ECOLOGY, AGRICULTURE AND SOCIAL ORGANIZATION: THE DYNAMICS OF GROUP COMPOSITION IN THE HIGHLANDS OF PAPUA NEW GUINEA

A THESIS

SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL

OF THE UNIVERSITY OF MINNESOTA

By

Paul Brandin Wohlt

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

August 1978

To the children of Yumbisa--
when their world is different
may they find a bit of the
past here.

ACKNOWLEDGMENTS

To the people of Yumbisa, nambanya tata, I owe a debt which cannot be diminished. All accommodated the strange kone as best they could. In particular, Imambu's loyalty and endurance were remarkable, and Kongo who knew not whether I was his son or father shared his knowledge with me anyway. Mupalii and Popoii became my brothers.

While in Papua New Guinea, we frequently stayed with Walt and Audrey Biberdorf. On the wall above their dining room table was the following:

He who hath helped thee hitherto
Will help thee all thy journey through.

Although that adage may mean something very different to them, it concisely describes their unfailing concern for us. Indeed, it appears to have been the motto of the many people we met in Papua New Guinea and all along the way.

The New Guinea Lutheran Mission--Missouri Synod provided the backbone of our intricate supply line and uncountable other services--particular thanks to Walt and Audrey Biberdorf and Herb and Faye Schaan. Father Raich and company of the Catholic Mission at Yapum saw our supplies off at the last outpost and received us as weary travelers with enduring good cheer. The Apostolic Church Mission also maintained the supply line and looked after us in several places--many thanks to Kenneth and Margaret Meehan. Appreciation is extended to the many government officers who provided transportation and otherwise smoothed our way; the kiaps of Kandepe and personnel of DASF from Hagen to Kandepe especially Roland Freund.

Various researchers kindly provided information, advice and supported us in many other ways. To William C. Clarke and Eric Waddell whose timely visits provided gentle guidance, I remain indebted. Thanks are also due the Tomasettis, Mary-Jane Mountain, Bill Standish, Ron Rahl, the Laceys and the Clarkes for their unselfish help and hospitality.

Research and preparatory studies were supported by a National Institute of General Medical Sciences Behavioral Science Training Program in Anthropology (GM 01164) at the University of Minnesota, Department of Anthropology. The faculty and graduate students of that department provided encouragement and guidance. Paul Schaefer and Mark Mosko were always willing to listen and encourage. Dennis

Puleston's unbounded enthusiasm was a continuing source of stimulation. I wish to thank my committee chairmen Eugene Ogan and Robert Kiste: Gene for his assistance both in Papua New Guinea and Minnesota and his constant encouragement through the writing-up period; Bob for taking the time to get the final product in shape and helping me all the journey through at Minnesota.

The love and support of my family--Ruth, Willy, Goosie and Nathan--are an integral part of this dissertation. Ruth and Willy, and later Goosie, shared the joys, sorrows, and labor of fieldwork. To Ruth, colleague, photographer, _etanenge_, typist, editor, homemaker and wife, I say _yaka pilino_.

TABLE OF CONTENTS

APPENDICES Page

LIST OF TABLES

LIST OF FIGURES

Figure | Page

LIST OF MAPS

CHAPTER I

INTRODUCTION

A. The Problem

The nature of relationships between people and environment has intrigued anthropologists for decades. Early and persisting attempts to establish the priority of ideological or environmental factors in unidirectional causal schemes have fruitfully given way to considerations of the complex interrelationship of factors in systemic interaction. This latter approach is employed in the following arguments.

It should be noted at the outset that the very assumption of systemic interrelationship denies that any hypothetical statement containing a small number of variables can deterministically describe any output of the system. Ignorance of the effect of the remaining variables (assumed to be a larger number) makes it impossible to account for their contribution to the observed behavior. However, in the absence of nonexistent, tightly constructed models which encompass large numbers of variables and depend on time-consuming computer runs or the like, we must grapple with as many variables as we can. This _obiter dictum_ envisions a progressive reduction of unexplained variance by systematically interrelating more and more data. The demonstration of a degree of relationship, at least, allows for some control in the examination of residual variance.

It is desirable to describe the underlying frame of reference against which this investigation is cast. There is an old adage in anthropological fieldwork that one must record what the "natives" say, what they do, and what they say about what they do. What they say is presumably the ideal, the norm, the digested cultural rule--but it is manifestly not what they invariably do. Recording the latter is the job of the observer even though some informants may indeed spell it out. At this point we may, like Firth (1951), generate _social structure_ from the various informant versions of the articulation of the social universe and then compare that to our digested records of observed social actions (_social organization_). Presumably what people say about what they do gives the fieldworker some clues as to which variables account for the greater or lesser degree of fit. Both structures are analytic constr~~ucts of~~ the ethnographer and his anthropological "socialization," among other things, but they derive from a single, underlying, total social fact (by presumption at least). Yet they are perceived in two different ways. The raw data for social structure come to us through communications behavior and are laden with meaning from which we make inferences having some relationship to cognitive patterns. Social organization, however, has a different component in that it is derived from empirically discernible behavior on the part of physical actors. It is not therefore more "real," just more readily accessible and, in fact, makes little sense without the component of meaning which orders social structure. Probably for this reason it is the organizational aspect which has been most carefully documented in Highland New Guinea, ethnographies, while only relatively recently has ideology been probed more deeply.

Still, the notion of social structure must be very complicated in order to handle individual differences in perception and belief. Thus, I prefer to speak of ideology as a cover term for the whole complex of cultural knowledge with its various parts differentially applicable and differentially distributed among individuals. Contained within the ~~ideology are~~ expectations and ideals and some degree of perception of the probable outcome of any action. We may inquire further as to what factors produce a difference between "ideal" expectations and actual outcomes. I suggest, as others have, that the "realities" of each individual existing in the face of conflicting possibilities of action disallows or makes it culturally unwise to follow an ideal for every case. The outcome of the resultant deliberations or decisions can be examined as strategies of action deriving differentially from various aspects of ideology and from characteristics of demography, environment and the behavior of other people. Thus, to put a complex situation too simply, the resultant composite behavior of many individuals pursuing sometimes disparate ends is the source from which we derive a version of social order. Moreover, the ideals, norms, etc. which motivate, condition, give meaning to individual behaviors are "opposed" (not necessarily "balanced") by social, demographic, and environmental features to yield this order. The interaction is assumed to occur in the context of a complex adaptive system which articulates in some fashion with its environment (both social and physical) and results in discernible regularities of behaviors.

With those general comments in mind, some restrictions on the field of inquiry of this dissertation must be specified. It is generally agreed that one crucial set of factors, which must be examined to understand any sociocultural system in relation to its adaptations to environment, centers on energy extractive strategies. In low energy agricultural societies, such as those in the Highlands of New Guinea (hereafter abbreviated as HNG), energy harnessing capacity relies primarily on domesticated crops. Agriculture in this situation is the crucial interface between environment and the sociocultural system. Energy considerations are thus critical factors in such adaptations since the flow of energy is the commodity that the agricultural subsystem controls. We need not fall victim to the calorific obsession that Brookfield (1972) decries to pursue such an investigation. The activities resulting in control over energy flow and the ideological factors affecting these activities are demonstrably interrelated with a host of sociocultural variables. An investigation of the relationships among environmental features, ideology and practice for particular societies in certain environments is central to an understanding of sociocultural dynamics.

We may then address the following general question. What interrelationships can be demonstrated between environmental factors, demographic variables and other characteristics of the sociocultural system related to agricultural practices? The focus of the dissertation must, perforce, be more modest. Specifically, it is concerned with the changing relationships among group composition, horticultural activities and associated land requirements. The research which informs this study was confined largely to one cultural group in the Enga Province of Papua New Guinea. Meggitt's agnation-density hypothesis provides an excellent entrée to the problem.

B. Meggitt's Agnation-Density Hypothesis

A great deal of literature from New Guinea alone bears upon this enquiry. Only selected major contributions are reviewed here to set the stage for a statement of the specific phrasing of the dissertation problem. Meggitt's Enga material is probably the earliest and most fertile example from HNG of the sort of investigation described above. Recognizing the tentative nature of the variables, he hypothesized that

> where the members of a homogeneous society of horticulturalists distinguish in any consistent

> fashion between agnates and other relatives, the degree to which social groups are structured in terms of agnatic descent and patrilocality varies with the pressure on available agrarian resources" (1965).

Since Meggitt's original formulation, several criticisms have been raised concerning the relationship, and two additions/modifications have been offered.

We must begin then by examining the criticisms of the original formulation. A. Strathern (1968) suggests that the hypothesis is stated too broadly and would replace the first clause "where the members . . . and other relatives" by "In the Highlands of New Guinea." He raises a much more serious issue, though, concerning the variable of "agnatic descent." Strathern notes that agnatic descent here implies both a principle of recruitment and a conceptualization of group segments. Citing Sahlins (1965) he goes on to ask, if recruitment rules are not the same in detail as group conceptualizations of unity and intergroup opposition, how can the strength of the descent principle be compared among different societies where it may manifest itself in different domains of social structure? Thus, following Scheffler, "descent constructs" (native categories that resemble either our technical or common-sense definition of descent) are not completely consistent and only make sense within specific transactional contexts (1965:111 and cf. de Lepervanche 1967; Glasse 1959; Barnes 1967). Strathern therefore concludes that the relationship may hold, but only in the Enga culture area where it was generated.

Meggitt operationalized his variables quantitatively where data were available, by calculating the percentage of adult men who lived with their natal agnatic group. This was compared to an average crude population density for the region in which the group resided when more specific information was unavailable. When quantification was not possible for the "degree of structuring" variable, he compared the available observations on group recruitment, residence patterns, land titles, warfare, ritual and exchange to better known groups and then estimated the "degree of structuring." This operationalization of the idea of agnatic structure received the major objections. McArthur's (1967; see also Barnes 1967; Sahlins 1963) detailed examination of Meggitt's computation of the number of agnates in a segment suggests that cross-cultural comparison is hampered by an uncertainty as to how agnates are counted--by the strict anthropological definition or the "Enga version." McArthur's recomputation by the former definition shows dramatically reduced numbers of agnates (54%--all ages and sexes vs. 71% for Mae C clan by Meggitt [1958]). Strathern goes on to point out that if the group under consideration is not well known to the ethnographer, upper level female links in a genealogy may be given as male thus increasing the degree of agnatic structuring.

Finally, and to echo Barnes (1967), we still have too few quantified agricultural and ecological data to gauge relative land shortage in HNG. Meggitt was forced to use crude population density to estimate "pressure on available agrarian resources" which likely obscures variation in productive capacity of different agricultural systems. Thus elevation, soil fertility, etc. vary from group to group rendering them to a large extent not easily comparable as to land needs. The criticism of this hypothesis might be characterized as follows: although the general relationship may appear attractive, operationalization of its variables presents such difficulties that cross-cultural comparison even within HNG is, to say the least, difficult.

Two significant additions/modifications have nonetheless been offered which are suggestive. First, Rappaport (1968:27) conjectured that low population densities may be associated with a fairly high "degree of agnation" since patrilineal land inheritance will tend to aggregate men on land conveniently near that their fathers utilized. With increased population, adjacent "cores" expand and interdigitate thus giving the spatial distribution of low agnation. As land resources become scarce Meggitt's relationship comes into play through exclusion of nonagnates and, to take a hint from A. Strathern (1968), a general concern with group boundaries.

The second modification derives from the Chimbu case which from the outset seemed to be contrary to Meggitt's hypothesis. The extreme deviation occurs in upper Chimbu where population density is 150/sq.km.--much higher than the central Enga area (Criper 1967). Central Chimbu, with a density similar to the central Enga area, does not show a comparable stress on patrifiliation. The upper Chimbu, Criper argues, do not even employ agnatic descent constructs; a man acquires land either from his father or his wife's father. This results in a flexible allocation of land which, when combined with a shortened fallow period, constitutes a systemic alternative response to high density. This case might be excluded by Meggitt's criteria since the Chimbu apparently do not make the same distinction between agnates and nonagnates that most other highlanders do. It could be a systemic alternate or, recalling Goodenough's "Malayo-Polynesian Problem" (1955), it could be the expectable upper limit of Meggitt's "curve" for agnation-density such that at very high densities agnation "peaks out" then falls off to alternative principles of structuring. Further evidence for this derives from Collier's highland Chiapas data (1975). Noting both Meggitt and Goodenough, he derives a curve of the "importance of patrilineal descent" vs. "increasing land scarcity" in which the former increases as land becomes more scarce, then declines. The rising portion of the curve he associates with a "conflict model" suggesting that warfare/defense is the critical variable in New Guinea. The falling portion of the curve he sees as an emphasis on cohesion in opposition to conflict--a solidarity response to shortage.

If the hypothesis were to hold with the additions/ modifications indicated above and in some specifiable circumstances, the empirical data would exhibit a distribution approximating Figure 1. In Chapter IV, two specific relationships are demonstrated which imply a

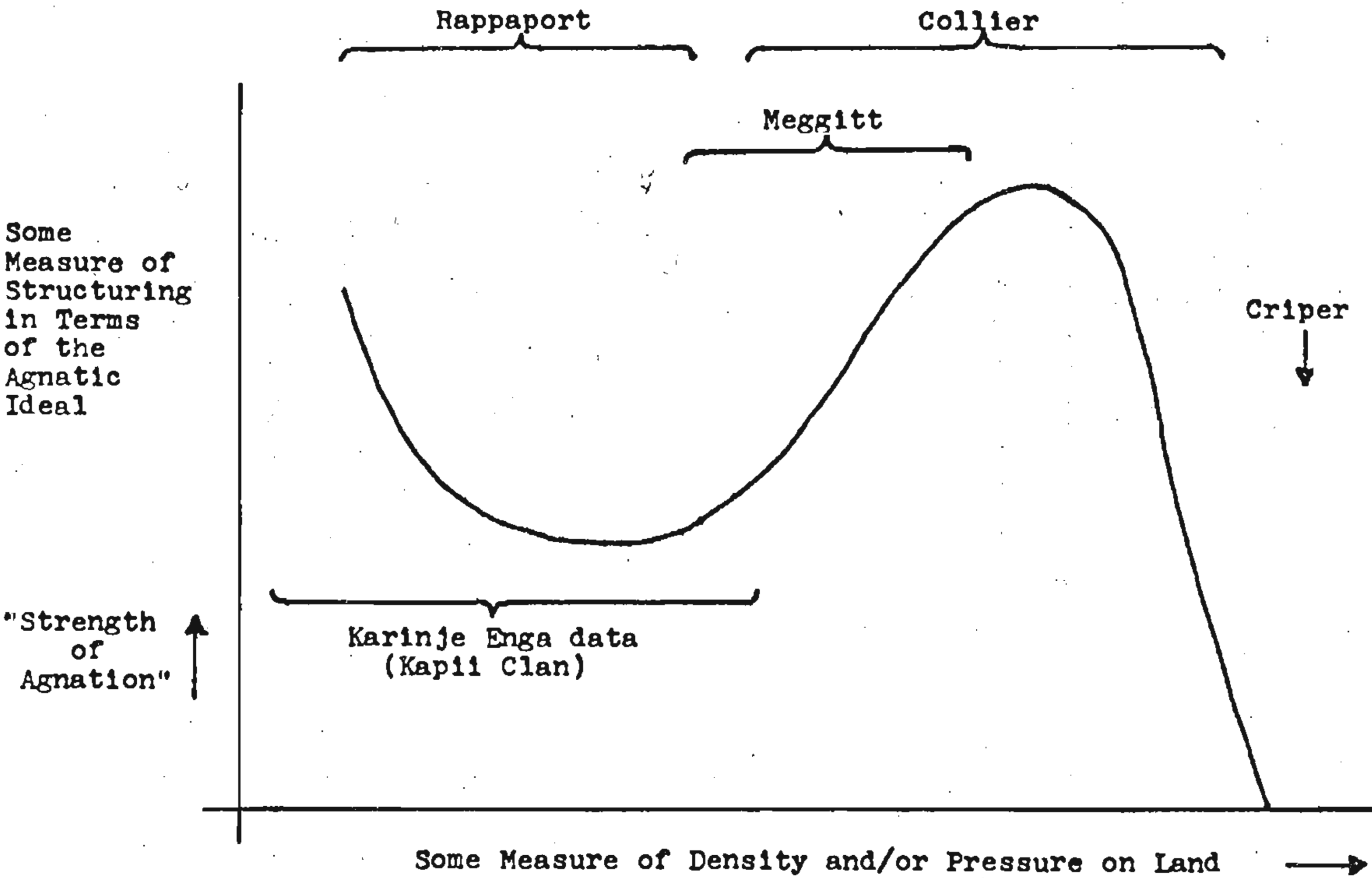


Figure 1: Theoretical Distribution of Agnatic Structuring vs. Pressure on Land

close fit with the lower portion of the curve in Figure 1--"Karinge Enga data (Kapii Clan)." But they are adduced from very particular circumstances. It is not my intention to test this modified hypothesis per se although I think the Kapii case lends it strong credence. The more important problem is one of determining the circumstances of applicability. Residual variance in the agnation-density hypothesis is so high as to render it untestable even if some operationalization problems were solved. Thus, it is the "conditioning" or "hidden" variables which must be examined to understand the limits of the relationship. This investigation requires a deeper understanding of the activities of individuals or classes of individuals which produce the outputs from which systemic statements can be made such as those of the original or modified hypothesis.

The heuristic value of Meggitt's hypothesis is apparent from the attention it has received in the literature. I explore further his hypothesis and the following comments suggest correspondences and deviations from the original which serve to initiate exposition.

1. The circumstances of applicability are ultimately an empirical question but Meggitt's emphasis on

agricultural societies is retained and the argument is confined to HNG societies.

2. Two ideological variable sets must be recognized (I and II) though other "values"/combinations need be considered in the broadest statement of such a relationship. This represents a departure from Meggitt's formulation on the basis of the Strathern *et al*. criticism but does not yet grapple with the crux of the comparison problem. Set I represents the ideal of "pure agnation" which can be used as the "etic" frame against which to compare group composition. Set II represents the ideology of a group in which immigration is a "norm" supported by criteria of appropriate incorporation. Such is the case where the research that supports this dissertation was carried out. Thus, I suggest that we must consider not only "the degree to which groups are structured in terms of agnatic descent" but also the degree to which groups are structured in terms of variant idioms concerning recruitment in general, filiation, and locality. Ideology thus varies and is perhaps best seen against a framework of "pure" lineality. Ideal structures can be related to behavior and presumably one might hope to discover how they covary.

3. "Pressure on available agrarian resources" is left intact from Meggitt's original formulation since it is the pivotal point of investigation in this dissertation. Here I simply indicate that the agricultural subsystem importantly conditions this variable set.

4. Population and area are the two variables Meggitt used to imply pressure on land and are retained here as fundamental parameters in the system (However, see 5 below).

5. Operationally the correspondence between ideal and real group composition can vary depending on how one defines the persons to be counted. One might count only adult married male family heads who cultivate gardens, or alternatively all individuals regardless of age or sex who fulfill appropriate recruitment criteria, or individuals by some other classification. Similarly, density may be determined on the basis of various categories of individuals, the whole population, cultivated area, cleared area, total group area and so forth. Alternatively, one might profitably utilize a different measure of pressure on land such as agricultural intensity or some energy consideration.

6. Finally, to harken back to the introductory remarks, a host of other variables might be implicated. In fact, it is just these "hidden variables" which I seek to illuminate.

Acquisition of data to investigate such a scheme is not easy and data are not readily available in the literature. Moreover, the available material usually derives from short-term studies (one to three years) which do not allow for an appreciation of process. Evaluation and modification of the hypothesis would greatly benefit from data which add time depth and allow us to see the processes yielding synchronic cases. It should be noted that Meggitt goes to some length to consider the dynamics of group segmentation, fusion, and alteration but does not have the corresponding ecological data in detail. Meggitt, Brookfield, Brown and several other ethnographers have long histories of research in HNG which might suggest that relevant data exist. However, it is not decades of evidence that will likely offer the crucial test, but generations.

An attempt to derive and analyze such long-term data for a fringe Enga group is the basis of this dissertation. An analysis of garden distribution, inheritance of land, clearing histories, genealogies, etc., reveals the process of growth of the local descent group since the area was settled (estimated at 170 years ago). This growth is largely accounted for by the incorporation of nonagnates into the local group, a practice which was dramatically curtailed after 1940. Although one must remain ignorant of the expression of agnatic idioms for the preceding generations, an examination of the group composition in terms of ideal descent and locality can be related to land clearing dynamics, inferred population and measures of density and scarcity of land. The results support the general pattern of the low density portion of the curve in Figure 1 and suggest some relationships to associated variables. The latter relationships, though projected well beyond the empirical data reported here, are an attempt "to achieve formulae which will enable us to make predictions from one system to another" (Strathern 1968:51). I thus begin with Meggitt's hypothesis and proceed toward Strathern's goal.

Before embarking on that journey, it is necessary to describe related ethnographic data which are required in order to evaluate details of my argument. Chapter II contains material pertinent to later developments and might be termed a "mini-ethnography." Chapter III reports in some detail on the critical interface between the sociocultural system and its environment—the agricultural subsystem. In Chapter IV the field data are presented and analyzed to derive results which, in Chapter V, are used for comparison with other societies, to account for variability, to suggest the nature of tentative models and to indicate further research possibilities.

C. Fieldwork

One more preliminary should be dealt with. It is all too often the case that the methods, procedures and less easily categorized information concerning anthropological fieldwork are not reported at all. Somewhere beyond a little information which is possibly worse than none at all and short of full psychoanalysis and daily diaries, the reader may appreciate a brief appraisal of the field circumstances under which these data were collected.

My wife, three year old son, and I entered Papua New Guinea in April 1972. We left, with a second son, a little more than three years later. During that period five and one-half months were spent in pursuits outside of fieldwork per se, some of which time was used to consult with researchers in the area. The remaining thirty and one-half months were distributed as follows: finding the field site--one month; settling in--one month; fieldwork with dispersed segments of the agnatic group, frost migrants and related groups--two and a half months; fieldwork at the main site--26 months. Roughly one-third of the major period was consumed in data gathering for the garden map, garden inheritance and genealogies which comprise together the data central to this dissertation. The remaining time was devoted to an examination of subsistence activities, the response to and recovery from a major frost, the exchange system, personal networks of exchange and mutual assistance, dispute settlement, a multitude of lesser projects and general ethnography. The "ideal" pattern was to spend about six hours a day, six days a week in data collection although the actual amount of work was decidedly lower in the first year (barring certain periods having to do with the frost) and climbed until saturation was reached during the last six months. Quantity of data recorded progressively increased with time and I fancy quality did too. The efficiency of this effort, however, varied with the type of information sought (see below). To find particular people on any given day in a situation of dispersed residence frequently required a good deal of walking. I might even say that if I forget everything else, I will always remember walking back and forth across the valley of Yumbisa--a pleasant memory, I might add.

