224}$$

$P = 38$ persons

5.0 Estimation of carrying capacity for pigs

As in the case of the human population, estimates will be made separately for (1) areas under cultivation and secondary forest during the field work period, and (2) areas under high forest, but which were deemed to be arable. Domestic food requirements only are considered. No attempt was made to estimate the requirements of the animals for grazing land.

5.1 Carrying capacity for pigs, land under cultivation and secondary forest

Two methods are used as a check upon each other: 1) the number of pigs which could be supported beyond the maximum of 1962 is computed and added to the maximum, and 2) the number of pigs which could be supported above the minimum are added to the minimum.

5.1.1 Computing carrying capacity for pigs, by increment to maximum population

The following formula (9) may be used:

$$(9) \quad P_p = N_m + N_a$$

Where:

P_p = The carrying capacity for pigs, holding human population constant (204 persons distributed in age-sex categories as in Table 1.)

N_m = Maximum herd size, as censused (169 pigs, average size 3.8, or 120 to 150 pounds).

N_a = Additional pigs, which may be supported without shortening fallows or bringing virgin forest into production. N_a may be solved for by the following equation:

$$(10) \quad N_a = \frac{T - G_1}{K}$$

T = Total Class I or Class I equivalent land which may be put into cultivation annually without shortening fallows or bringing virgin forest into production.

$$T = \frac{T \text{ Class I} + (T \text{ Class II} \times .926 \times .6)}{R + y} \times Y$$

G_1 = Total acreage of Class I or Class I equivalent land put into production when the pig population was at maximum size. Values have been assigned by actual measurements of all gardens in 1962.

K = Amount of land required to feed each 120-150 pound pig in excess of those included in the minimum pig population. K has been assigned a value of .15 acres (see Chapter III, section 3.1.3.1.).

These equivalents may now replace unknowns in formula

(9).

$$P_p = N_m + N_a$$

$$P_p = N_m + \frac{L - G_1}{K}$$

$$P_p = N_m + \frac{T \text{ Class I} + (T \text{ Class II} \times .926 \times .6) \times Y - G \text{ Class I} + (G \text{ Class II} \times .926)}{(R + Y) \times K}$$

$$P_p = \frac{169 + 650 + (352 \times .926)}{(14 + 1)} \times 1 - (27.84 + 17.91)$$

$$P_p = \frac{169 + 56.40 - 45.75}{.15}$$

$$P_p = 169 + 71$$

$P_p = 240$ pigs averaging 120-150 pounds

5.1.2 Computing carrying capacity for pigs by increment to the Minimum population

The following formula is used:

$$(11) \quad P_p = \frac{N_s}{2} + N_b$$

Where:

P_p = The carrying capacity for pigs of an average size of 120-150 pounds, holding human population constant (204 persons distributed in age-sex categories in Table II - I).

N_s = The number of pigs, averaging 60 - 75 pounds comprising the minimum pig herd (Nov., 1963).

2 = A correcting factor, converting average size of animals when pig population is minimum (60-75 lbs) to average size when pig population is maximum (120-150 lbs).

N_b = The number of additional pigs of size 120-150 pounds which may be supported without shortening fallows or bringing virgin forest into production. N_b may be solved for by the following equation:

$$(12) \quad N_b = \frac{T - G_s}{K}$$

Where:

T and K have the same values as in formula (10). G_s represents total acreage of Class I or Class I equivalent land under production when the pig population was at a minimum. Three values have already been derived for G_s . Calculations will be made using the two extremes: 28.87 and 39.61 acres.

a) Value of G_s = 39.61 acres

$$P_p = \frac{N_s}{2} + \frac{T - G_s}{K}$$

$$P_p = \frac{60}{2} + \frac{56.40 - 39.61}{.15}$$

P_p = 142 pigs averaging 120-150 pounds.

b) Value of G_s = 28.87 acres

$$P_p = \frac{60}{2} + \frac{56.40 - 28.87}{.15}$$

P_p = 214 pigs averaging 120-150 pounds

5.2 Carrying capacity for pigs, land under high forest

Only formula (11) will be used. Adjustment must be made,

however in the value of N_s . This adjustment is accomplished by solving the following ratio for X .

$$(13) \quad G_1 : G_h = N_s : X$$

Where:

G_1 = The maximum amount of Class I and Class II land which could be put under production at one time without shortening fallows. This has already been determined (see section 4.1.1 above) to be 56.40 acres.

G_h = The maximum amount of Class III land which could be put under production at one time allowing a 35 year fallow. This has already been determined to be 8.6 acres.

N_s = The number of pigs, averaging 60-75 pounds, comprising the minimum pig herd (Nov. 1963). This number, by census, was determined to be 60.

$$56.40 : 8.6 = 60 : X$$

$$X = 9.1$$

Values may now be provided for all variables in for-

mula.

$$(11) \quad P_p = \frac{N_s}{2} + N_b$$

$$P_p = \frac{9.1}{2} + \frac{8.6}{.15}$$

$P_p = 62$ pigs averaging 120-150 pound size.

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