My wife assisted in the fieldwork throughout but contributed especially as regards agricultural techniques by the direct process of becoming a gardener in the local fashion. This turned out to be particularly relevant as will be apparent in Chapter V.

For the first three months we employed an English speaking interpreter from a nearby group who spoke a closely related Enga dialect. During our first month and sporadically thereafter, we engaged in formal lessons with him with the aid of a Lutheran Mission grammar of central Enga--a distinctly different but intelligible dialect. After the interpreter's departure, we shifted to NeoMelanesian Pidgin which created difficulties; only a half dozen local residents spoke that language at all, and only three spoke it well. After exhausting most of these sources in a few months, we were extremely fortunate to employ Imambu, a local man who had formerly been the

Lutheran pastor at Yumbisa and could read and write Pidgin and Enga. Our relationship was maintained throughout the fieldwork, and he became an interpreter and field assistant capable of carrying out certain data gathering without direct supervision. Indeed, he became a colleague, and as time passed, we were obliged to argue out conflicting interpretations of not insignificant anthropological points. His insight, which I came to learn was clearly influenced by his missionization and social position, was nonetheless extremely valuable even as my heavy reliance on him was potentially dangerous. As we learned some of the language, we were able to work on occasion without him but only where interviews dealt with simple straightforward matters. He was employed as interpreter up to the last day for any situation where rapid speech, heated exchange or esoteric topics occurred. The data collection was to all extents and purposes filtered through a Pidgin translation and translator. In the later days of fieldwork, I was able to check the gist of his translation through my own understanding of the language and throughout, the same questions and themes were hit again and again ad nauseam. I am confident that the bulk of the information I recorded faithfully replicates that which was given, though no doubt some details are lost or distorted.

We lived in an Enga house modified for some western comforts, ate local food in addition to Western staples, maintained a large garden and a few pigs, wore no shoes (a point they seemed to think important) and participated in social interactions and activities as much as possible according to community norms. All of which is to say, we were closely involved with everyday life and were recognized by the local people and surrounding groups for considerable distances as, to a large degree at least, endakali kininqi, 'real people'.

With regard to assuming the rights and duties of a kinsman, two distinct strategies were employed. For the first half of the fieldwork, I consciously remained outside of any quasi-kinship associations under the assumption that I thereby insured access to a larger population of informants and avoided animosities between groups. I think that assumption may have been false since our foreignness allowed us to be outside petty quarrels anyway, but this insulation wore rather thin toward the end. We declared our "kinship" for the last half of the work and were thereby drawn into the community to a degree that was sometimes almost regrettable. To achieve this, I acted the culturally accepted role of "brother" to Mupali (our neighbor) who willingly participated, and the ramifications were legion. In terms of understanding social life at Yumbisa, the latter strategy was worth any slight discomfort that accrued.

To get finally to the heart of data collection, I should note that my intention in selecting the site was to find a place which frequently experienced frost and to examine its effect on the sociocultural system. As it turned out, the choice was excellent, and the data pertaining to frost and its consequences are central to this dissertation because they help describe an unusual social drama in which various features of the system are revealed. Frost did, however, wreak havoc with the baseline ecological/agricultural data because a "normal" situation only reappeared during the last year of our stay. Be that as it may, each daily excursion was directed toward the acquisition of some specific data. This was modified by the difficulty of finding particular individuals, or even certain categories of people, and the occurrence of unanticipated social activities. As time passed, the following strategy developed. An appraisal (usually agonizing) of what I knew (little) and what I needed to know (a lot) resulted in a decision to pursue certain lines of inquiry in the immediate future. These goals were arranged according to categories each with its particular topics and instructions for completion which are exemplified in Table 1 for a hypothetical time.

Some of these endeavors, of course, lasted throughout the fieldwork. Others were completed, and new ones generated. Lest the reader get the wrong impression, all research time was not strictly structured. It simply was not possible to interview constantly, and early rains, lulls in ongoing activities, etc. resulted in simply "hanging out" with people for whom I just had no particular questions. Information gathered at such times was often found to be quite significant: listening to gossip, idle reminiscences, stories, and rumors of coming events. Informants were almost always engaged at whatever place they happened to be when they were willing to talk and always on their terms. No inducements were offered excepting those exchanges of tobacco, food, etc., that solidify ordinary social intercourse. On rare occasions informants were "formally" interviewed at our house. In all cases, I attempted to get breadth of input as well as depth. Many people contributed but certain ones naturally were

Category	Topic	Instructions
I. Recorded in topic notebook		
1. Major project	a) Mapping gardens b) Collecting genealogies	a) Complete Yanakepaka area b) Get major genealogies for Yurimi: (name)
2. Minor project	a) Agricultural experiment b) Agricultural technology	a) Harvest mounds 1-8 b) Find someone to construct a pre-contact shovel with stone tools
3. Major survey	a) Garden record b) Census	a) Do bimonthly survey (of 100 plots) b) Pick up Lemongo (returned from Kiteli)
4. Minor survey	a) Precontact trade partners b) "Time of darkness"	a) Interview all men over 50 and ask following question... b) Find out who knows the story and ask following questions...
5. Special project	a) Food consumption	a) (Lengthy instructions)
II. Recorded in daily notebook		
1. Social activities	a) Exchange b) Dispute settlement	a) Observe all exchanges b) Observe only those concerned with land
2. Questions	(variable)	Ask Kongo about <u>poo lenge</u>
3. Daily notebook	any	none

Table 1: Organization of Field Notes

disproportionately represented in special categories (e.g. my major source of information on precontact curing ceremonies comes from Kongo, 75 years old, a leading practitioner in the past).

Thus, on a hypothetical day at the peak of data gathering, our anthropologist sallies forth from his house as the morning mist rises from the valley floor armed with a half dozen project and survey notebooks, his daily notebook, a scrap of paper with crucial questions, a compass, tape,scale, camera, three pens, a pipe, tobacco and a rain coat all in his pack. He returns exhausted in a cold, pouring rain that afternoon having found almost no one to talk to despite walking back and forth across the valley until his interpreter went home in disgust. Ah well, time stands still in Yumbisa and tomorrow is another day.

CHAPTER II

ETHNOGRAPHIC BACKGROUND

A. Myth, Fiction and History

As the story has it,[1] Kapii left his home at Bipi early one morning in the beginning of the nineteenth century, climbed the steep hill behind his house and picked his way through the forest. It was kumupipi moon and wild pandanus nuts would soon be ready for harvest. He intended to see if they were mature in a distant valley where he knew a rich grove flourished. In the afternoon after skirting the shoulder of Lipitaka mountain, he paused on the last ridge and caught a glimpse of the valley below. It was bowl shaped and the center was so wet that no trees grew, only swamp grasses. Around the swamp on very slightly rising ground the pandanus grew among a tangle of other trees. That would be good garden ground if only there were enough people to clear and ditch it as

[1] plus a great deal of reconstruction and "literary license." My apologies to the native historians of Yumbisa.

had been done at Bipi long ago. Beyond the valley, mountains rose again embracing other high uninhabited valleys. The Wage river drained the valley southward into the land of his enemies, the Huli, who would also be spreading into the bush in search of pandanus groves. He picked up his bow and arrows and descended quickly to the valley. In the northeast corner, a spur of the surrounding ridges jutted out into the grove with a small level platform at its tip. It was just above the valley tree tops and an ideal place for a pandanus house. He rapidly constructed an overnight shelter of poles and pandanus leaves. The next day he completed the structure.

A few weeks later, Kapii returned with his family, pigs, and relatives. The harvest was as good as expected; they (and the pigs) ate as much as they wanted and dried and carried back as much as they could. In subsequent years they returned, each time rebuilding the house more permanently and clearing a bit of forest around it in the process. During the pandanus season men worked hard cutting, cleaning and carrying nuts (the bush was after all the province of men) while women, relieved of their garden obligations, had little that had to be done. On one occasion, his wife brought with her a bundle of <u>yumbi</u>

sweet potato vines, made a few mounds by the house and planted them. The soil looked good. Perhaps someone would come back to see.

Many months later Kapii and his two older brothers, Meoko and Epee, wanted to hunt marsupials in the bush. During the last pandanus season, Kapii had come upon a large pile of komaipa dung beneath a tree in the valley. A large marsupial must have lived there and recalling this, they went back to see if they could kill it. When they reached the pandanus house they noticed that the sweet potatoes Kapii's wife had planted were flourishing. When they dug out the tubers they were astounded; they were huge, larger than any they had seen, with stout stems that they cut with their axes. This was indeed a fine place for gardening, they all agreed, and Kapii forthwith resolved to clear the surrounding bush.

Meoko and Epee were the first and third male children of the family while Kapii was the fourth. Meoko and Epee had received better land from their father than their younger brothers and had developed their resources and connections before Kapii came of age. The last three sons of the family, Ekeme, Apone, and Taumo, moved to another bush place near Kapii's other older brother, Kungadine, the second born. Kapii's father had marked Yumbisa to be Ekeme's place but the older siblings were too strong and took it from their younger brother when he did not exchange pigs properly. It was thus Kapii who actually moved to "the place of the yumbi sweet potato"--Yumbisa--while the other two cut pandanus on nearby ground. His family flourished and grew as he married several wives and had many sons. But Yumbisa turned out not to be quite the paradise it had appeared for the frost fell there more often and harder than at Bipi. Still, Kapii's first three sons, Pao, Kepa, and Yurimi, actually stayed at Yumbisa while the last three, Anamu, Murelyu, and Apolo, gardened at Bipi. Before he died, the old man saw his older sons clear bush along the valley edge and begin the process he had earlier envisaged of working out into the valley flats.

During the next hundred years, the people of Yumbisa grew in numbers, cleared the forest, ditched the valley and fought with their Huli enemies who were pioneering the other side of the valley. Land was abundant and many relatives were encouraged to come to live at Yumbisa. Descendants of Meoko and Epee gardened along the northern edge of the valley and with them too the Kapii people occasionally fought. About 1900 an especially bad frost killed the gardens. They knew what to do from previous experience: everyone packed up and went to stay with relatives at lower elevations. This was easily done since they maintained contact with relatives in far flung localities; lineal descendants of Kapii's ancestors lived in many distant places. When they had re-established their Yumbisa gardens, they returned and life went on as before. Around 1940 another terrible frost occurred and some people died of hunger, a sickness killed more people, a second sickness killed many pigs, and two strangers from the Lyaimi to the north came telling the people to kill their pigs, to change their ways and prepare for a new time.

Shortly thereafter, the kone (whites) came with their mysterious powers. They stopped the fighting, forbade the old curing ceremonies and related activities, brought steel axes, other goods and finally planes, money, taxes and medicine. Schools, roads, vehicles, businesses and a bewildering new world loomed just over the horizon in 1972.

In that year my family and I arrived at Kandepe on the back of a truck carrying gasoline. The Kandepe patrol post was the administrative center of the Kandepe sub-district, (then) Western Highlands District, comprising three stores, the government offices, a few houses and other buildings and an airstrip. Some 53 km. away lay Yumbisa. In a few weeks we were once again jostling along the rough raw limestone covered road, this time in a Lutheran Mission Land Rover toward the roadhead, some 21 to 14 km. from Yumbisa, depending on road conditions. The better part of a day's walk finally put us on the last ridge above Yumbisa valley where we had been preceded by our 700 pounds of supplies on the backs of sturdy descendants of Kapii. This ridge lay directly opposite the one where Kapii had paused--opposite in space, time and many ways. Now this place was securely in the territory of the fringe Huli speakers. Below us the center portion of the valley was still unused swamp (at about 2,540 m. at the lowest), but the eastern periphery (rising to about 2,570 m.) had been cleared except for some remnant pandanus trees, and a geometrical pattern of garden boundaries was indistinctly visible. The slopes above had also been cleared and there the 383 people of Kapii clan resided. The northern side of the valley was similarly populated by a lesser number of people of Meoko and Epee clans. On the western and southern side of the valley the Huli dialect speakers (several hundred) similarly utilized the area known as Katikati (Kerekere in the government census). Around the valley, the mountains, largely uninhabited except during pandanus season, rose to heights of 3,000 to 3,800 m.

Thus after 170 years one may, like Kapii, quickly descend into Yumbisa valley and get a closer look at life there in the ethnographic present of 1975.

B. Climate

A typical day at Yumbisa begins with a ground fog filling the valley up to about 100 m. By 9:00 A.M. this is dissipating and people are just beginning their outside activities. It is usually clear until early afternoon when the cold rains begin driving people to take refuge. The sun rarely sets in a clear sky and temperatures drop quickly whenever the sun is obscured by cloud. Nighttime lows occur just before sunrise and average 8.5°C.[2] but range from 11.5°C. to -3°C. Daytime highs

---

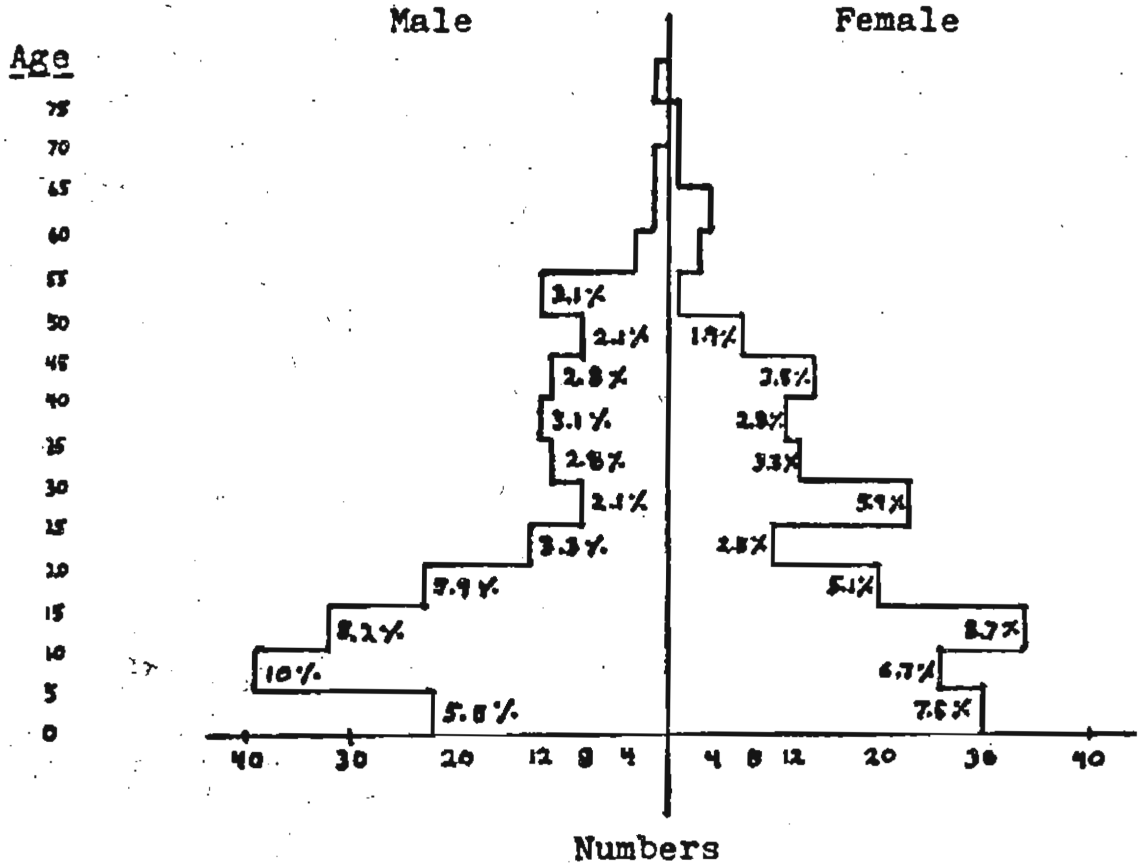
[2]Meterological records (max.-min. temperature and rainfall) were kept during the entire period of resident fieldwork and thus include the first year of serious frost/drought. The recording station was on the eastern edge of the valley about 30 m. above the adjacent valley floor and 1.6 m. above the ground.

average 21.5°C., occur in the early afternoon and range from 29.5°C. to 11°C. Rainfall averaged 2,618 mm. per year with a monthly mean of 218 mm. and a range of 39 mm. to 411 mm. per month. Maximum daily rainfalls of over 50 mm. were recorded twice in three years while 25 to 50 mm. falls occurred 44 times. Hail fell twelve times during the same period. The extremes of temperature and rainfall correspond with a season variation such that January through April is still, warm at night and cool in the day with frequent cloud starting early and persisting into the night, little ground fog, and measurable rainfall 90 percent of the days, often raining lightly for days without long breaks. July through September (some times June into October) is cold at night, hot and breezy during the day with little cloud cover, clear nights, heavy morning ground fog, and measurable rainfall on 62 percent of the days, occurring in brief light afternoon thunderstorms. However, yearly variation can be great, and the dry period may be indistinguishable from months on either side. Soil observations suggest that during a distinguishable dry season evapotranspiration markedly exceeds rainfall. In comparison to Kandepe (the nearest government recording station), Yumbisa experiences wetter and colder weather with a slightly more seasonal regime. The major direct effect of this pattern on daily life at Yumbisa centers around the cold. Nighttime temperatures require both well-insulated houses and the constant acquisition of firewood. Cold afternoon rains frequently terminate public gatherings outside and discourage garden activities. No clothing for cold is worn but an efficient raincape made of pandanus leaves is used. Effects on agriculture are considered in Chapter III and social responses to frost damage are described in Section H of this chapter.

C. Population

This study focuses on the 398 people of Kapii clan. Less intensive observations on another approximately 100 people in Meoko and Epee clans are made. The age (estimated) pyramid of Kapii people for April 1975 is given in Figure 2.

Of the 197 males, 101 (51%) are of the appropriate age (15-60) and physical capacity to contribute effectively to the male labor force (directed toward gardening, cutting firewood, clearing, fencing, ditching, house construction and fighting). Girls ordinarily begin serious



Note: Percent are of TOTAL Population

Figure 2: Population Pyramid

garden work early. Thus, of the 201 females, 128 (64%) constitute the female labor force, age 12-65 (directed primarily toward gardening but also caring for children and pigs, and participating in house construction).

Individuals are grouped into tata 'families' which are composed of a married male head, his wife or wives and all co-resident children plus any "adopted" children, elderly parents or other relatives residing permanently with them. Where the male head is not living or where unmarried brothers form a commensal unit, they were counted as families (one case each). There are thus 73 families averaging 5.3 individuals. One can also distinguish 52 "households" composed of one or more families who share a house or houses, form a commensal unit and behave much like a family (7.5 persons per household). Of these households eleven comprise more than one family (15.7 persons on the average). Men and women ideally sleep in separate houses. There are about eighteen men's houses with a variable population of residents; a few men sleep regularly in the front room of the 63 women's houses and young men move around. The total population is housed in 81 occupied dwellings.

Some characteristics of marriage and childbirth are summarized in Table 2. A sample of 94 marriages for which reasonable estimates of the duration could be made,[3] gives a birth spacing interval of 3.8 years (11.5 years of marriage per wife). This corresponds to an average interval between surviving children (<u>at the time of census, regardless of age</u>) of 5.9 years. Infant mortality is very difficult to determine since years are not counted. However, considering the 25 cases of marriage which have durations of five years or less and which produced at least one birth, twelve of 29 children died which would imply a five-year mortality of 41 percent for all data; 44 percent for the fifteen most reliable time estimates. Many of these deaths are reported to have occurred within the first year, as one might expect, but I was unable to determine the distribution of deaths associated with

---

[3]When no data to the contrary were reported or observed, this assumes that men marry at age 25, women at 18 and female fertility is terminated at age 43 which accord well with observed practice. The results are approximations which depend largely on the age estimate of individuals. Government census (since about 1962) was not found to be very useful for this. However, the last major frost is known to have occurred around 1941 and it is well remembered. Thus it serves as a reference point for older individuals.

Marriage

Married men	74	Married women	104
Marriages/man	1.85	Marriages/woman	1.18
Current wives/ man	1.27	Current husbands/ woman	1.00
Men with multiple marriages	29 (39%)	Women with multiple marriages	22 (21%)

Divorce

De facto	3.7% of marriages
Jural	9.7% of marriages
Both	13.4% of marriages

Births

(from all marriages of 74 living men)

				"Mortality"	
Male births	181	Male deaths	63	Male	35%
Female births	186	Female deaths	71	Female	38%
Unsexed	12	Unsexed	7		37%
Total	379	Total	141		

	Per husband	Per wife (by local husband)
Surviving children	3.22	1.72
Births	5.12	2.74

Table 2: Some Characteristics of Kapil Marriage and Childbirth

birth and weaning. (Weaning occurs at about three years and depends on the mother's appraisal of the child's development.)

In physical appearance, the people of Yumbisa closely resemble other highlanders. Adult men average around 158 cm. in height and weigh about 61.5 kg. while adult women average 148 cm. and 49 kg. They are normally very active and healthy. Several ailments are recurrent, however. Of 70 cases of treatment recorded by the Native Medical Orderly in nearby Katikati in 1972, sixteen involved gastrointestinal complaints with diarrhea, eight were cases of pneumonia and eight influenza. Hepatitis is said by expatriates to be endemic but only to result in "a general slowing down." When a severe food shortage occurred, people seemed to reduce their general activity level appreciably.

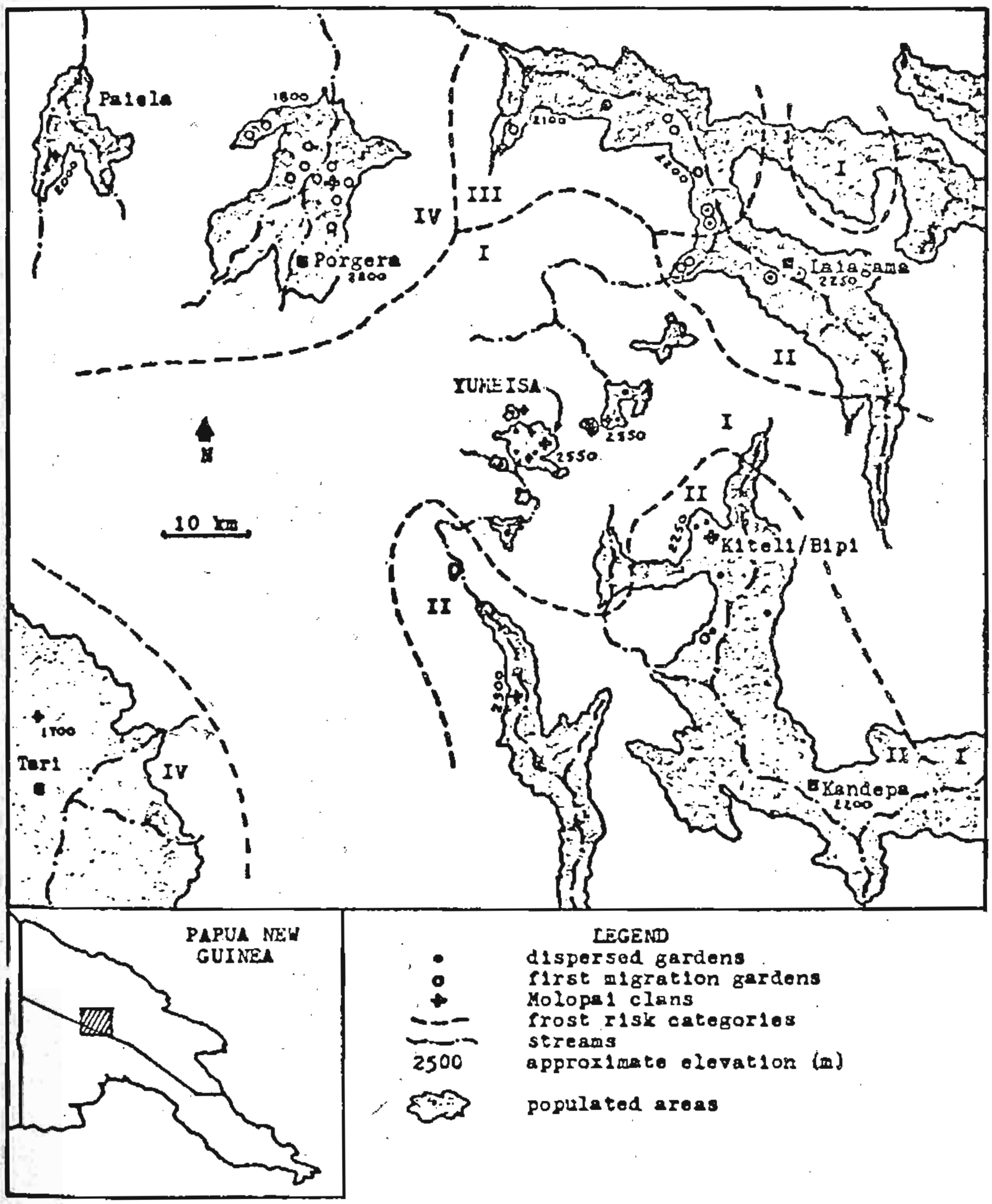
During the 34 months that field records were maintained, there were 45 births. Of these, seven infants died in their first year of unknown ailments. During that same period, a total of 30 deaths occurred including the infants: 11 male, 18 female, one death at birth--sex unknown. Of these, eleven were children five or under and the average age of death was 1.6 years. Nineteen were adults between 24 and 69 years of age, and the average age of death was 50.2 years. Although the Western observer could usually identify some illness as the most likely cause of death, the local view has it that eight of the nineteen adult deaths were the result of previous physical violence which "broke the skin" of the head or trunk. This is significant because such deaths must be compensated by making <u>tee pingi</u> (see Section F). Since physical violence is fairly common, almost any death results in such accusations (excepting very old individuals and very young). A public inquest is held to decide if in fact the accusation is probable. There was one actual homicide but the murderer was in a "wild man" state (Clarke 1973) and thus not responsible for his actions. No pattern of deaths in association with food shortage was observed, but a weak correlation with a flu epidemic could be seen.

D. Social Structure and Land Tenure

Kapii's great grandfather (maybe it was his great great grandfather) had made his home on Bipi hill. His name was Molopai and he was a snake man as were his many sons. When one of his sons was helping a man clear the bush, down the Wage river, the man discovered that the son was a snake. He tried to kill and cook him but the injured son escaped, bound his wounds with _take_ leaves and cut a _pai_ pole for a cane. As he returned home he planted _take_ and _pai_ everywhere he slept. When the son told of his troubles his brothers were afraid that people would want to eat them all, so Molopai sent them to hide in small lakes in the forest all around the upper Wage river area. The mother of these children and her one daughter also fled. They encountered two of the sons at Kindana and all four went to the Lagaip watershed. Wherever they slept they planted _take_ and _pai_ trees. The two boys quarreled with their mother and sister and went off by themselves. Then the girl was abducted by a worthless man and the mother stayed at Kanaka (near Laiagama). Wherever they had slept _take_ and _pai_ grew and people later performed the _kapelandaka_ ceremony. Molopai married a woman from Mendi and she bore sons from whom the Molopai people came.

If one asks a dozen informants over age forty the particulars of genealogical connection of Molopai's descendants, one gets a dozen different versions, but all know the gist of the myth. It serves both to rationalize and to exemplify some important characteristics of social grouping in the region. First, the diaspora of Molopai's snake children fairly reflects the distribution of Molopai peoples now. Local segments claiming agnatic descent from Molopai (called Pui in Porgera and Paiela) can be found throughout the upper Wage and Lai rivers, in the Lagaip, and at Porgera, Paiela and Tari (see Map 1). The most distant of these places are four or five days' walk away for an unencumbered party of strong men. They probably number less than 1,500 people, the bulk of whom live in the upper Wage and Lai valleys.

Second, it is not an accident that the final destination of Molopai's daughter is called to attention. Since Molopai's time, women who have married out are remembered as having established enduring ties with other groups. Such ties establish traditional intergroup relationships between those of common agnatic descent and no descent (i.e. enemies). Several such relationships exist. In some cases these people were given land and became attached groups while in others they remained autonomous but are recognized corporately to be relatives (see "nephew groups" in Figure 3).



Map 1: Location of Molopai Clans and Kapii Dispersed Gardens by Frost Threat

The final point is that the _kapelandaka_ ceremony (which has not been practiced since about 1963) served as the only large-scale mechanism of unification. However, it was never performed with the whole tribal group nor any major portion of it in attendance, at least in memory. It occurred at, perhaps, five-year intervals and involved the construction and destruction of a large ceremonial house, the "revelation" to children of ceremonial pictures and figures, the sacrifice of many pigs, dancing, various taboos and a general truce on warfare within the area. All surrounding people were permitted guests and the activities constituted a renewal ceremony for the hosts. Central to this and the various lower-level curing ceremonies was the propitiation of agnatic spirits through an offering of pig fat. That this ceremony was performed everywhere that Molopai's children or wife planted the _take_ and _pai_ trees distinguishes a larger region wherein all the tribes are united to some degree through a similar ceremony. All Molopai did this but so did Katikati people and others. (In some places Mendi and Huli peoples have taken over the ceremonial site and perform their own ceremonies.)

When the pig fat was offered to the agnatic spirits, the names of all dead agnates who founded segments were called. Thus at any site the unity of the total tribal group was reaffirmed in a recitation beginning with Molopai, followed by several names of quasi humans (like the "snake men") or spirit beings rather vaguely conceived and continuing on down through each level of the hierarchy of segmentation to the lineage founders of the participating men. Variability in this recitation from place to place reflects the exclusion of high-level segments, whose members live farther away, and the additions of local apical ancestors and their purported descendants. This genealogical reckoning is done in terms of pure agnation but without preserving exactly the order of segmentation with respect to siblings; all members of the same generation are named without differentiation as to birth order. The classic form of a segmentary lineage system is implied, but the exact genealogical relationships are not seen as important.

Likewise in a related ceremony, the names of ancestors were called. This, the kaimandaka, was purely a curing ceremony and was used when sickness was widespread. Since illness was believed to be caused by an agnatic ghost damaging the spirit of the living, such a ghost could possibly be placated by the offering of pig fat in the proper ceremonial context. Although recently dead agnates were considered to be the most likely perpetrators of an attack, they were not nearly as powerful as ancestors further removed. Thus, if many people were sick, or being killed in fights, it was undoubtedly an ancestor (or combination of ancestors) far up the genealogical line who caused it to happen. The kaimandaka, then, approached the kapelandaka as a means of renewing and righting relationships with the ancestors and served as a solidarity ceremony for a lower level (the exogamous segments) of Molopai as a whole. The kaimandaka is not mentioned by name in the myth, though it is strongly implicated; the kaimandaka was conducted at any site where the snake children hid (and remain). In fact, other stories not quite in the mythical tradition, relate how men of the most distant agnatic outliers returned to Piange (the site of the major Molopai hole) to carry a container of that water to a similar site in their home territory where they thereafter conducted the ceremony. Both the kapelandaka and kaimandaka were directed at the very top of the descent structure and occurred to prevent or correct widespread illness and misfortune. Although informants suggest that the proper observance of these ceremonies insured that _everything_ went well, they could not be used to prevent or rectify the effects of frost, drought or similar calamities.

As the curing ceremonies suggest, the social structure of Molopai people resembles a segmentary lineage system. It is basically the same as that described by Meggitt (1965) for the Mae Enga but there are also some important differences.

I begin with the familiar anthropological notion of a segmentary lineage system. The segments are said to have been founded by direct agnatic descendants of Molopai and are called _tata_, occasionally _yama_, for any level of segmentation down to the family (described in Section C). Segments bear the names of founders. Those individuals within such segments who are said to come from "one penis" are agnates.

Contrary to central Enga and various other New Guinea societies, any notion of blood, spirit, bone or flesh deriving differentially from parents, is denied.[4]

---

[4]One informant did say that blood "followed" agnatic lines.

Babies are simply the natural product of the combination of male and female fluids in the womb. Ghosts of dead agnates reside primarily in the territory of their clan (see below) and they may influence bush spirits causing them to attack people. Ancestral ghosts may also warn individuals of impending ambush or other harm and aid them in various ways. It is almost as though the Yumbisa ideology was at one time similar to central Enga but lost certain elements in the hinterland. Such may have been the case, a point to which I return in Chapter V.

A composite diagram of the relationships among various agnatic segments of Molopai, which would probably satisfy most old men at Yumbisa, is shown in Figures 3a and b. The solid lines indicate relationships which are widely agreed upon while the broken lines represent disagreement. Each triangle represents a segment founder and segments founded by his children are, of course, a part of the larger unit.

Particulars concerning levels I, II and III are sparse, deriving largely from the origin myth recounted briefly above. A few informants suggested that the snake-man Molopai was a brother of the marsupial-man Kuu and, although there is another myth to this effect, it appears

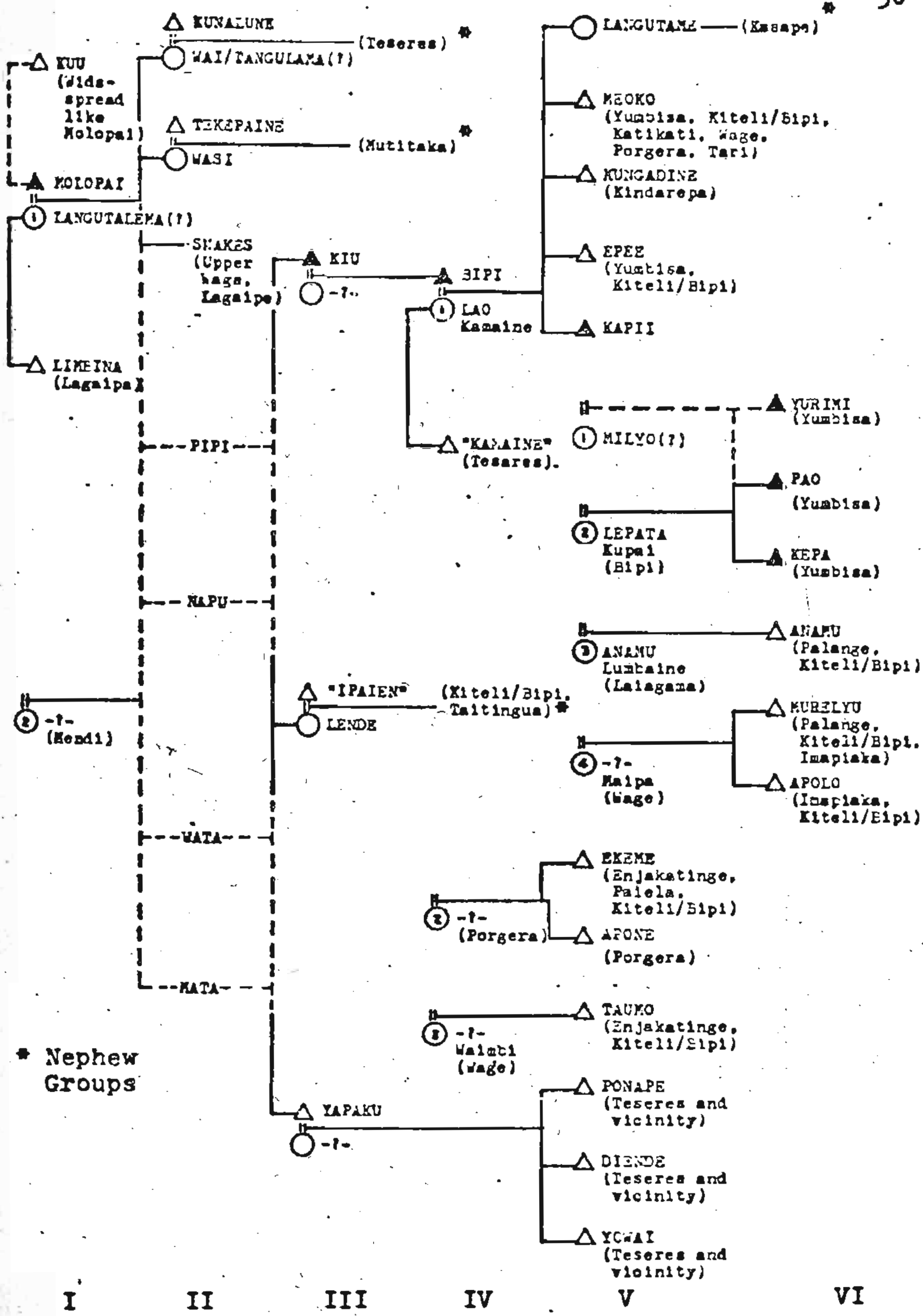


Figure 3a: Relationship and Location of Segments

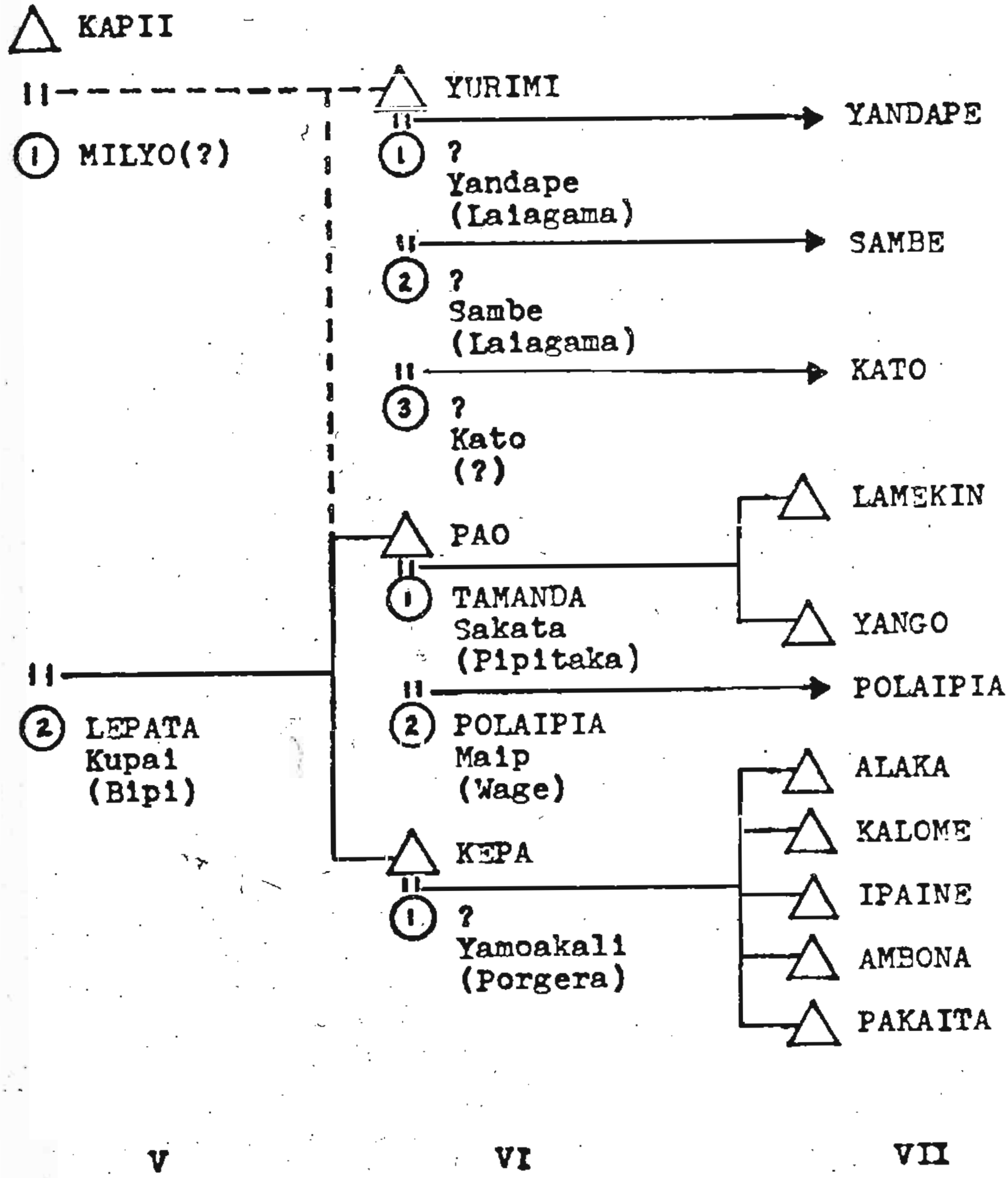

KAPII
MILYO(?)
LEPATA
Kupai
(Bipi)
YURIMI
?
Yandape
(Laiagama)
?
Sambe
(Laiagama)
?
Kato
(?)
PAO
TAMANDA
Sakata
(Pipitaka)
POLAIPIA
Maip
(Wage)
KEPA
?
Yamoakali
(Porgera)
YANDAPE
SAMBE
KATO
LAMEKIN
YANGO
POLAIPIA
ALAKA
KALOME
IPAINE
AMBONA
PAKAITA
V
VI
VII

Figure 3b

to have no discernible effect on relationships between their descendants. The people of Katikati on the southwestern side of the valley opposite Yumbisa are Kuu. I call Molopai and Kuu peoples tribes. In addition to the characters of the origin myth and a second daughter of Molopai, four quasi-humans[5] are frequently recalled, but their genealogical relationships are simply not known in detail and are considered unimportant in specifying segment boundaries below Molopai. In level III, two clear segments emerge which I call phratries. Level IV contains only one segment, Bipi, which is coterminous with Kiu. The former name is most often used. Ten clans make up level V, some of which contain subclans, level VI (only Kapii subclans are shown in Figure 3). Within clans or subclans, the smallest named segment is the lineage (level VII, see Figure 3b) composed of families (level VIII).

The levels of segmentation that I have singled out with anthropological designations (e.g., clan, lineage,

---

[5]Like Molopai and other eponymous entities in the region, these quasi-humans are anthropomorphized snakes (for Molopai), marsupials, birds, worms, trees, plants and even rocks. When they found a tribe, the thing is not eaten or used or (in the case of the rock) minor rituals are performed when passing it. Lower-level quasi-humans require no such restrictions.

etc.) exhibit the following salient features. Molopai as a whole demarks the maximum extension of descent idioms. In the absence of any more specific relationship, tribal agemates address one another as "brother" or "sister." Other primary kin terms are used similarly. Beyond the unity maintained through oral tradition and the ceremonies described above, relationships among tribal members entail little else than hospitality, and that only in need.

Phratry unity is somewhat more important. The _kapelandaka_ ceremonies among Molopai people were usually performed at one of two sites where the _take_ and _pai_ grew. One was held on Bipi phratry land (at the place called Bipi, Molopai's home) and one on Yapaku phratry land. Hence, separate ceremonies tended to maintain the division even though the two locations are only about one kilometer apart. Representatives of any of the clans in a phratry sponsored the _kapelandaka_ ceremony, boys of any clan participate in the _sangai_ initiation ritual of other clans in the phratry and men provide shelter for their "brothers" in case of defeat in warfare or temporary migration after frost.

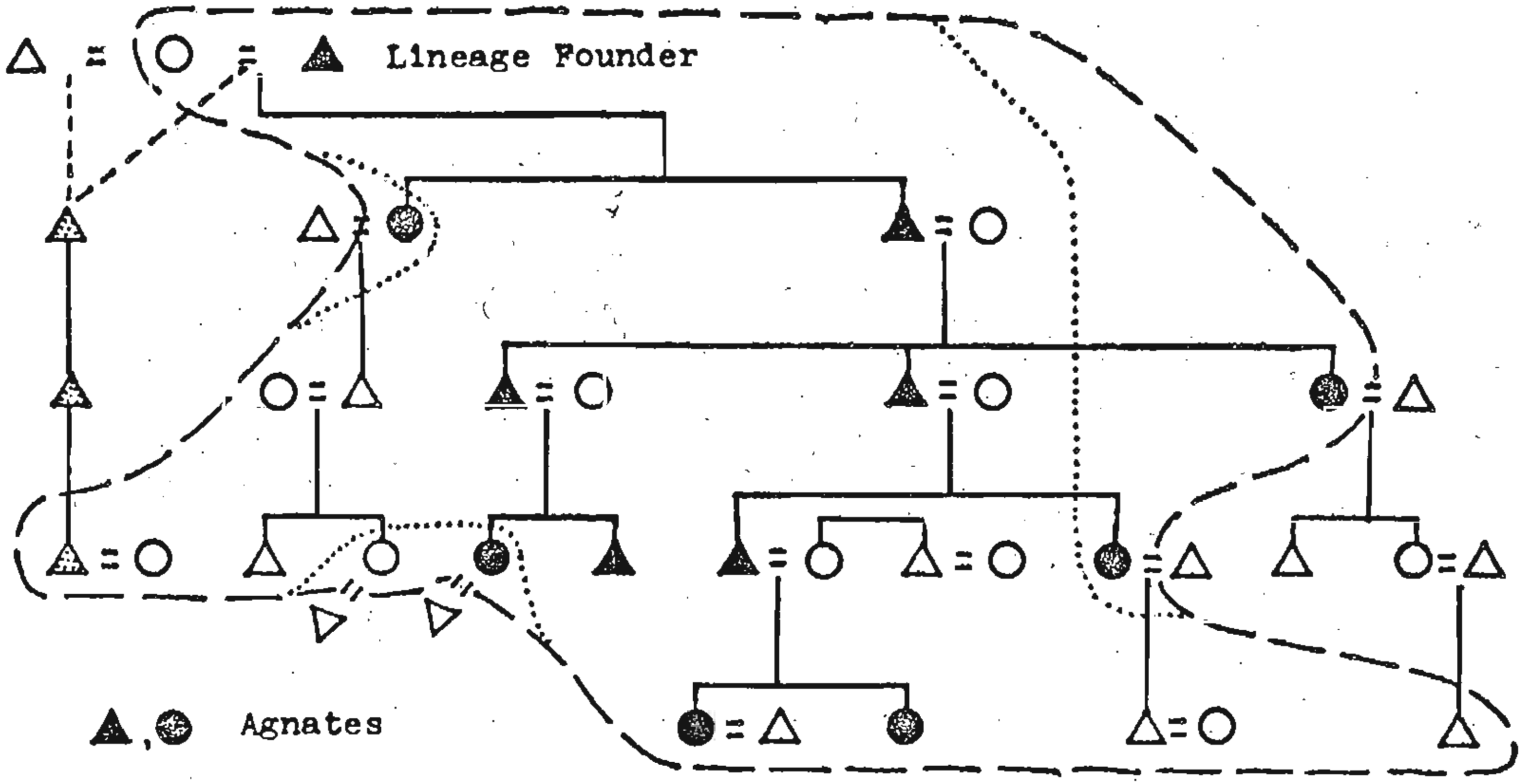
The clan is the largest exogamous segment and the fundamental social group. Within the clans, men are expected to reflect brotherly behavior in an exemplary fashion: pigs should be freely given to aid in bride-price and death compensation payments, received pigs should be shared with largess, all should participate in curing ceremonies and funerals, give support in dispute settlement, not cause disputes within the group, share gardens and food, give usufruct grants of land, help in house building, ditching, fencing and so forth.

Conduct among clans of the same phratry should be modeled after the support brothers give one another against others. Hence, when Kapii clan fought with the Kuu people, Meoko and Taumo clans gave assistance. But, as anyone at Yumbisa knows, brothers do not always get along without quarreling. Thus Kapii defeated Epee clan at Yumbisa and drove them back to Kiteli/Bipi from which they returned only after pacification in the late 1950s. Yet today Epee would help Kapii against Yowai clan of Yapaku phratry. In short, as is commonly the case in segmentary lineage systems, segments align against complementary units of the same order. Yumbisa people allege that warfare outside of the tribal group was a "no holds barred" affair while fights within decline in intensity down to lineage brawls and brothers striking each other with their fists. The converse of this is that violation of the scale of aggression would require greater obligation to compensate and greater certainty of settlement the further down the scale one goes.

In the case of large clans like Kapii and Meoko, there are named subclans. Their place lies variably between clan and lineage. Usually they function as clans. In the case of Meoko, this probably derives largely from its exceptional dispersion, being nearly as far-flung as Molopai tribe. However, the Kapii situation serves to illustrate another aspect, the transitional nature of the subclan level. Quite clearly the model of an ideal set of agnatically related segments is maintained by the interpretation of a few men acting in the context of dispute settlement and/or demonstration of the relationships between segments for various purposes. It is supported not only by memory of the relationships but also by oratorical skills, convincing others and aligning political factions for support. The case in point is the recent practice of marriage within Kapii clan. In the past generation Yurimi subclan has begun to marry with Pao and Kepa subclans. This practice is currently justified by the principle that after six generations descendants of half brothers may marry. The difficulty arises with the allegation that Kapii had a heretofore little known wife--Milyo. Those who support the marriages that have occurred supply a new mother for Yurimi while others report that Yurimi, Pao, and Kepa were all born by Lepata. When the discrepancy is pointed out, the latter now hesitantly concede that Milyo must have been Yurimi's mother. Anamu-Yurimi and Murelyu-Pao marriages have recently occurred as well. However, since Pao-Kepa and Murelyu-Apolo intermarriage is still prohibited, I retain the designation of clan for the segment named Kapii.

In the Molopai outliers, the relationship of segments is altered in a different way. There, lineages drawn from several central clans are realigned such that, for example, Ekème becomes a subclan of Waitika (said to be the same as Kapii) and includes a lineage of Meoko as a subclan. Naturally such manipulation does not destroy the basic principles of the agnatic lineage system, but serves to preserve them.

The smallest named segment I call a lineage (see Figure 4). Individual members have the greatest obligation to fulfill the ideals of behavior indicated for the clan. They form the core of one's supporters in any



Agnates

Nonagnates and Nonagnatic Descendants

Encloses Lineage Membership

Encloses Residential Group

Dual Agnatic Descent Claim

NOTE: See genealogies in Appendix 6 for actual cases.

Figure 4: Hypothetical Lineage Composition

endeavor. Most men can identify the founder of their lineage and lineages can receive names in at least two ways. Ideally sons of the subclan founder are the progenitors of lineages bearing their names. In several cases, though, the lineages are named after the natal clans of the founder's various wives. There appear to be no resulting differences in current position. There is occasional doubt expressed by informants at this point as to which case is appropriate but below, the genealogical litany is clear. Bigmen and ceremonial practioners (who recited the names in the curing ceremonies) are more likely to have knowledge outside their lineage (or subclan) while the ordinary man usually knows only the particulars of inheritance for his land, his affiliation to the group (if a nonagnate), and the clan level tied directly to Molopai through Bipi. Knowledgeable men, then, recall eight or nine ascending generations to Molopai and they themselves have adult sons and/or grandchildren. And this is as it should be, an old man told me, for the world will end after eleven generations.

The segments I have called tribe, lineage and clan are readily identified by informants as the maximal, minimal and exogamous named segments. Elsewhere in the

Wage area, including the fringe Huli, the number of levels with named segments varies. The regional application of the terms phratry, subphratry, subclan and sublineage is thus imprecise.

So far I have been primarily describing social groups as conceived of in terms of descent. This is the way segments are represented in ordinary discourse and during oratorical performances. The picture is much like that of central Enga but with fewer levels of segmentation (cf. Meggitt 1965). In addition, Molopai people are more explicit concerning recruitment criteria beyond descent. Agnatic descent is, in fact, the recruitment basis for less than half the married men of Kapii clan at Yumbisa. Individuals can become members of segments other than their father's, and I call this process <u>incorporation</u>. Incorporation occurs in three ways.

Young brides are identified by their father's clan but as time goes by they are referred to as belonging to their husband's clan unless the affinal relationship is being singled out. They, in effect, have dual membership. In Chapter V, I return to the general usage of the term incorporation as it applies to women. The term marriage should be understood to imply this dual membership but the term wife's clan refers to her clan of origin.

Men may also be incorporated into a clan and there are specific notions of who they should be and what they must do to earn membership. Since this is a central concern of the dissertation I leave the details for a later section. Here I note only the following: the men must be relatives of some sort, the process of incorporation is such that there is a period of ambiguity in membership and, once having made the change, the children of incorporated men are automatically considered clan members. I will refer to the individual incorporated (and his descendants) as a nonagnate (nonagnatic descendant) and his sponsor as host.

Finally, informal adoption occurs. In such cases a husband and wife raise the child of a relative. No incorporation process is necessary, the child is already an agnate or, if not, is viewed as a nonagnatic descendant.

In addition to recruitment criteria of descent and incorporation, the component of locality is also of importance (cf., Barnes 1962, 1967; Langness 1964; de Lepervanche 1967; Sahlins 1973; Salisbury 1964). The fact of being born of a resident of clan territory is viewed as tantamount to membership. This became evident when our child was born during the fieldwork. The significance of locality is best understood through patterns of land tenure and inheritance.

Each segment of Molopai is associated with a discrete territory. Above the clan level the demarkation is one of geographical reference only, i.e., clans have no say in the disposition of land by other clans of the same phratry. It is the clan which constitutes the highest level of corporate land rights. Ideally a clan holds the residual rights, consensus must be achieved to alienate any significant area[6] and members defend the territory as a whole. Kapii clan at Yumbisa maintains this ideal despite the alteration of exogamy. Elsewhere exogamy and corporate landholding coincide.

Although clan decisions concerning land alienation are rare, lineage interests are more closely guarded because it is the lineage which actually forms the core of most group activities including marriage and incorporation of males. Nonetheless, I heard of no case in which a lineage denied an individual the right to dispose of his

---

[6]Prior to contact this only occurred on a small scale when some of the previously mentioned "nephew groups" were given land. After contact certain small plots were given to missions.

land as he pleased. In theory they could.

With the exception of certain areas of old slope garden in fallow and ground unsuited for cultivation that are held by the lineage as a whole, individual men hold primary rights to land. Occasionally, however, women may substitute in the absence of an appropriate adult male. Land is acquired or disposed of through patrilineal inheritance or usufruct grants. Typically when a boy approaches adulthood, his father indicates certain plots that he can begin to manage. Men do not plant but the son's female relatives assist him. If a man dies before his land is fully distributed, his sons divide it among themselves. They are supposed to do so equitably. In either case, the eldest usually get more and if the sons are many and land little, the younger sons must look elsewhere.

There are several ways to acquire usufruct rights to land. Short-term loans within the lineage subclan or clan are common and usually last only for one or two plantings. This option may be transformed into a permanent grant, but such will only occur if the two men involved maintain their lineage or clan obligations of mutual assistance somewhat more reliably than otherwise.

The land in question may be inherited patrilinealy if the mutual obligations are sustained in the next generation. After the second generation the transfer is apparently secure.

Usufruct grants outside the clan can also be arranged, largely at the discretion of the primary holder although lineage mates may offer vociferous advice. Short-term loans are acquired easily as within the clan. Long-term transfer of usufruct rights requires careful attention to the maintenance of the relationship between grantor and receiver. Usufruct rights may be inherited patrilinealy with the same conditions of mutual assistance but the transfers are not viewed as permanent. If, however, an individual becomes a member of the grantor's clan he acquires primary land rights.

These land transfers apply to garden land, forest and pandanus groves. As a result, a man at Yumbisa will have a certain number of plots for which he holds primary rights. Some of them may be on loan to fellow clansmen or nonagnates from other tribes and some may be in long-term use by individuals who live elsewhere and intend to continue to use them indefinitely. I call these latter recipients <u>nonresident cultivators</u>. The same Yumbisa man may himself have the loan of plots and be a nonresident cultivator elsewhere. In addition, each man with multiple wives distributes his gardens among them. If he decides later to grant one of her gardens to someone else, he should consult with her. If he fails to do so, it is at his own peril. I observed no such case and the settlement of such a dispute is not clear to me though I suspect the community would support the wife. Men may also give gardens to their unmarried daughters which may or may not then go to their husbands. These grants to women are the origin of the occasional primary rights in land held by women.

Because of the corporate landholding nature of clans and their constituent segments, the effective social unit for most circumstances is one based upon descent, incorporation and locality. Although I began by using the term clan in the sense of a descent group, including outmarrying women and excluding nonagnates, I will hereafter use clan, subclan and lineage in a sense which is closer to that used at Yumbisa. When people employ idioms of agnatic segments, e.g. the word <u>tata</u>, they do so with full realization that they refer to <u>populations</u> associated with a particular territory as well as having certain descent relationships superimposed on them. This complex of factors should be borne in mind where ever clan, sub-clan or lineage is referred to. Moreover, for sake of brevity, Kapii clan should be understood to refer only to Kapii clan at Yumbisa. The term segment will be retained to refer specifically to descent group relationships. The territory associated with a clan or lineage will be referred to as a clan parish or lineage parish, or community for general usage.

The above view of the nature of social structure at Yumbisa has been presented largely as an ideal, norm or ideology with some variation. To better understand "on the ground" variation one must turn to an examination of social networks which crosscut that structure. This will require an elucidation of the role of marriage, death compensation payments, bigman activities and recruitment of nonagnates, the latter being the central phenomenon that is examined in Chapter IV.

E. Marriage

Marriage is the result of an interaction between the potential spouses rather than any arrangement by others. Although parents may occasionally attempt to apply pressure toward a particular match, the children can and do resist effectively (three cases observed in three years). It is also true that individuals may make a politically wise marriage though it is denied that this is an important consideration. The one situation in which public pressure toward marriage will be great is that of discovered premarital intercourse, but the offending man may avoid marriage by making a compensation payment in live pigs to the woman's lineage. The ordinary marriage occurs upon completion of a courtship lasting, perhaps, less than one year though in some cases the couple have known one another off and on for many years. Typically the development is as follows. A young woman of about seventeen comes to visit her relatives or a young man goes to visit his. In either case, with a few other men of similar ages (about 23 or 24), he sings courting songs outside the house where the young woman sleeps. If invited in, the young men take turns sitting by the woman and singing a monotonous recitation of all they might do after marriage while the rest of the people in the house sing impromptu social songs. If the woman is interested, she indicates as much in a form of figurative speech. This constitutes a tentative engagement.

Alternatively a couple might meet at a public social occasion (a dance or during the pandanus harvest, etc.) and, frequently, early evidence of interest is manifested through "playing" (striking each other) with the leaves of a stinging nettle. This latter custom is formalized in the nakauwa yanda 'stinging nettle fight' at the end of the pandanus season. While the pandanus are cooking in an earth oven, men and women form groups and sing courting songs. Suddenly, stinging nettles are produced and a veritable war breaks out, each person attempting to strike the genitals of their eligible and prospective marriage partners. The effect is extremely painful anywhere on the body, I can attest, and must be immeasurably more so at the prime target. This must be done carefully so as not to expose anyone's genitals since that would be almost an unbearable embarrassment. The implications to sexual antagonism are, I trust, fairly obvious (cf. Langness 1967; Allen 1967; Meggitt 1964).

At any rate, these early hurdles having been leaped, the couple proceeds to demonstrate to each other and their relatives their desirability as spouses by doing just those (permitted) things a good spouse is expected to do. The man gives repeated small gifts to the woman, especially any pork he may receive. He visits her home place and participates in man's garden work and other activities with her people, and she comes to his community and makes garden with the women of his local group. When a young man is courting seriously, he often clears a "demonstration garden" from the bush and an eligible woman constructs her garden with artistic care. When he goes to the sangai (initiation seclusion) his betrothed provides decorative materials, arm bands or a string bag. At this time, too, the sexual antagonism theme reappears as a girl friend is allowed to damage or destroy her boy friend's property (house, garden, possessions, tobacco plants, etc.) the day before he returns from seclusion in the forest. The man's co-residents take this with bemusement as long as it does not get out of hand.[7] The final step in the courting procedure is the appearance of the woman and her clan representative at the man's mother's house where she is shown some pigs, perhaps a half dozen. She then returns home and tells her relatives to go to the man's place to receive the brideprice.

---

[7]This custom is said to have come from Liagam way about ten years ago.

On the chosen day, the bride and her relatives return for the marriage (enda tali pingi) She usually has her eyes demarked with paint, wears new grass skirts, a new string bag, and a gold-lip shell and carries the bride's cane (kendai) inherited from her mother or other female relative. With her lineage representative, she takes an active part in the deliberations while the unadorned groom lounges about appearing to be totally uninterested--quite unlike all other observers. A male relative acts as his spokesman. Bride price pigs (wanalapo) are lined up in the yard of a woman's house where the groom eats: they number, on the average, fourteen pigs of various sizes from a very large lead pig or two down to piglets and are accompanied by about $18, a gold-lip shell and perhaps some other items such as an axe or spade. The bride's relatives then attempt to evaluate the brideprice in terms of eligible receivers. At this point negotiations commonly break down. Of 58 such instances observed, 32 (55%) failed. It is frequently the case that the bride's spokesman announces that she does not like the groom after all (meaning he needs more pigs to satisfy all the claimants). Such false starts may occur several times before the affair is given up or satisfactorily settled. Not infrequently a bride grows weary of the intricate maneuverings and declares that she is satisfied and is going to stay with the groom no matter what they do with their pigs. That sometimes settles the prestation but not the subsequent negotiations which go on endlessly.

After acceptance, the pigs are distributed on the spot. The woman, coached by her representative, calls the names of the recipients, indicating the pigs with her cane. She then goes to a woman's house with a female member of the groom's lineage while he goes off with his cohorts. Several days later, the groom's relatives go to the bride's house to receive the return payment (wa-tapae). This can reopen any festering resentments from the previous negotiations and cause the whole affair to collapse. But if all goes well, the groom's people return home with three or four large pigs after a careful public decision about how these pigs balance certain of the bride-price pigs in the event of divorce. Within the next few days the groom's people kill one or more of the pigs and distribute the pork to those who aided with the bride-price or those who now offer further brideprice.

The pork distribution signals the successful completion of the marriage negotiation but not necessarily the successful welding of the union. At first intercourse, the bride and groom traditionally drink some water which has been bespelled by a magical practitioner[a] to insure that the husband will not be damaged by dangerous and polluting qualities of female body fluids, especially menstrual blood. The groom has been strengthened for this encounter through careful teaching by one of his "fathers" and the sangai ritual which removed the taint of childbirth and made him a man in the social sense (and in local belief, in the physical sense). During the following months further brideprice may be given. Finally, the birth of the first child marks the successful marriage and strengthens the alliance between the lineages.

In case of divorce, brideprice must be returned, the exact amount depending on agreements made at marriage, the length of the marriage, the number of children and their disposition, and the recent history of exchange activities between the two groups. In the event the husband

---

[a]The water drinking ceremony has been dying out rapidly in the face of mission teachings.

dies, his brothers, and secondly, his clan brothers, have claim on the woman without further brideprice, if she consents. She may also return to her clan parish especially if she is older or childless. Should she wish to marry a man outside her dead husband's clan, his clan receives the new brideprice.

I have described the marriage negotiation at some length since it indicates the importance and difficulty of establishing the affinal tie which is, however, a critical one. Relationships of affinity along with descent generate the framework of kinship from which interpersonal networks are realized. At Yumbisa, however, marriage establishes a relationship between individuals which is further cemented by death compensation payments that obligate affines and their descendants to interact in mutually advantageous though asymmetrical ways. If you ask an older man what brideprice he gave, he will ask whether you mean the initial brideprice only, or are including the later death compensation payments. The two run together and result in an enduring set of obligations that persist over several generations or which are terminated only with considerable acrimony. Little wonder then that people are passionately concerned with the minute details of the brideprice negotiations for they are both establishing interpersonal avenues which can be built into larger boulevards and at the same time testing the sincerity of the relationship. The eighteen-year-old bride mainly wants a good husband and if the groom were to speak on his own behalf he might have a "fool for a client." Others, with a clearer perception of lineage priorities, carry the argument.

The ideal marriage (male view) is one in which the wife works diligently in the garden, takes care of the pigs, has intercourse with her husband and no one else, bears many children (both male and female but at least some male), is careful to avoid violating menstrual taboos, encourages her lineage to help her husband in pig exchanges, does not cause trouble and follows her husband's advice. From the woman's perspective, a good husband willingly does male garden work, does not attempt to shorten the post partum intercourse taboo (about three years), provides well for her and their children, makes his exchange payments to her clan promptly and generously, treats co-wives fairly, and consults with her on the disposition of the pigs she raises. I confess that after reading the literature on sexual antagonism for the HNG, I was somewhat surprised to find that quite a few Yumbisa marriages were characterized by genuine and persisting affection. Disagreements are, on the other hand, quite common and volatile often leading to violence. As one man told me however, he was a good husband because he only hit his wife with a <u>small</u> stick. The underlying cause of most of the domestic squabbles is difficult to elicit, but on the surface quarrels often revolve around the disposition of pigs or accusations of infidelity against the woman. Wives, especially older ones, can be extremely powerful in influencing their husbands' activities, though in public situations men tend to dominate decision making. Divorce proceedings frequently allege that one or more of the obligations of marriage were not met (female: adultery, not working gardens, not bearing children; male: not giving pigs to affines). Public discussants eventually attempt to determine the underlying problem and make every effort to rectify it by the payment of a pig or other valuable. This is often difficult because Yumbisa people are characteristically reticent to speak of things they hold deep "in their heart," especially if they have sexual overtones. Adultery accusations are a prominent exception. That one spouse is determined to divorce is sufficient, and the settlement of the bride-price return occupies the greatest attention.

Ideal marriage prohibitions are as follows (male ego):

1. Any woman of his exogamous descent group (subclan level for Kapii; clan level elsewhere).
2. Any female descendant of any living or dead woman of 1 above (when the female antecedent in question is greater than two generations removed, this rule becomes ambiguous).
3. Any woman of the clans of his father's mother, mother's mother and mother's father. (The rule is ambiguous for members of clans of Fa Mo Mo, Mo Mo Mo and Mo Fa Mo.)
4. Any woman who is a descendant of mother's sister.
5. Any woman of wife's clan and wife's mother's clan (unless wife is dead).

Violations of these prohibitions occur. The rules are commonly phrased in terms of descent groups, but the exact genealogical relationships are carefully distinguished from clan membership. Thus, with an abundance of people in any clan who are descendants of nonagnates, such unions can occur and are defended on the grounds that, although the individuals involved are full members of the local group, they have different genealogical connections. As a result, some individuals end up being both givers and receivers of brideprice. Marriage prohibitions 1-4 are an extension of the incest prohibition applying to immediate relatives. The fifth rule seems to be aimed more at distributing alliances widely and is more easily violated.

I observed one case of an incestuous marriage which is illustrative of the manipulation possible within these rules. Incest violations are a capital offense yet a marriage exists between individuals of one subclan who both appear to be proper agnates by their genealogies. The woman's brothers did in fact set out to kill the offending man, but they were talked out of it. The defense alleged that the woman's genetrix four generations earlier had had intercourse with two different men at about the same time. Although the resulting son resided with the man who married his mother, his true paternity remains in doubt and subsequent generations have taken advantage of both possible agnatic ties. This "dual agnatic descent" is not an uncommon claim and is used in various circumstances to gain access to land or to defend activities such as this marriage. It was, even so, a difficult situation which still after ten years has men mumbling about giving pigs to themselves.

In comparison to the central Enga, these rules are somewhat less restrictive (Meggitt 1965:93). Marriage to ego's sister's husband's clan is permitted. So also are marriages permitted to ego's brother's wife's clan, his father's other wife's clan, and his mother's other husband's clan (if he were not "adopted" by his mother's other husband). The first unions are considered foolish since an affinal relationship between the clans is already established. The last two would be extremely unwise since potentially strong helpers would thus be turned into receivers of exchange payments. The latter two cases could only occur if the separation of ego's parents had been long past. I discovered no such cases.

As a result of general observance of these rules, marriages are widespread both spacially and socially. Marriage to persons of distant places (covering approximately the same area as Molopai clans) occur somewhat infrequently but they are important. The bulk of the unions are concentrated throughout the nearby (one day's walk) surrounding clans. As a result, any clan has current affinal ties to nearly as many groups as it has married men. This has advantages and disadvantages, in terms of exchange and mutual aid, as will be demonstrated.

In summary, several points should be noted. First, a successful marriage forms a weak alliance between corporate groups focused on a very strong and enduring relationship between the husband and his brother-in-law. The ties are established by the brideprice exchange and cemented by further death compensation exchange. Second, this relationship is somewhat asymmetrical. The woman's clan receives the initial brideprice, subsequent brideprice, death compensation payments and assistance of various kinds. The man's clan receives in turn the woman and her services, her children, the small return payment for the initial brideprice, small initiatory payments for death compensation, brideprice for female children of the union and aid of various kinds. Third, marriage prohibitions reflect both the agnatic principle that serves as a model for segment relationships and the importance of descent through men <u>and</u> women. Against this cognatic background, clan members can be differentiated on the basis of social factors having to do with locality, patrifiliation, land holding, exchange activities and so forth.

As will be discussed, nonagnates are readily converted to "agnatic" status.

F. Exchange

There are seven distinguishable types of "exchange payments": 1) wanalapo 'brideprice,' 2) beta pinqi 'injury compensation,' 3) laita pinqi 'ordinary death compensation,' 4) tee pinqi 'violent death compensation,' 5) sepya 'pork payment,' 6) insult compensation and 7) mena yae pinqi 'pig killing.' All are permutations of the same relationship except the last which is an intrusion from the Mendi area.

The cultural reason for giving brideprice is concisely summed up by the recurrent idiom that "a man is the fence around a garden which keeps the pigs out." In this case the "fence" is the father, brothers and mother of the bride who nurture and protect her. No one is to enter another's garden unbidden, but if they are habitually allowed to, it signifies a close relationship of reciprocity. I cannot attest that informants visualize the groom to be like the pig snuffling and poking at the fence, but certainly what he receives he must reciprocate. Thus the bride's people are compensated for their efforts and the groom's people receive the woman who is publicly admonished by her spokesman to be a good wife and not to come running home again. Pidgin speaking informants easily fall into the habit of describing marriage transactions as "buying" a wife. The translation is misleading since buying anything is a foreign concept. Nevertheless, no discussion of marriage ideology failed to stimulate the observation that "women are the road to pigs." The choice of a particular spouse is an individual's decision based largely upon emotional grounds. If the groom is naive concerning the economic implications of marriage, he will not remain so for long because his relatives are dependent upon this aspect of it. Both sides are then anxious to maintain the union in good standing. This is further illustrated in the case of divorce or death of the husband. The groom's kinsmen try to keep the woman and especially her children. If they cannot and she marries into another clan, they receive the brideprice and relinquish the exchange relationship for the marriage.

Marriage establishes an enduring relationship. Thus an individual's mother's clan is always expected to be his or her champion; they welcome the children, give them things in a context of generalized reciprocity, support them against their agnates and maintain the relationship in the face of animosities between the corporate groups. One's mother's brother is a constant haven and a source of aid often more reliable than one's own agnates. This relationship continues with one's matrilateral cross cousins. Kinship terminology is Iroquois and mother's brother's children are termed <u>kaiingi</u>. One term for an exchange helper is <u>auu kaiingi</u> (literally "a good cross cousin," but sometimes rendered "one with whom we are pleased").

Because illness and other misfortunes are attributed to agnatic ghosts, if a person dies, his agnates are held responsible. If the relationship is to be maintained, further compensation to the mother's clan must be made. This is the <u>laita pingi</u>.[9] The recipients are supposed to be primarily those who received the brideprice (Figure 5). Continuing the ideology of the marriage payment itself, this is said to compensate for the mother's efforts in raising the child, the pain of childbirth and her care of the child. The latter is phrased in terms of feeding the

---

[9]The <u>laita pingi</u> is the keystone of the exchange system. I consider a gloss to be inadequate and will retain the native term in its shortened form <u>laita</u>.

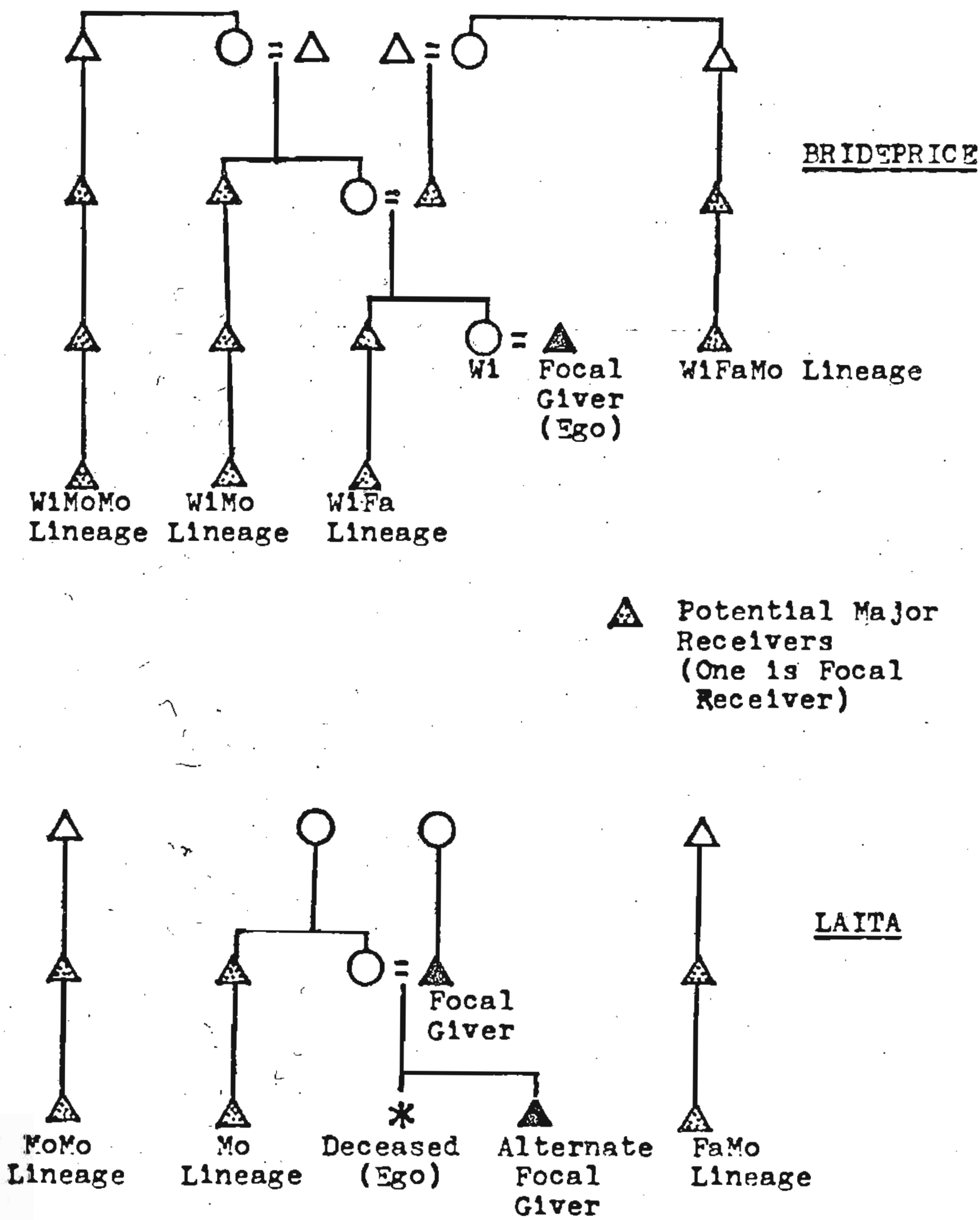


Figure 5: Recipients of Brideprice and *Laita*

child and cleaning its excrement, an obligation of the mother and no one else. The actual pigs go to her close male agnates, not herself. Here, too, the economic implications are not lost to sight, people emphasizing that "we give the laita so they will help us with pigs." Laita may be done by an individual for himself while still living and multiple payments are possible. It is initiated by the focal receiver who gives pork (laitasanda).

The beta pingi is simply a minor laita pingi for injury to the body of a person which does not cause (immediate) death. Compensation (a few dollars or a small pig) usually goes to a mother's brother's son. If a husband injures his wife, she herself gets the compensation. If a wife injures her husband there is unlikely to be any compensation at all, but if there is, her brothers give to the husband, not his mother's clan. In a similar fashion, a compensation for insult is sometimes given to the insulted, though this practice is not formalized or named.

The tee pingi is somewhat more complicated. It is a death compensation payment for violent deaths. It is not a simple homicide settlement, but it can contribute to that end. The supporting reasons for payment are threefold: 1) to compensate for the loss of a person, 2) to terminate fighting or deter retaliatory fights, 3) to re-establish relationships so that laita pingi may be continued. There are two circumstances in which this exchange occurs. In the first case, the individual who died did so while assisting relatives in a fight (at any level of aggression). The clan that was assisted must compensate the clan that lost the person. Note that the ideal is phrased in terms of clans which has the result of making this exchange larger than others in terms of participants and numbers of pigs.

In the second case, deaths occur on one or both sides of a fight between two clans which immediately involves the whole history of intermarriage, laita pingi, alliance, descent relationship, mutual aid, proximity, and so forth. The outcomes are extremely context sensitive and provide the arena for prolonged negotiations, political maneuvering, oratorical performance, and intricately convoluted solutions to intractable problems. Basically, however, the goal is to "make the fight die" so that normal relationships can continue and, unlike other exchanges, both parties arm themselves at the presentations which are rather tense affairs even now. Because marriages tend to be concentrated in nearby clans and fights tend to occur with neighbors there is usually good reason to settle. Negotiations are initiated by intermediaries who are peripherally related to both clans and pig presentations may not occur for years, after which they may persist for a decade. The central questions revolve around who will be compensated for, and what further exchanges are implicit. It is not necessary to compensate for the loss of the person who started the trouble, but such blame is difficult to establish to the satisfaction of both parties. However, if men died on both sides they can be considered to have equalled out the debt and the remaining ("corner") deaths are the focus of negotiation.

The ideal arrangement is that in which the _tee_ receivers will later return _laita pingi_. Since corporate resentment is long lasting attempts to settle may not be made quickly. But since affinal ties are to a degree independent of clan relationships, there may still be interaction. As a result, a later marriage may occur between the clans. Upon the death of a child of that marriage, the _laita_ is reciprocated by a _tee_ and quite likely many such arrangements follow until outstanding debts are settled or clan relations deteriorate again.

Let me repeat that this situation involves large numbers of individuals who discharge their corporate responsibility. If payments are insufficient, lineages within the clan that failed to receive adequate compensation may retaliate by "payback" murders of any of the relatives of the other clan (except those who are their own close relatives). Thus, there is a negative feedback mechanism toward re-establishment of exchange relationships. Failure to settle the conflict to the satisfaction of all concerned contains the potential for further violence and thus a positive feedback loop contributes to overall warfare. The resultant interpersonal relationships in a region of any size, given frequent warfare, are incredibly complex.

In the past, a preliminary payment of pork (the <u>sepya</u>) always preceded both <u>tee</u> and <u>laita</u>. The unit of exchange was a "halfside" of butchered, raw pig (fore and hind legs joined by the back and side skin and fat). This was to have been given quickly as a promissory of later live pigs, which had the effect of gaining time for the givers to amass these pigs. Today, the <u>sepya</u> is not always observed, especially prior to the <u>laita</u>, and when it is, it is overtly a statement that pigs are in short supply and will be offered at an indefinite time in the future. Those who give or receive the sepya give or receive the subsequent exchange. It is sometimes said to be the equivalent of the beta pingi for a dead person.

The last exchange, mena yae pingi, is not well integrated with the others except to the extent that giving pigs always implies reciprocity or abatement of outstanding obligations. The prominent local interpretation of the mena yae pingi of fringe Mendi people in Kandepe, focuses on the prestige accruing to the giver. Hence a man will kill a few pigs with no direct exchange purpose and distribute the pork to relatives thus enhancing his "name" and, in one case, to shame another who failed to give him pigs. Only two cases occurred during fieldwork. Various "unregulated" minor exchanges are arranged between individuals which articulate with the others or serve overt solidarity functions.

When these exchanges are viewed as a whole, a bewildering web of relationships emerges that fluctuates in pattern and intensity over time. The pattern can be perceived more clearly by focusing on egocentric networks of exchange and mutual assistance which bring together descent and affinity. This phenomenon is a critical nexus of activities at Yumbisa which must be at least partially explained to understand its role in subsequent discussion. A proper treatment is, I am afraid, beyond the scope of this dissertation. Nonetheless, I turn to some particulars of the realization of these exchanges which illuminate the importance of these networks and their role in the total system.

Tables 3, 4 and 5 provide a breakdown of the type of item exchanged and typical amounts for each. Quantities vary depending on sex and age of the central figure with a rough order from greatest to least as follows: bigmen, men, wives of childbearing age, old people (not bigmen), children. The appropriate categories of givers and receivers are indicated. Individual, network and corporate group play differing roles. The appropriate givers and receivers are spoken of as segments. Thus Yurimi subclan "marries" Yapakatutu clan of Kuu tribe and Kepa subclan gives laita or tee to Yomendaka clan of Kuu. But individuals direct and orchestrate these prestations so that men say, "I gave thirty pigs to Yapakatutu" (see bigmen, Section G). In point of fact, neither is quite descriptively adequate. In none but the most minor exchanges

Type of Exchange		Typical Range of Items and Amount
	Marriage (<u>enda tali pingi</u>)	
1) a)	Brideprice (wanalapo)	5-24 pigs \$2-\$48 0-5 goldlip shells 1 or 2 axes, etc.
b)	Return gift (watapae)	0-7 pigs
	Death/Injury	
2)	Promissory payment (sepya)	1-10 butchered pigs
3)	Violent death (tee pingi)	1-50 or more pigs and goldlip shells
4) a)	Initiatory gift (laitasanda)	1-6 butchered pigs
b)	Death compensation (laita pingi)	1-30 pigs
5)	Injury (beta pingi)	\$2 to 1 pig
6)	Insult	\$2 to 1 pig
	Other	
7)	Pig killing (mena yae pingi)	3-4 pigs

Table 3: Types of Exchanges and Items Given or Received

Type of Exchange	Primary Givers	Secondary Givers
Marriage (enda tali pingi)		
1) a) Brideprice (wanalapo)	Groom's Br, Fa Lineage "Br's" and "Pa's"	MoBr, MoBrSn, etc.
b) Return gift (watapae)	Those who received 2 pigs or large wanalapo pig	---
Death/Injury		
2) Promissory payment (sepya)	-----Same as major participants in corresponding laita pingi or tee pingi---------	
3) Violent death (tee pingi)	i) Lineage being helped by deceased ii) Lineage that killed deceased	i) and ii) Parallel segments to include whole clan
4) a) Initiatory gift (laitasanda)	MoBr or MoBrSn of deceased	---
b) Death compensation (laita pingi)	Lineage of deceased	Any helpers of lineage members
5) Injury (beta pingi)	Assailant	Male relative if assailant won't pay
6) Insult	Insulter	Male relative if insulter won't pay
Other		
7) Pig killing (mena yae pingi)	Man or brothers	---

Table 4: Givers of Exchanges

Type of Exchange	Primary Recipients	Redistribution
Marriage (enda tali pingi)		
1) a) Brideprice (wanalapo)	Bride and representatives (Fa, Mo, Br or etc.)	Fa and his lineage (most) Mo and her lineage FaMo lineage MoMo lineage (least)
b) Return gift (watapae)	Those who gave 2 pigs or large wanalapo pig	1 or 2 pigs eaten by groom's lineage and helpers
Death/Injury		
2) Promissory payment (sepya)	-----Same as major participants in corresponding laita pingi or tee pingi--------	
3) Violent death (tee pingi)	Closest male relative to deceased and representatives of each lineage of his clan	To all lineages of clan who redistribute by own criteria. Most to lineage of deceased but varies depending on relationships between members of two groups.
4) a) Initiatory gift (laitasanda)	Nearest male relative of deceased	Eaten by lineage of deceased and relatives
b) Death compensation (laita pingi)	MoBr or MoBrSn who gave laitasanda pigs	To lineage and FaMo's and MoMo's lineage
5) Injury (beta pingi)	Representative of Mo's clan	---
6) Insult	Insulted	Might be eaten by lineage
Other		
7) Pig killing (mena yae pingi)	---	Eaten by relatives

Table 5: Recipients of Exchanges

are all the pigs from any one individual or group. The source of the bulk of pigs an individual gives to any other is his personal network and when he receives pigs the flow is reversed. The structure of these exchanges tends from ego's point of view to funnel pigs from his helpers to his wife's or mother's clan (see Figure 5). Conversely, when he receives pigs from his sister's husband or father's sister's son, the funnel works in reverse and he distributes pigs to appropriate individuals including as many of his helpers as possible. In general, for relationships involving male ego's own wife's clan, his agnates tend to be his major supporters and his wife's clan the receivers. He might also get pigs from his sister's husband to aid in this exchange and these will condition the <u>laita</u> from that person. Some pigs may be received by ego before his sister's husband makes the public <u>laita</u> prestation. Ego can raise these pigs or give them as he pleases. Subsequent <u>laita</u> from sister's husband are smaller. He may also encourage a new sister's daughter's husband to give him additional brideprice pigs which he can use for his own exchange purposes. As noted earlier, brideprice and death compensation are not entirely separable. When ego's own clan and wife's clan combine to make tee, he may be the funnel through which both clans give pigs to a third. When ego marries, his fathers, his brothers, and his mother's brothers may each give him a pig, for which they get no immediate return (unless he makes his own laita to mother's brother or mother's brother's son). These instances of aid can be ignored for a long time, but further help dries up, especially from his brothers, if he does not reciprocate in some way.

All of ego's relatives are potential helpers for his own exchange purposes. Only certain ones are potentially direct receivers of his payments, but all may be recipients of his aid. There must be some discernible genealogical relationship between two individuals to thus assist one another. Those individuals who actually do assist ego together with their multiplex relationships, constitute what I call "the egocentric network of exchange and mutual assistance." It is an activation (by giving pigs, etc.) of relationships inherent in the overall network of relationships deriving from descent and affinity. To this I will shortly add nonagnatic recruitment and later consider the question of patrifiliation and descent.

An examination of 232 observed instances of assistance are broken down in Table 6 which shows the percent of helpers in each classification for each of three major exchange types. This sample is composed of five marriages, five _laita_ and five _tee_ although their occurrence is not even--_laita_ are most common (being multiple for each marriage) and _tee_ rare. Relationships are to the groom, or to the organizer of the other exchanges. The number of contributors to brideprice is greater than for other cases because there are more small payments which serve to make a tenuous claim for later relationships. The mother's clan helps the groom in marriages more than otherwise and will, of course, receive a _laita_ for him. There are no mother's clan helpers in the _laita_ since they are the receivers. The high proportion of affines represented is made up of individuals who earlier received or subsequently will receive _laita_ from ego.

It is clear that the bulk of one's assistance comes from the exogamous group. One's lineage is, expectably, the major source of contributors but other lineages in the clan are strongly represented. Even those Kapii subclans who intermarry provide significant assistance across that social boundary. Total clan participation is especially

Percentage of Helpers in Each Relationship for Each Type of Exchange

	Coresident Group[1]							
	Lineage	Parallel Lineages	Parallel Subclans	Subtotal Clan	Affines[2]	Mo Clan and MoMo Clan	Other	Total Number of Helpers
Marriage	34	22	14	70	14	12	4	101
Laita	27	20	17	64	29	0	7	41
Tee	36	31	12	79	12	1	8	90
All	32	25	14	71	16	6	7	232

---

[1] Does not count affines within clan.

[2] Includes affines within clan

Table 6: Relationships of Helpers in Fifteen Exchanges

strong in the case of tee which is a clan responsibility as opposed to laita which may be small in scale, "improper" (i.e. to representatives of mother's clan rather than genealogically specified receivers) and reflect more directly relationships between individuals. But the assistance from outside the descent group is no less important to satisfactory completion of the prestation since there is a constant pressure to give more. In general, one is expected to make as large a payment as possible so that the clan's reputation is enhanced. One is more likely to get assistance if he repeatedly gives generously and repayments should always be more, exact equivalents are taken as evidence of a desire to terminate the relationship.

Multiple relationships between individuals are not uncommon and serve to strengthen the overall bond. Commonly one develops a strong relationship with a few men who can be relied upon for assistance and who one reliably supports. These relationships are extended to activities beyond exchange--to land rights, trade, defense, support in dispute settlement, gifts and so forth. When an individual is the primary recipient of an exchange payment, he must redistribute it carefully to balance group claims and demands from his personal network. The two never coincide exactly. A further complication is a definite tendency to make exchanges with nearby local representatives of the appropriate social group. This is done to bind the nearby person more strongly and thus increase the probability and ease of gaining his aid in further activities. Given the dispersed nature of descent groups in the region, this is often possible. The difficulty is, of course, that the proper (more distant) receivers will demand theirs and more. If they are not satisfied, they may be truculent hosts in the advent of migration from frost or warfare. Unfulfilled obligations can usually be corrected, at some cost to the people in arrears. Any exchange occasion is thus rich with potential possibilities for manipulation and frought with potential difficulties; the ideal nexus for bigman activities.

G. Bigmen, "Littlemen," and the Incorporation of Nonagnates

A bigman at Yumbisa is described in the following way. He has six to ten female pigs, two or three gold-lip shells and several wives. If his "brothers" kill someone, he himself will arrange to line up five to ten big pigs and six small ones (not all his "own" pigs) and direct the tee. When his clan receives pigs, he distributes them. He also organizes fights because he can give the tee (can get lots of pigs), and if he is killed, his clan stops fighting because they could not give tee if someone else is killed. He directs clan activities such as fence construction, settles quarrels, and shares the food of his garden which all his female relatives work. He is an eloquent orator, and all fear him.

Since contact, the differentiation of bigmen from ordinary men is said to have lost its clarity. Before, there were fewer pigs and they were concentrated around a few individuals. Now there are more pigs and everyone can make exchanges and be bigmen.[10] The fact remains that most men (not all) attempt to emulate this ideal, but only a few are very successful at it. These men are relatively more powerful and more influential in affecting the outcome of certain activities. The foremost arena

[10]I doubt that bigmen anywhere comprise a category with unambiguous boundaries in any useful sense. It might be better to speak of "bigman-ness" or "entrepreneurial practices" or some such. I would prefer to focus on such behavior as the result of certain cultural motivations being played out within and against certain structural limitation. That would, however, take us far afield of the argument under development.

of their endeavors is the exchange system. As indicated in the previous section, the bigman manipulates both the multiplicity of interpersonal relationships in any exchange situation and the ambiguities surrounding who proper receivers are for his own and his group's advantage. He is nothing if he is not a genius at devising intricate plans which seem to benefit everyone, including the persons who do not receive pigs, and then convincing people to implement them.

I cannot go into the complexities of how one gets to be a bigman. Suffice it to say that in addition to personal characteristics of intelligence, drive, and so forth, certain demographic accidents can greatly aid his rise. Thus a man who has several younger sisters and few brothers will receive brideprice early in his career. With this capital he creates more by proper "investment" in the exchange system. By the time he is fifty he has several wives, much land, a pig herd, a network of helpers who assist him because he helps them and,quite likely, a few resentful enemies who feel that they were not helped in kind. His pig herd, it should be noted, is an adjunct to his major source of pigs. He can perhaps be characterized best as a "broker" of pigs rather than an owner. Be that as it may, his position of controlling the flow of wealth extends beyond his immediate lineage at least to the limits of his clan.

He is a person of power since everyone else wants the pigs he distributes and his personal network is large and well developed. In this case, he is able to influence behavior outside the exchange system as well. A bigman prospers by indebting others so he is always eager to recruit new followers in whatever capacity. One of his major sources of pigs is, of course, those people who will pay him the laita pingi. Since this is a death compensation payment, there are many people living for whom he would be the proper recipient of their laita if only they would die. If he can convince them to make the laita while they still live, he is that much ahead. This can be done by arranging return exchanges or assisting those persons in their own prestations. But greater gain derives from some indebtedness external to the exchange system. At Yumbisa this has long been achieved by granting usufruct rights to land to immigrant nonagnates who are expected then to make their own laita to their host. In this fashion, and others, the bigman aligns a group of permanent helpers. Bigmen are primarily responsible for this sort of recruitment. In the past, because land was relatively abundant, ordinary men were able to take advantage of the situation too.

It should be clear that this incorporation process is of fundamental interest to the thesis under consideration. How this affected the group composition and ideology in subsequent generations is a topic for Chapter IV. Here I only examine the ideology of recruitment, the composition of the clan with respect to nonagnates and the role they and their descendants play in corporate and interpersonal activities.

The current ideology of male residence can be elicited with little ambiguity. A man may reside with any of the lineages of his father, his mother, his father's mother, his mother's mother or his wife. There are really three cases. 1) He should stay with his own lineage for a number of reasons, but if he chooses to go elsewhere that is his business and it does not of itself sever relationships with his natal group. 2) If he resides with any of the "mother" groups, he will make his own <u>laita</u> to them. The general rule for these cases is that a man and his <u>laita</u> go to the same place. To reside with them <u>and</u> to make <u>laita</u> is to transfer one's primary allegiance to that lineage. To secure his position and that of his children, he must behave as a brother by helping with exchanges and so forth and they reciprocate. He still may do the same with his natal lineage, though this is usually a burden which only the most successful man can manage well. In general, he is never completely a member of the new lineage, but exceptional individuals play prominent roles. His children are full-fledged members (endakali tenge). 3) The man who lives with his wife's lineage is somewhat less secure. He is even less able to be a "real" member of the group but like the former case, he approaches that status by making laita for all of his children and fulfilling the role of brother. His children are then members.

An examination of Table 7 gives some indication of the social and economic situation of married males at Yumbisa in relation to their "agnatic status." "Agnates" are individuals who claim an unbroken male line of descent from Molopai. Although there are undoubtedly genealogical alterations in high levels, informants are willing to acknowledge any female ancestors that they know about. Men with one or more female links are "nonagnates" (including two men who are residents because of the "dual agnatic

	Agnates	Natal Non-agnates	Immi-grants	Together
Number of Men	32	31	11	74
Number of Wives (ever)	1.9	1.8	1.7	1.8
Garden Area, Valley (ha.)	1.32	0.93	0.51	1.04
Garden Area, Slope (ha.)	0.75	0.67	0.38	0.66
Brideprice[1] (number of pigs/wife)	12.6	13.5	17.4	13.4
Brideprice[1] (other valuables/wife)	6.9	5.6	6.5	6.6
Number of Pigs (current)	3.9	3.0	5.6	3.7
Bigman Index[2]	1.8	1.8	1.6	1.8

[1] Reported brideprice. Observed: 13.9 pigs, 10.4 other valuables.

[2] Bigman index: 3 = Bigman; 2 = Ordinary man; 1 = Young man (just married), Old man or "Rubbish man".

Table 7: Social and Economic Characteristics of Kapil Male Family Heads

descent" claim). Non-natal members of the group are "migrants." Thus only 43 percent of the males who have been married are agnates.

The most important differences in Table 7 are the values for valley garden area. This resource is the primary subsistence base as explained in the next chapter. The differences here are statistically significant (agnates vs. nonagnates: 99% confidence level; nonagnates vs. migrants: 99% confidence level; agnates vs. migrants: 95% confidence level). None of the other comparisons are significant at those levels of confidence which strongly suggests the importance of land and its preferential distribution to agnates and that the descendants of migrants acquire more land than the migrants do during their own lifetimes.

Slope land and number of marriages follow the same pattern though not at high levels of significance. The bulk of data for brideprice (both number of pigs and number of things, including pigs) derive from recalled amounts which are dangerous to interpret too strongly. Pigs and "things" tend to be remembered in multiples of five which is suspicious. However, at any prestation the total number of things is carefully and publicly counted several times, and men not infrequently record the transaction by making a bundle of sticks, one stick for each item, which they stash in the roof of the house. Moreover, the average observed brideprice was 13.9 pigs or 24.3 things all together (23 cases). This agrees closely with the overall average of 13.4 and 20.0 (131 cases observed and reported). The number of things may be slightly inflated in the observed average by the recent use of money. I am obliged to conclude that the figure, though rough, must be approximately correct. The question remains whether the high migrant brideprice is an artifact of the sample. Five of those eleven men who moved to wife's relatives paid on the average, 13 pigs (19.5 things) per marriage, while the remaining six paid 21 pigs (27.5 things). These six men moved to maternal kin (four) or affines (two) who are the appropriate or representative receivers of the man's own <u>laita</u> or one for his children. Thus the hosts support the man's marriage in hopes of receiving a large <u>laita</u>.

In the case of pigs currently held, each man residing in his wife's community may have more pigs <u>in his house</u> since she may care for her brother's pigs (in some cases as a tentative <u>laitasanda</u> for the man's children's laita). It was not possible to ascertain the ownership status of each pig, only the residence. At any rate, the number of cases is too small to demonstrate this possibility.

Finally, the bigman index is my subjective evaluation of each individual's participation in group discussions, outside of those in which he is the central participant, and is roughly an estimate of leadership. It includes all men locally considered bigmen but excludes those who are too old to be active. This table generally reflects a strong similarity in the profiles of agnates and nonagnates, except for valley land. Migrants appear to be decidedly different but the low sample size suggests that some caution is appropriate. If one recalculates the average for men aged forty or more (Table 8), the migrant sample becomes even smaller and more variable but the overall pattern is similar. This suggests, however, that even older migrants do not gain land resources.

Although these figures are not conclusive, they support field observations that nonagnates are as fully lineage members as the purported agnates. Migrants appear

	Bigmen	Ag-nates	Natal Non-agnates	Immi-grants	To-gether
Number of Men	10	14	18	6	38
Number of Wives (ever)	3.9	2.6	2.0	2.2	2.3
Garden Area Valley (ha.)	2.26	1.71	1.24	0.57	1.31
Garden Area Slope (ha.)	0.66	0.49	0.79	0.43	0.51
Brideprice (number of pigs/wife)	14.8	11.3	12.2	17.0	12.5
Brideprice (other valuables/ wife)	4.9	4.4	4.9	5.6	4.8
Number of Pigs (current)	4.7	4.1	3.2	5.7	3.9
Bigman Index	3	2.1	2.1	1.8	2.1

Table 8: Social and Economic Characteristics of Kapii Male Family Heads over Age Forty

somewhat less well integrated.[11] To see how a social difference might appear in these terms, Table 8 includes the same array for the ten bigmen in Kapii clan (six agnates, three nonagnates, one migrant). Once again the sample is too small and variability too large to show high statistical significance in comparison to other types of men. However, the difference between bigmen and the average of all men is striking. If bigmen do not pay larger brideprices, they have more wives and thus move more pigs (bigmen--14% of the population--paid 33% of the total brideprice). This ability to manipulate pigs is the primary characteristic of a bigman.

H. Regional Articulation and Frost

This "mini-ethnography" has been offered to give an elliptical view of important activities and ideas at Yumbisa. It demonstrates the way in which Kapii clan is related to its larger descent group and, to a lesser extent, to surrounding peoples. Clan relationships provide a weak field of rights and obligations applicable to each

---

[11]A better measure might be the degree of participation in exchange (observed and reported), but such a measure is beyond the scope of this analysis.

individual at birth. A stronger field derives from one's genealogical relationships. Thus a person has certain potential helpers and certain obligations to focal individuals on the basis of genealogy. He has potential ties to individuals and local groups deriving from these obligations. On the basis of natal resources the person actualizes specific ties. Marriage (both ego's and his relatives') is especially important in this regard because it is the only way to extend ties beyond those one is born with. The result is an egocentric social network whose major expression occurs in the exchange system. Taking a regional view, these networks form a complex web of relationships among individuals which in turn condition the relationships among clans.

No individual escapes completely from this web and, in particular, a man's success, in emic terms, depends on his activities in this context. In etic terms, male exchange obligations and the resulting networks might be termed the "social glue" which binds members of a clan together, cements relationships outside the clan and rejoins clans that have been broken apart by warfare. These bonds then serve functions outside of the exchange system itself which will now be exemplified.

In 1900,[12] 1941, 1972, and on many occasions in between, frosts have induced food shortage of such severity that all or some of the families at Yumbisa have been obliged to seek refuge elsewhere. Informants allege that every other year frost kills at least some sweet potatoes. Let me stress that the occurrence of frost is variable. It may differentially affect plants in the same garden, gardens in the same valley and/or valleys in the same region. Hail and drought may also be a cause of food shortage and temporary migration may be desirable in the face of warfare. Migration utilizes social networks which are based on exchange activities similar to those of Central Enga areas which experience little or no frost (see Chapter V for comparison).

When household food shortages occur, for whatever reasons, the first social response is to share garden produce within the clan parish (see Chapter III for technological responses). Cooperative labor among women of different families is common, supporting this practice.

The major "line of defense" against local food shortages affecting the entire Yumbisa valley is the

---

[12]Dates prior to 1940 are approximate.

dispersed garden system. Because of the nonlocal nature of segments and widespread marriage ties within the region, a man may maintain garden rights in nearby areas where frost threat is similar or slightly less. In addition, some have gardens in low frost risk areas (see Chapter III). Thus if one garden area does not produce, another may.

The main response to a regional food shortage is temporary migration, which is examined below. Few people can be supported on resources of the local bush. During the 1941 frost, two men survived at Yumbisa in this manner while 46 people are said to have died.

The frost we observed in 1972[13] was one of the most severe in memory, comparable to the one in 1941. Unlike the latter, an option to migration was available--government and mission relief. Nevertheless, 60 percent of the population of Molopai people of Yumbisa chose to leave. This was due largely to a certain skepticism and unfamiliarity concerning such novel social behavior as relief. Those who remained indicated they had inadequate

---

[13] See Waddell (1975) for details of this frost for the greater region.

ties to potential hosts.

The 56 families from Kapii, Epee and Meoko clans who migrated went to the Lagaipa valley from Laiagama westward (1 1/2 to two day's walk with pigs and children) and to Porgera (about three days' walk)--see Map 1. Almost two-thirds of the population that normally resides at Yumbisa migrated. Of 90 families in all, 31 left in whole and 25 in part, plus young men who were too mobile to pin down. These families found hosts in 24 localities distributed between the Lagaipa and Porgera with 12 families concentrated in one locality. About half of the families went to the same place as the husband or his father had in 1941. Overall, about six Yumbisa people stayed with each host (range 2-13 persons per host). Only three families stopped at a first location before settling at a second and only one family returned to Yumbisa unable to find refuge, although some other individuals who went out to evaluate their possibilities returned as well. They took about 132 (86%) of their own pigs with them leaving the remainder at Yumbisa.

If the frost-burned Yumbisa valley had dampened spirits, they were quickly revived in the hosts' valleys. It was a time of increased socialization with the tremendous influx of people from all over the Kandepe area. Many nights were spent in courting the young women and "business" dances were held at which pork and taro were sold. People were seen visiting all around, young men touring the whole circuit. There was continual coming and going between Yumbisa and lower elevations and the latest news from "home," usually quite distorted, spread rapidly. But all was not play and the migrants soon began garden work either in "rented" gardens, "given" gardens (see below) or the host's gardens. Although two families purchased food outright (giving, for example, a pig for the right to harvest an ongoing garden), the majority replanted what they ate. The produce of replanted gardens would be eaten when mature or returned to the host. Even people who returned to Yumbisa before the maturation of first plantings, frequently came back to their migration garden to harvest that which they had planted.

Everyone was hosted by a relative of some sort. However, the connection was on occasion rather tenuous as in the case of the man Lenge who took his family to stay with his WiMoSiSnSnWiMoFaSiSnDaHu! (See Figure 6) He was in a joint party consisting of his WiMoSiSnSn

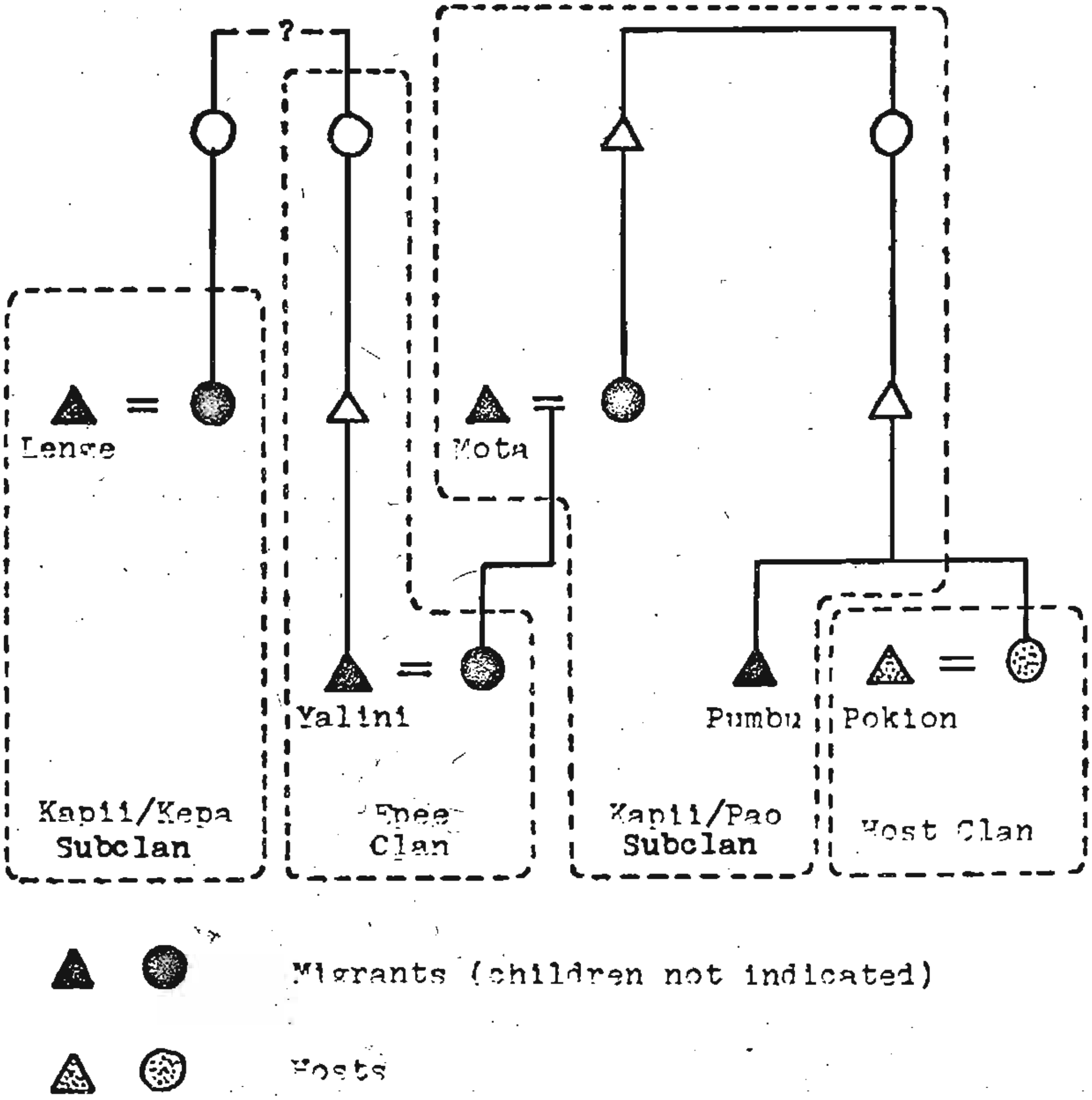


Figure 6: Genealogical Relationships of Some Migrants

(Yalini--a parallel clan member) and the latter's WiFa (Mota--a parallel subclan member)and Pumbu (parallel subclan member) who was the focal person that sought his own SiHu (Pokion) as a host. Mota is a migrant to Pao subclan (living at his wife's place) and Pumbu is a nonagnate. Such connections are better understood in terms of descent groups. Thus Lenge went with his parallel subclan "son," Yalini, to the latter's host while Mota accompanied his lineage "son," Pumbu, and Yalini his parallel clan "brother," Pumbu. That a relationship of "known" genealogy exists in addition to cognatic descent and group membership, is important though it is not, I think, essential. What is essential is that the individuals be on relatively good terms as far as personal networks go. In the 1941 frost when almost everyone was obliged to find a host, such relationships among the migrants--grouping with an individual who had a secure host--were more common.

In 1972, however, most of the relationships of male head of migrant family household to male head of host household could be described in four primary kin designations or less. These relationships are further condensed and summarized in Table 9 where ego is male head

Relationship of Host	Number of Hosts	Exchange Relationship
Ego's* own lineage or clan	11	*Laita* helpers (Assist ego for *laita* in which he is giver.)
Ego's Wi natal lineage	11	
Ego's WiMo natal lineage	2	
Ego's Mo natal lineage	2	Primary *laita* recipients (Receive *laita* from ego.)
Ego's MoMo natal lineage	1	
Ego's FaMo natal lineage	0	
Sn of woman of ego's lineage	6	
Hu (or his Br) of woman of ego's lineage	5	*Laita* givers (Give *laita* to ego.)
Ego's SiHu lineage	2	
Sn or SiHu of woman of ego's Wi or WiMo natal lineage	5	Possible secondary *laita* recipients (May receive "improper" *laita* from ego.)
Sn of woman of ego's Mo, MoMo or FaMo natal lineage	4	
Ego's MoBrWiBr	2	

* Ego is male head of migrating household.

Table 9: Relationships of Migration Hosts to Migrants

of migrant household and the hosts are grouped according to corporate group membership, genealogical relationship and their corresponding exchange relationship. Thus eleven migrants took refuge with individuals who would ordinarily be their helpers in the _laita pinqi_, fourteen with individuals who might give _laita_ to them, fifteen with primary recipients of a _laita_ they might direct and eleven with possible secondary _laita_ recipients. The last category constitutes a large residual class of affinal relatives of various sorts (excluding wife's agnates and lineals) who are not ordinarily given _laita_ but who may receive it as representatives of the appropriate (primary) group as explained earlier. Now, recall that some migrants worked "rented" gardens and some were "given" gardens. Recall too the discussion of bride-price as "buying" a wife. In a similar way here, the gardens are not "rented" in traditional terms. Sophisticated (i.e. somewhat Westernized) informants like to compare traditional exchange activities to their dimly understood view of the white man's "business." What they see dimly is the impersonality and finality of Western monetary purchases (which is not to deny they may ultimately recognize certain advantages in that type of transaction). The fact remains that giving some pigs to the host to acquire the use of a garden or not doing so is based upon traditional ideas of the existing relationships between the two individuals. In the 1941 migration, a similar distinction was reported but it was not (of course) called "business." It is the traditional relationship that is of interest here.

The exchange categories of Table 9 are reproduced in Table 10 which adds the numbers of migrants who "rented" gardens and the "rent." The category of laita helpers has been divided by removing all migrants of a lineage of Meoko clan and placing them in the category "Meoko agnates." I interpret the resultant array in the following manner. Ego may go to his own agnates and be assured of hospitality if he has maintained the agnatic relationship of mutual assistance. Some of the five Meoko families who went to agnates and who all paid (high) for garden space, maintained that they simply felt pity for their clansmen. Of the other six migrants who stayed with agnates, only one paid (high). Non-Meoko people explained that they and the other agnate who paid did so because they had not previously kept up their obligations of aiding fellow clansmen in pig prestations. Once again we see the difficulty

Exchange Relationship of Host: Migrants...	Number of Cases	Number Paid	Amount Paid[1] (Number of Pigs)	Mean Pay (Number of Pigs)
Laita helpers (Agnates--other than Meoko clan)	6	1	3	3.0
Primary laita recipients	15	3	3	1.0
Laita givers	14	7	8.5	1.2
Possible secondary laita recipients	11	6	10.5	1.8
Laita helpers (Agnates--Meoko clan)	5	5	11	2.2
Other[2]	4	2	2	1.0
All	55[a]	24	38	1.6

1 "Pig equivalents"--three "pigs" were cash payments.

2 One migrant went to his "sister's" boyfriend and one to his own nonlocal garden. Three others went to their own gardens but required hosts for housing, etc. Two relationships: no data.

a One migrant who returned without finding a host is not counted.

Table 10: Exchange Relationships of Migration Hosts and Garden Payments

of concentrating on local members of one's network to the exclusion of geographically more distant kinsmen. Three Meoko families who live at Katikati (across the valley from Yumbisa) migrated to the same hosts and all three paid as well. Thus the state of activation of one's network is important to its utilization but delinquency in meeting obligations can be rectified. This principle is likely acting in the other cases as well but is not as clearly demonstrable.

The next category of hosts who offer secure refuge are those people who stand to receive a laita directed by the migrant. Two of the three payments in this category were surrounded by mitigating circumstances. One man who stayed with his mother's agnates brought with him two other families who were his affines. Thus the payment (two pigs) may have actually been from them. In the other case, there was some doubt about the exact relationship suggesting that the migrant's host may not really have been his mother's mother's agnate.

In the case of possible secondary laita recipients, the hosts who received pay are indistinguishable from those who did not in terms of genealogy. Given the geographical distance, it would appear that some of these hosts doubt that they will receive laita and get what they can while others may be better articulated with the migrant or hope to use the hospitality as an indication of active relationship and thus claim laita later. One such migrant gave five pigs to his host for the latter's use in a pig prestation. They are MoSiSn to each other which is a close relationship often leading to mutual support so in all likelihood the migrant will subsequently receive pigs from his host. Nonetheless, secondary laita recipients are less secure hosts and on the average require larger payment.

Finally, those individuals who are potential laita givers appear to be a poor choice of host in terms of having to pay. However, like so many exchange interactions one tries to "have his pig and eat it too." In this case the migrants have, in a sense, buttressed their tie to the host and may hope thus to encourage a laita through further interaction.

The basic cultural principle, as I interpret it, is that the giving of pigs implies their return, but realization of this exchange rests upon the maintenance of the relationship and adroit maneuverings, persuasion and so forth. Channels thus maintained can also be used for other favors such as usufruct land grants, aid in warfare, and sharing of resources such as pandanus. In general, hospitality is an obligation which is simply part of the normal reciprocity between kinsmen. I never encountered an instance in the two and a half years that followed the migration of reference to hospitality as implying any other obligations. Several of the migration hosts came to Yumbisa to share in the pandanus harvest but nonhosts came as well.

Thus, no migrant (possibly excepting the two outright purchasers of garden contents) had to pay for their food or housing *per se*. Rather the giving of pigs is part of exchange manipulations and the maintenance of social ties. Obviously, the two realms are tightly interrelated. Similarly nonagnates are incorporated into the landholding corporate group through *laita pingi* and subsequent reciprocal aid in exchange activities.

In brief recapitulation then, the case of frost migration demonstrates both the utilization of network ties for purposes not directly related to exchange and the concomitant, pervasive manipulation of those ties with regard to exchange. The importance of exchange and network ties is critical to elucidating the nature of social life at Yumbisa. Thus we have considered the ideology of descent and its variations with respect to clan composition, the cross-cutting personal networks in terms of exchange, bigman activities and mutual assistance, and the observed output of their interaction. With this sketch in hand, we may now turn to an examination of agricultural practices and environmental constraints to pave the way for an articulation of these factors.

CHAPTER III

SUBSISTENCE

A. Bush

Kapii contiguous[1] clan land comprises approximately 25 square kilometers, the exact boundaries of which are difficult to ascertain in the tangle of forested limestone ridges, valleys, sinks and peaks. The northern reaches are especially vague because the nearest neighboring group in that direction lies nearly 25 km. away. In the other directions, where neighboring groups have adjacent pandanus groves, boundaries are precisely claimed and sometimes marked by blazed trees. On the total area, about 18 square kilometers is pandanus bush or land too steep or high to be much frequented except for occasional marsupial hunting. This large forest lies generally above 2,700 m. with one peak (Lipitaka) rising to 3,100 m. The montane rainforest consists of mixed species of trees

[1]In addition, Kapii clan has a small but important piece of clan territory at the ancestral home (Kiteli/Bipi)--about six hectares of valley gardenland (see Section D: Dispersed Gardens).

although beech (*Nothofagus*) occasionally forms single species stands and pandanus tends to cluster in small valleys. Mosses and a host of other plants commonly cover the tree trunks. In the deepest forest the ground is fairly clear but whenever there is an opening in the canopy, ground cover is profuse. Major resources of the area are pandanus nuts and marsupials but certain fungi, various ferns, a fruit locally called *matakombe* and a few other species are sometimes eaten.

Hunting is not a common endeavor for most married men, and it provides little input to the diet. Young men occasionally spend a night in the bush attempting to tree a marsupial (*Phalanger* sp.) aided by their dogs. However, when a number of marsupials must be given to a new bride's clan, for example, the groom and his helpers can bring back a couple of dozen in a few days.

The principal dietary contribution from the bush is wild pandanus which occurs throughout the area. Every tree is claimed by someone. Thus almost all of the bush, even far from valley residences, is divided by subclan, lineage and individual family. There are a dozen major groves where trees are sufficiently clustered to warrant the construction of semipermanent dwellings, and where competing vegetation is controlled to some extent by cutting out the undergrowth. Pandanus yields seasonally in January and February but, it is said, only in alternate years are numbers large. Observations of three harvests fit the seasonal pattern. At such times, the valley is all but abandoned as everyone who can walk or be carried, along with the pigs, "goes bush." Individuals who do not have pandanus land in the deep forest nonetheless build a pandanus house even if it is next to their valley house. This provides space for drying the nuts in the rafters. At this time, too, both sexes reside under the same roof, carefully dividing the house down the center with the pigs in stalls behind.

The pandanus harvest is a time of great festivities and pigs and people grow sleek on a diet of almost pure pandanus.[2] It is the sole storable foodstuff. What cannot be eaten in the two weeks to one month of harvest is dried and carried back to the valley. Although tales are told of saving pandanus for years, very little is in evidence three months after harvest. It is a premium

---

[2]Pandanus is high in caloric value (588 C. per 100 gm.), protein (10.7 gm. per 100 gm.), fat (59 gm. per 100 gm.), thiamin and niacin (Peters 1958).

foodstuff frequently given to relatives who live at lower elevation where it does not grow so plentifully. These relatives often come to share in the harvest.

Pandanus disputes are currently the major cause of interclan fighting. The pax australiana does not extend into the forest effectively and during both harvests that I observed, the clan mobilized for warfare with neighbors over boundary disputes. Happily nothing came of it but litigation, though in other years people were not so fortunate. Extraclan animosities are somewhat dissipated because of dispersion and because of intraclan quarrels which are legion. There never seems to be enough pandanus. Poaching and boundary disputes within the clan are common, often leading to physical violence and endless settlement procedures.

Bordering the major habitation area is about 2 1/2 square kilometers of bush which is comparable in topography to the area already cleared for slope gardens. It is dotted with pandanus and partially cleared by constant demands for firewood. There, undergrowth is much thicker and various resources are sought: the berries of *Rubus rosaefolius* and the introduced cape gooseberry (both eaten mainly by children), *Oenanthe javanica*, ferns to cook with pork, fungi, passion fruit, pandanus, marsupials, wood for construction, the shrubs from which string bags, ropes and traditional men's loin cloths are made, and so forth. Pigs graze there. This area constitutes a land resource which could be utilized for slope gardens without walking farther from houses than for current gardens.

On the valley side of current gardens lie about 1 1/2 square kilometers of swamp which is too wet to support trees and is of little use. On rare occasions a duck may be snared in this area, and swamp grass is burned during the dry season with intent to produce clouds and prevent frost. Of the remaining 2 1/2 square kilometers, 52 ha. is in valley forest which provides some firewood, pig forage, pandanus and a few edible plants. A small stand of podocarps occurs in the southwest corner and the remaining trees are small and scrubby. This 52 ha. is the remainder of the valley bush from which the primary gardens were cleared and this process is continuing at a slow rate. Of the overall clan land, then, 7-8 percent has been cleared for gardens: 86.29 ha. slope and 103.40 ha. valley (see Map 2).

Map 2 is in Appendix 5

B. Valley Gardens

Some 77 percent of sweet potato mounds are made in valley gardens which lie on a gentle slope of about 25 m. drop per kilometer (1.5 degrees). This is insufficient to drain the garden area so a system of ditches has been dug based on nine major channels, the most extensive of which are 1.62 km. long and extended far into the swamp. A system of subparallel ditches and lateral drains results in a neat rectalinear pattern of gardens. Boundaries are often marked, in addition, by planted tankets (*Cordyline* sp.). Pandanus trees are preserved in the gardens but only survive in those cleared less than 35 years ago.

Within these boundaries sweet potato mounds are constructed in well-aligned rows by heaping up grass from the surrounding area, ditches or nearby fallow gardens and covering with well-broken earth. The grass centers often weigh over 27 kg. (green) and may contain weeds, sweet potato vines, and any other green matter lying around. The result is a round mound standing on the average, 0.83 m. high and 2.04 m. in diameter containing 0.8 cubic meters of fill and 0.4 cubic meters of earth cover. In unusually wet gardens, mounds occasionally reach 1.2 m.

in height. A woman takes 45 minutes to one hour to mound the earth and somewhat less time for gathering grass, hauling it and preparing the ground. During the dry season five or six mounds is the maximum daily work of one woman--about two mounds in the wet. By harvest time (nine months) the mounds have subsided to 0.41 m. but the green matter has not fully decomposed. Thus a core of porous material protects the tubers from rotting, an important reason for mulch mounding according to the gardeners. When prolonged drought occurs, the technique is disadvantageous since the plants (especially young ones) are raised above ground level, but an excess of water is more often the problem than drought in valley gardens. High mounding serves also to raise younger plants above the effect of light frost and mulching raises the internal temperature of the mound through decomposition (Waddell 1972).

Upon completion of the mound, bunches of three mature sweet potato vines cut to 0.6 m. length are thrust into the earth just above the grass fill at eleven locations (0.6 m. above the base) until only the tip leaves are showing. Four or five different named "varieties" (of at least 27 currently planted at Yumbisa) are commonly planted in the same mound. If the garden has just been removed from fallow, nearly the full range of food crops is planted. Traditional subsidiary crops, also planted in the mounds, are as follows (see Table 11 and Appendix 1 for list of cultigens): taro (shoots planted in pairs around the base of the mound), sugar cane and *Setaria palmaefolia* (cuttings planted in pairs around base--the latter rare in valley gardens) and greens--*Rungia klossii*, *Roripa* sp., *Solanum nigrum* (seeds sprinkled over the surface). Introduced crops are Irish potatoes (tubers into sides and tops of mounds--but often a volunteer), Chinese cabbage (seeds sprinkled on top--replacing native greens to a large extent) and cabbage, corn, onions, peas and beans (seeds or seedlings around the sides). Chinese cabbage and cabbage flowers are eaten as well. If the garden has been planted several times in succession, it will likely contain only sweet potato, Irish potato, Chinese cabbage and taro. Planted in wet places between the mounds is *Elaeocharis sphacelata*, the plant from which women's skirts are made. Taro may also be planted in the small lateral ditches.

Mounds are clean weeded at about three months and six months, the debris is thrown down in the grass between

Crop	Percent of Gardens in which Crop Occurred (272 Gardens)	Mean Frequency with which Crops Occurred in Sample of 2780 Mounds (Number of Plants per Mound)
Sweet potato*	100	33.00
Irish potato (planted + volunteer)	49	planted .75+ volunteer 2.00
Chinese cabbage	46	.88
Cabbage	40	.29
Taro*	37	.52
Sugar cane*	14	.08
Maize	11	.28
<u>Setaria palmaefolia</u>*[1]	10	.21
Other native greens*	> 10	<u>takani</u> .05 <u>auwa</u> > .05
Onions	6	.02
Peas	6	.09
Beans	2	.01
Turnips[2]	2	.01

* Traditional.

[1] Occurs almost exclusively in slope gardens.

[2] Turnips were introduced during the famine relief effort. Silverbeet, sunflowers and brussel sprouts occurred in three gardens and originated in our garden. Several patches of rice (from the relief issue) were also growing.

Table 11: Extent and Frequency of Individual Crops in Gardens

mounds. Around the fourth month *Solanum nigrum*, early peas and Chinese cabbage can be harvested. Irish potatoes and early cabbage mature in four or five months; late maturing cabbages and peas in five to six months. *Setaria palmaefolia* is ready for harvest in seven to nine months and can be continuously harvested thereafter. Sweet potato is harvested, on the average, after 41 weeks but the larger tubers may be gleaned at 31 weeks and, on occasion, harvest is not completed until the 51st week. Ordinarily the larger tubers are taken somewhat earlier than 41 weeks and, if sweet potato is plentiful, the smallest tubers may be left in the ground for the pigs to forage. Taro planted in the gardens is incorporated into the next series of mounds, which are constructed in the interstices of the last series and after those mounds mature it is frequently harvested. Thus the usual interval for taro is 19 months or more even though informants say 28 months (three sweet potato harvests) is ideal.[3] Sugar cane takes the longest time, though, requiring in excess of three years to yield large canes. Under good conditions a one

---

[3]Taro grown in traditional mounds in our garden reached its maximum size at 27 months and was somewhat larger than ordinary.

meter cane takes two years. All these maturation/harvest times are dependent on the severity of drought, occurrence of frost, and availability of alternative foodstuffs near harvest time.

Ideally, garden production is continuous throughout the year, but a certain rhythm derives from the frequent occurrence of frost. When the sweet potato vines are killed it takes approximately five months for regrowth to reach a length deemed adequate for planting. Thus a killing frost in September leads to a flurry of garden replanting in March. Also, since many families maintain gardens in areas up to two days' walk away, they must move to that location to harvest and replant those outlying gardens. This is most likely to occur when food is scarce at Yumbisa. So the cycle that begins with a killing frost is maintained until it decays to continuous planting or a new cycle is activated by another frost.

Fallowing occurs in three ways: a brief lapse between plantings, a short fallow and a wet fallow. A transect of 100 garden plots (see Map 2 for location) was observed at intervals of two to four weeks and revealed the following pattern (see Appendix 2). Fifteen plots were fallow for the full period of observation. Of the remainder, 38 percent were in continuous cultivation except for a period of less than a month during which old mounds had been harvested but the new garden had not been completed. This brief lapse is insufficient for new grass to develop. Pigs are commonly staked in such gardens and turn the soil extensively.

Some 16 percent of the gardens exhibited a short fallow averaging 38 weeks long. This is sufficient time for a good stand of grass to develop which becomes the mulch for later mounds. However, another 16 percent of the gardens were fallow at the beginning of the period and a similar proportion at the end. Observations of other gardens suggest that individuals who have more available land may let some lie fallow for years which would increase the average short fallow period. The ideal for short fallow is five sweet potato harvests (about four years).

The wet fallow is achieved by letting laterals fill with vegetation and not maintaining major drains. Large blocks are thus inundated. Ideally, if a young married man utilizes a certain segment of garden that his father also cultivated, he will then fallow it until he is old. This gives a wet fallow period of approximately 20 years.

Areas currently in this state are readily apparent on Map 2 by the larger size of the plots. The largest such area, in the southwest portion of the valley (Map 2b), is now ready to be reopened. It was cleared in the 1920s and 1930s, cultivated for perhaps 20 years, then fallowed. One of the principal land owners renewed the pig fence before our arrival preparatory to cleaning the ditches. However, his lineage brothers were not yet interested in reworking their plots since other land was preferred. Unless he wishes to undertake the considerable labor of clearing the ditches by himself, he will have to await their decision to help.

C. Slope Gardens

Some 94 ha. of slope ground have been used for gardening. In April 1975, 5.92 ha. (6% of the cleared slope) was in garden. Cultivated slopes range up to 35 degrees for short falls but are more commonly of the order of 25 degrees or less. Basic mounding technique is similar to valley gardens but a developmental cycle can be recognized. The first planting after clearing results in mounds which are somewhat wider and lower than for valley garden. Fill is likely to include pandanus leaves, ferns and other vegetation from nearby forest. Subsequent

Map 3 is in Appendix 5

plantings result in mounds which are progressively smaller and the number of sweet potato bunches drops to eight or nine. Slopes are preferred over valley gardens for traditional nonroot crops. But, as with new valley gardens, the first planting consists of most cultigens (including taro and sugar cane) and later may be only sweet potato. Beds of ash from burned clearing debris, are frequently used for cabbage seedlings.

Since it is expected that sweet potato production will deteriorate rapidly, only three or four successive plantings are made after which the garden is fallowed for a similar period. Most slope gardens were apparently abandoned after about 20 years of such cultivation, but one small area cleared about 40 years ago is still in production. Gardens must be recultivated before the "pit pit" takes hold. "Pit pit" (Miscanthus floridulus) is a tall grass, commonly three meters high, and dominates the garden abandoned more than a few years. It is very difficult to remove, and only two gardens were made on slopes covered by it during fieldwork although clearing technique is well known from other areas. These slopes are considered to be nearly useless and men would rather clear peripheral forest than "pit pit." This grass is not purposefully burned since it surrounds most of the houses.

Excepting pockets of deeper soil, slope gardens are clearly recognized to be less productive than their valley counterparts after the first few plantings. They are nonetheless of considerable value. Traditional nonroot crops including sugar cane, are favored on these sites (90-100% of all plantings on slope or valley) and cabbage is strongly represented as well (44%). But the major advantage derives from enhanced drainage of cold air which significantly reduces the threat of frost. This was apparent during the early (lighter) frosts of 1972 in which slope gardens were largely spared. Mulch mounding and clean weeding further ameliorate frost damage. As a result, a family with some slope garden may be better able to cope with light frost. Mounding also tends to concentrate the thin layer of topsoil which is particularly important in later plantings. Slope gardens are never, of course, inundated during overly wet weather as occasionally happens in valley gardens when ditches are not adequately maintained. Periods of drought, on the other hand, can virtually halt sweet potato growth in slope gardens.

Another type of garden is made near residences, comprising one to twenty mounds. Composition and technique is generally the same as any early post fallow planting but the crop inventory is greater. Introduced species and rarely occurring plants are tried in these house gardens: beans, beetroot, pumpkin, carrot and gourd. Tobacco is grown around the house, beneath the eaves.

D. Dispersed Gardens

The maintenance of gardens outside of the Kapii local clan area is critical to the subsistence adaptation at Yumbisa. The strategy of dispersed gardening can be seen as a direct response to the frequent occurrence of killing frosts. As mentioned earlier, a frost which terminates garden production results in temporary migration to lower elevations. When such destruction is widespread (as it was in 1941 and 1972) the only recourse is migration to frost free or nearly frost free areas. For more localized frosts, gardens in similar or slightly lower frost risk areas may provide relief. In either case, absence results in a period of shortage in food production nine months later when the sweet potatoes that were not planted at Yumbisa would have matured. At that time, too, or somewhat earlier, the gardens planted at the host locality of the first retreat mature, thus calling the migrants back again. This cycle continues but is slowly damped out by shortening or extending the nominal harvest time of the sweet potato. Differing strategies on the part of individual families smooth out the fluctuations for the whole clan.

Records of peoples' major movements were kept and the estimates of population present at Yumbisa are presented in Figure 7. An examination of this graph reveals five migrations deriving from the frost of 1972 and two pandanus harvests (during which most of the population was absent). The first migration in October 1972 began the cycle as a large portion of the population retreated to mainly frost-free areas as explained in the preceding chapter. Many returned to Yumbisa in January 1973, then immediately went to the bush for the first pandanus harvest. By March, sweet potato vines had grown long enough to plant and gardens were made at an unprecedented rate. Pandanus, maturing Irish potatoes and greens provided sustenance. Slowly the second migration occurred as most (but not all) of the migrants went back to harvest the gardens planted during the first migration. At this point seventeen families, including some who did not migrate the first time, went to Kiteli/Bipi where gardens which

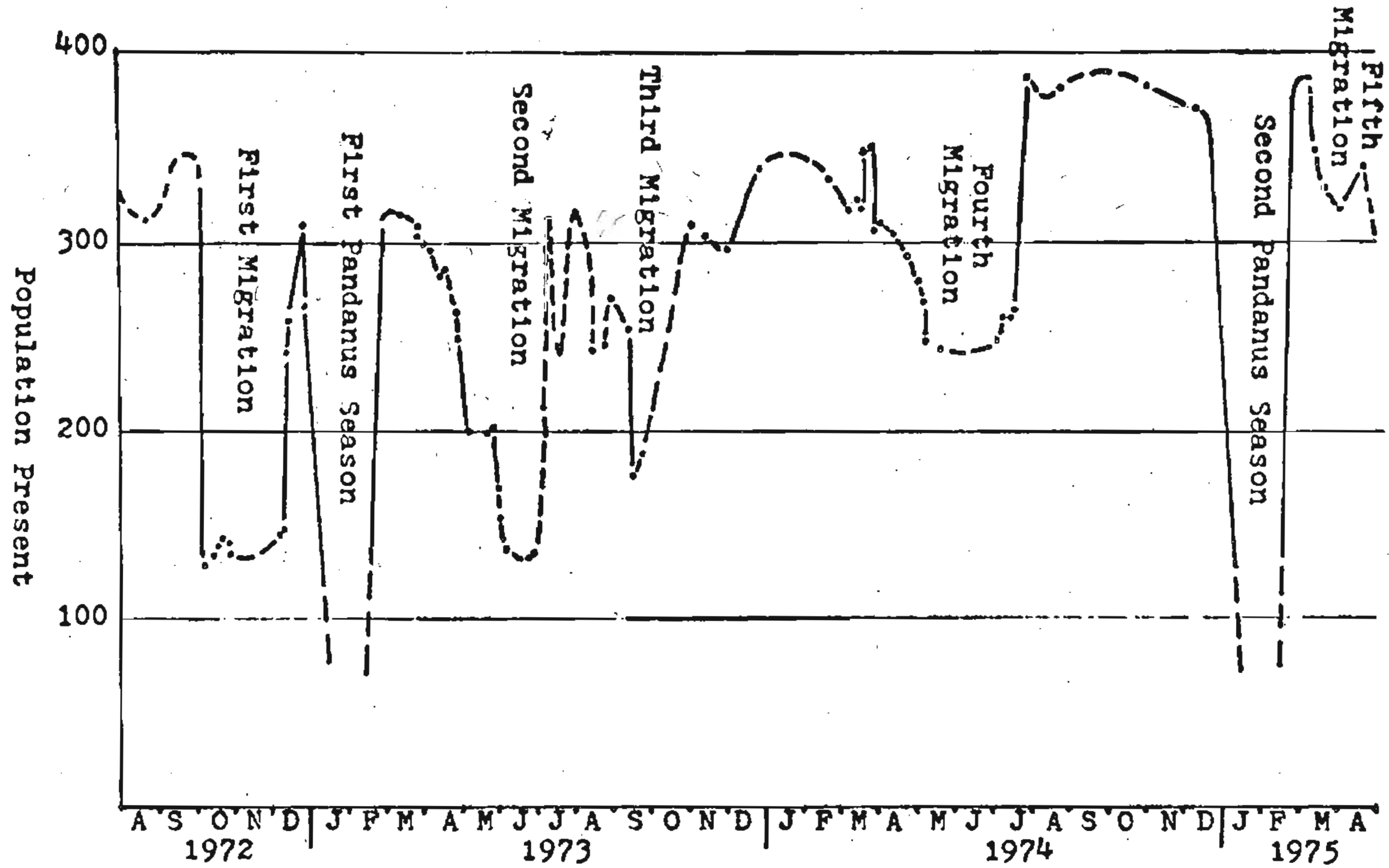


Figure 7: Kapii Population Present at Yumbisa

were planted just before the final frost were ready. (The mature gardens there derived in part from a cycle initiated by the frost of 1971.)

The third migration was somewhat more complicated. Informants report that severe frosts (and sometimes hail damage) result in poor sweet potato production from the early first planting after the event. This is called a <u>nia</u> and apparently does not commonly occur in the slightly lower Kandepe area. Tubers are characteristically small, long, thin, and hairy.[4]

The <u>nia</u> and the resultant third migration were not synchronized with the initial cycle and this presented difficulties. Moreover, the government relief effort had been terminated a few months earlier. When relief was in effect, returnees could count on at least a minimum ration of rice and sometimes fish. The <u>nia</u> food shortage had to be dealt with purely by traditional means. Several strategies were employed.

---

[4]Suspecting that this might result from planting vines that were too young, my wife and I ran trials one year later. Women assured us that the youngest vines (four months old--barely long enough to plant) would die. Their yield, however, exceeded that of the older vines. Whatever the cause of the <u>nia</u> may be, it is not simply attributable to planting young vines, though planting <u>first regrowth</u> young vines is not ruled out.

1. A few families simply did not return to Yumbisa from earlier migration.

2. Some families could still harvest gardens planted on their host's land late in the first migration and they returned to those hosts.

3. Many families utilized their own dispersed gardens (in semi-continuous production since the first migration or before). This included gardens at Kiteli/Bipi where it was necessary to harvest immature tubers.

4. Others joined families that had employed one of the above three strategies.

5. The rest stayed at Yumbisa despite very low levels of sweet potato production (see Section F, Subsistence Security, below).

In December 1973, garden production climbed rapidly back to reasonable levels. By January 1974, those who had stayed at home and planted were rewarded with good production while the "habitual" migrants were still stuck in their cycles. The third migration had extended the period of absence and a fourth migration resulted from the previous two combined. All families having gardens at Kiteli/Bipi went there taking other families with them. This migration occurred despite high levels of sweet potato production at Yumbisa. In addition to the gardens being ready at Kiteli/Bipi, a large dance and a baptism served to further attract people. Finally, after the pandanus season of 1975, a fifth migration was shaping up when we left the field. Its main impetus appears to have been a return to Kiteli/Bipi to harvest the gardens planted during the previous migration.

The damping of the fluctuations can be seen clearly in Figure 7 and suggests that it would take about three years to return to major reliance on local gardens. Since significant frosts, i.e., killing at least some gardens, are alleged to occur about "every other year," it seems likely that this mobility is the rule rather than the exception at least for some families at any given time. Thus for major frosts, the host option is used while lesser and subsequent shortages tend to be met by utilizing dispersed gardens.

The importance of dispersed gardens is reflected in the following figures. Of 73 families, forty (52%) claim 196 nonlocal gardens in 24 localities. About 80 percent of these claims appear to be secure while the remainder may be temporary. This total count includes the 57 gardens which twenty Kapii families have at Kiteli/Bipi. Of these, about 47 are on Kapii land--the clan holdings remaining from the period before settlement of Yumbisa plus subsequent additions. The full distribution of dispersed gardens is presented in Table 12 (see Map 1 for locations) where localities are categorized geographically with respect to frost risk. The categories are derived from my own observations and through questioning informants in the areas. Boundaries are thus approximate divisions of a continuum.

Gardens in category I where frost risk is similar to Kapii local gardens are least useful for migration purposes. However, since light frost occurrence can be freakish, they may escape damage which occurs in local gardens. These areas are within a few hours' walk of Kapii houses and their cultivation results in minimal disruption of gardening activities at Yumbisa.

Category II gardens are the mainstay of the dispersed garden system, especially the Kiteli/Bipi area. Most of the localities are a day's walk away, but the Upper Lagaipa area usually requires an overnight stop when traveling with pigs and children. Some 38 percent of the families have access to these gardens. Due to its low elevation, category

	Number of Families with Gardens at Locality	Number of Plots Reported
I. Frost Risk Similar to Kapii Local Gardens		
1. Molopai Area (Yumbisa/Katikati Valley)...........................	4	25
2. Non-Molopai Area (Yumbisa/Katikati Valley)...........................	10	38
3. Molopai (Outside of Valley)..........	9	19
4. Non-Molopai (Outside of Valley).....	2	6
Number of families with gardens in I: 22		Subtotal 88
II. Frost Risk Less than Kapii Local Gardens		
1. Molopai Land (Upper Kandepe Valley including Kiteli/Bipi)........	20	57
2. Non-Molopai (Upper Kandepe Valley)............................	6	17
3. Non-Molopai (Upper Lagaipa Valley)............................	6	11
Number of families with gardens in II: 29		Subtotal 85
III. Little or No Frost Risk		
1. Lower Lagaipa Valley..................	8	23
IV. No Frost Risk*		
1. Porgera and Tari......................	0	0
Number of families with gardens in I, II, or III:	40	Total 196

* Does not count first migration gardens which may be cultivated for two years after frost.

Table 12: Location of Reported Dispersed Gardens by Frost Risk

III (about two days' walk away) is a better locality with respect to frost risk but only six families have gardens there.

If the dispersed garden system were the only option available for frost retreat, a large number of gardens would have to be kept in nearly continuous production to be ready for a frost any given year. Given the frequency of frost, the system is self-regulating. Before all outliers are left to fallow, a frost occurs sending people to their gardens where they recultivate them while living with relatives if the gardens are not producing. However, as the migration cycles damp out fewer and fewer of the outlying gardens are maintained in cultivation. Thus, the worst situation, with the exception of widespread frosts such as those of 1941 and 1972, is one in which there is severe frost after several good years have passed without migration. As a result, in almost any year of frost (e.g. 1971) some people's outlying gardens are all fallow and they must use the host option to cope with food shortage.

E. Pigs

Valley gardens as a whole are fenced on the slope side from pig foraging areas. Occasionally a pig may go around the fence or get loose while on the swamp side and destroy some garden. More often they find or make a hole in the fence. Such predations are very common and a constant source of friction. Slope gardens on the forest edge are individually fenced. Thus pigs have an open ended pasture. They do not, however, go wild. Rather, they return to the gate in the evening and wait impatiently for someone to let them into the house where they are given the small sweet potatoes from the day's harvest. Should a pig not return at night, a rare event, a man may spend several days tracking it down.

During the 1972/3 food shortage, no more pigs (actually less) were killed than at any other time. They were fed almost nothing at the house, but appeared not to suffer for it. Apparently, resources of the bush are sufficient to support a significant number of pigs if not people.

The actual number of pigs at Yumbisa was rather difficult to determine since one does not admit to having very many, if any. After two and a half years I succeeded in counting the number of pigs per house (though not per individual). There were, in December 1974, 322 pigs sleeping in houses associated with 423 people of Kapii, Meoko and Epee clans which gives a ratio of 0.77 pigs per person. Table 13 summarizes some further characteristics of the pig population. Most males are castrated at three or four months to stimulate growth and keep them docile. Those few that remain uncastrated are the less promising members of the litter. The five Yumbisa boars are decidedly smaller pigs which presumably implies a selective pressure towards small size. Breeding is arranged and boars are kept separate from sows. The owner of the boar receives one good piglet.

During the fieldwork, I attempted to keep records of all pigs that came into or left the care of Kapii people either through exchange activities or by slaughter. These data together with the pig census of December 1974, a sample of the pig population from October of 1972 made by an agricultural officer, and my observations during the frost migration provide the basis for a calculation of the dynamics of the pig population at Yumbisa. Figure 8 shows the approximate number of pigs owned[5] by Kapii people on this basis. A fairly regular pattern emerges in which the

---

[5]This represents pigs owned by Kapii people at any time rather than pigs present at Yumbisa. Typically during the migrations about 80-85% of the pigs go with the migrants while the rest remain at Yumbisa.

MALES:	
Large	52
Small	54
Boars	5
Total	111

UNSEXED:	
Small	25

FEMALES:	
Large, not yet fertile or not yet bred	35
Large, fertile, not pregnant, not lactating	44
Large, pregnant	15
Large, lactating	23
Small	69
Total	186

Total all pigs: 322

***

Sample of 16 litters in "past few months":

Farrowed live	79
Surviving at time of census	62 (78%)

Table 13: Some Characteristics of the Pig Population of Kapii, Meoko, and Epee Clans

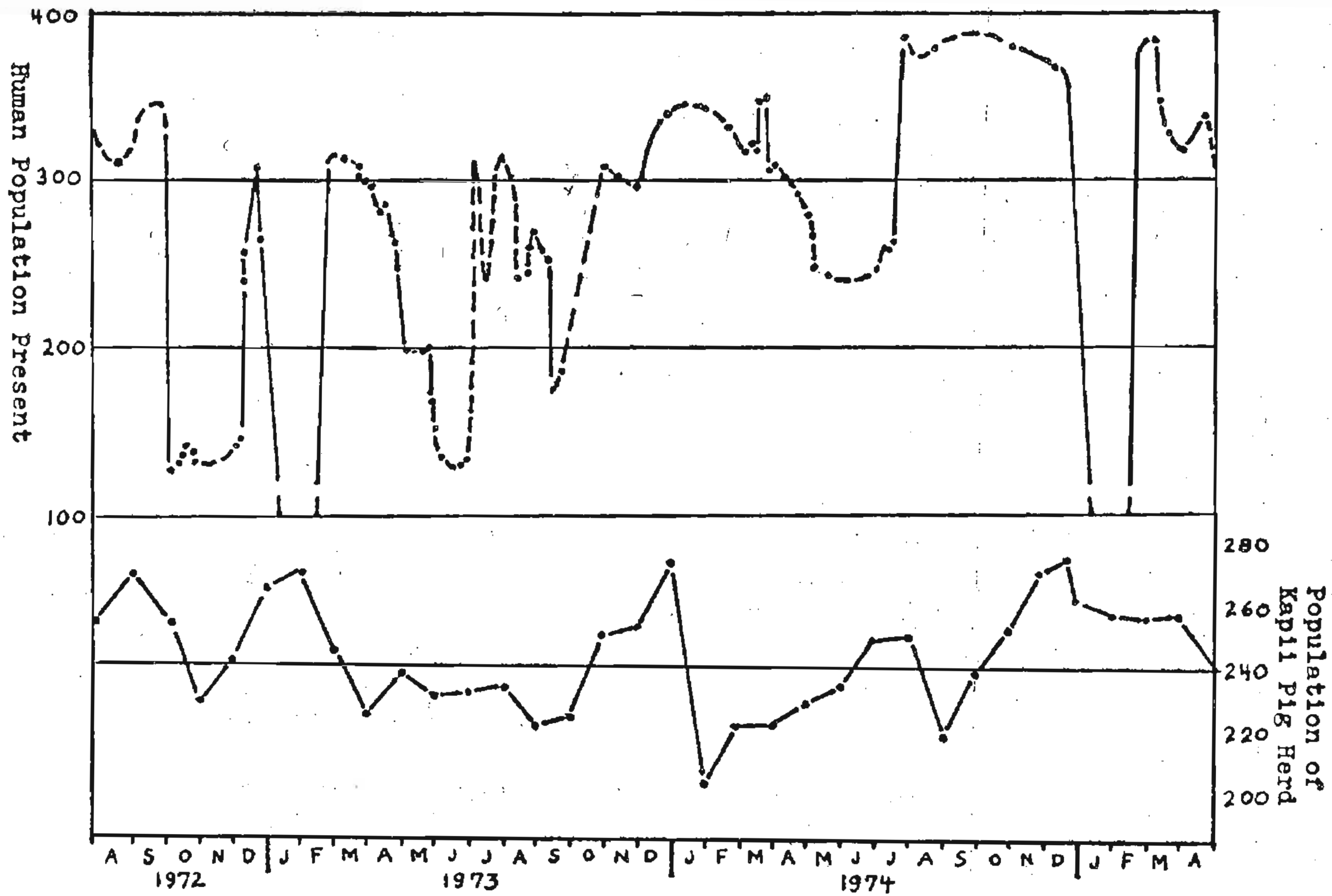


Figure 8: Population of Kapii Pig Herd

pig population is allowed to increase to a recurrent level of 270-275 followed by a flurry of pig prestations which dramatically reduces numbers. The pig:human ratio for Kapii clan thus varies from 0.52 to 0.69 and averages 0.62 over this period. The events that account for pigs entering and leaving the Kapii herd are listed by type in Table 14. This compilation does not count pigs given <u>within</u> Kapii nor those given during Kapii prestation but originating from outsiders and going to outsiders. It thus represents input and output (both by exchange and by killing) to the Kapii herd as a whole.

The most dramatic feature of this array is the loss of pigs from the Kapii herd. Since 146 pigs were eaten at Yumbisa, the net loss of pigs to the Kapii population (mainly through exchange activities) was 359.[6] This figure is likely inflated since recipients of pigs go to the place of the givers without fanfare unless the exchange is a large one. Hence, it is quite likely that I did not hear of the receipt of some pigs especially in early months of fieldwork. The figure then may be more on the order of

---

[6]Note that pigs given during the first migration account for only 4% of the loss.

Event	Number of Pigs IN	Number of Pigs OUT	Percent of Pigs IN	Percent of Pigs OUT
Laita pingi (live)	123	223	41	28
Baptism (pork)	-	37	-	5
Laitasanda[1] (pork)	?	8	?	1
Subtotal: Laita related	123	268	41	34
Brideprice (live)	73	191	24	24
Return gift (live)	36	12	12	1
Divorce (live)	3	?	1	?
Subtotal: Marriage related	112	203	37	25
Sepya (pork)	6	19	2	2
Tee pingi	52	173	17	22
Subtotal: Tee related	58	192	19	24
Migration (live)	-	35	-	4
"Business" (pork)	-	52	-	7
Sale or exchange (live)	7	10	2	1
Dispute settlement, mena yae pingi, insult and all other (mostly pork)	3	43	1	5
Unknown[2]	?	5	-	-
Subtotal: Other	10	145	3	17
Totals.	303	808	100%	100%

[1] Laitasanda category uncertain--may be obscured in other categories.

[2] Probably others unrecorded--see text.

Table 14: Pigs Leaving or Entering Kapii Herd by Event

300--still rather astounding. At least two factors partially explain this imbalance. First, during the period of observation, 27 marriages were recorded but only eight Kapii women married and only five outside of Kapii. This trend can be expected to alter since the cohort of eligible women, which was constricted during fieldwork, will be larger in the next few years and comparable in size to the male cohort (see Figure 2). Thus, a better balance can be expected in brideprice. In a similar fashion the temporal variation in receipt of _laita pingi_ and _tee pingi_ may simply be at a low ebb. I cannot say as longer observations would be required, but I heard nothing that could be construed as indicating that this was the case. On the other hand, it might be that this _is_ the normal situation, and that Yumbisa serves as a pig source for surrounding groups. Indeed the area is reputed to be a place where pigs grow well in comparison to lower elevations. Since the ideology has it that renown grows with largess in pig prestations, there may be a positive impetus to such a flow. Regional observations would be required to settle this question.

Be that as it may, the internal dynamics of pig husbandry are illuminated by the data in Figure 8 and

Table 14. To sustain the pig populations indicated in Figure 8, an average population growth rate of 6 percent per month[7] is required. The pig census of 1975 suggests that about 25 percent of the population are fertile females and four of five pigs per litter survive. This results in a farrowing interval of 17 months compared to roughly six months for U. S. pigs. It would appear on the surface that pig production at Yumbisa is not maximized. However, U. S. pigs are fed a high calorie, protein rich diet designed to maximize production. Yumbisa pigs receive supplementary feedings of sweet potatoes and a few greens during good times (on the order of two kilograms per day maximum for large pigs) and forage freely in the bush eating, at least, a lot of worms. If this diet were low in protein it could result in a poor rate of conception and/or a reabsorption of fetuses thus extending the farrowing interval. Since boars are carefully controlled, however, breeding appears more likely to occur at the discretion of the owners rather than from a nutritionally based limitation. All in all, it is suggested that pig

---

[7]This is an upper limit since some incoming pigs were probably not counted. If 52 such pigs were missed over the observation time, the growth rate drops to just over 5%.

production could be increased if desired but that cultural practices regulate the rate. If the lower population growth rate of 5 percent is more appropriate, there must be an even longer farrowing interval and greater potential for increased production. Thus pig population is controlled at a level which provides at least minimally for exchange obligations and also minimizes the attendant labor of caring for pigs.

F. Subsistence Security

Descriptive material in the preceding sections of this chapter can be drawn together by examining the overall subsistence adaptation of Kapii people. Activities that occur to generate energetic and nutritive capacity include those which are directed primarily toward production or extraction of foodstuff and those which facilitate such extraction, e.g., exchange as it relates to dispersed gardens. The former I have characterized as the subsistence subsystem or interface between the sociocultural system and its environment. It is the latter features of the system, those that facilitate subsistence security, which we seek to understand in terms of more traditional anthropological aspects of the sociocultural system. This is not to deny the importance of social and ideological parameters nor to draw a causal arrow in one direction. On the contrary, to understand the nature of that interaction is the goal. We must first evaluate the subsistence subsystem both in terms of its actual production and capacity to provide in order to gauge the importance of practices which facilitate or hinder the output.

Production and consumption of foodstuffs is a basic reference line. I have described the land resources, crops techniques and other resources in the preceding sections. The output of that gardening, gathering and pig husbandry is assayed here. Three approaches were used to generate the data. The first was a two-year record of gardening activities for all plots along a "transect" of 100 gardens (see Map 2 and Appendix 2). This revealed gardening rates, maturation/harvest times, weeding intervals, crop distributions and so forth. The second project was a count and age estimate of all garden mounts as of April 1, 1975 (plus or minus a week since it took two weeks to do it) and a sample of the crop composition of 2,780 mounds from May 1974 (see Appendix 3 for details). These counts, in conjunction with data on gardening rates and sample yield data for sweet potatoes allow for a projection of garden production over a two-year period from which a theoretical profile of domestic foodstuffs can be estimated. The third endeavor consisted of two observations of dietary intake for individuals in a small sample of households, the first at the nadir of food shortage and the last during "good times." (See Appendix 4 for method and critique.) The results are rather rough for various reasons (detailed in the appendices and indicated below) and do not allow for fine determination of nutrients in low concentrations which might be of considerable importance. However, the major outlines of the adaptation are revealed and the principal relationships to the central thesis of this dissertation can be shown to relate to gross anomalies in _local_ subsistence security.

The theoretical daily, _per capita_ availability of foodstuffs deriving from the 1975 mound count, expressed in calories, for the total resident population of Kapii clan _averaged over the nine months preceding 1 April 1975_ is displayed in Table 15, column I. (The observed consumption at the end of that period is presented in column II for comparison.) The figure is derived from a nine-month average since this corresponds to the garden production which was recorded in the total mound count of 1 April

	I. By Mound Count (Theoretical)		II. By Household Survey (Observed)	
	Per Capita Human	Per Capita Pig	Per Capita Human	Per Capita Pig
Sweet Potato	1651	2577	1183	1551[a]
Irish Potato	92	10	200	25
Taro	73	0	24	0
Pork	54[b]	0	218	0
Pandanus	45[c]	0	45	0
Chinese Cabbage	5	0	45	0
Cabbage	3	0	2	0
Sugarcane	1	0	0	0
Other Greens, Peas, Maize, Berries, Etc.	1	some[1]	25	5
TOTAL CALORIES	1925	2590	1710	1584[a]

[a] Plus indeterminate amount from grazing in abandoned gardens.

[b] Value is derived from count of total number of pigs eaten at Yumbisa in three years.

[c] Value from II used since pandanus is seasonal.

[1] Primarily sweet potato leaf and _Setaria palmaefolia_.

Table 15: Per Capita Daily Caloric Intake by Two Methods

and is a reliable count in total. To project such a figure would assume garden production to be constant which it manifestly is not given the migration cycles explained earlier. Thus during the nine months subsequent to this period the total available calories per Kapii resident per day deriving solely from sweet potatoes would vary from 800 C.[8] to 5,400 C. The figure in Table 15 of 1,651 C. comes from the observed proportional distribution, at that time, of tubers to pigs (55%) and to people (45%) and translates to 3,670 C. per Kapii resident. This proportion is said to be 50/50 (ideally) but admittedly varies with sweet potato availability. People take what they want and if any is left it goes to the pigs.

The 1975 theoretical production calculation of the gardens, then, serves as a rather rough indication of sweet potato availability. Sweet potatoes at that time comprised 88 percent by weight of the available vegetable foods. The other vegetables may have a more constant proportional occurrence. I found little evidence of seasonality in planting. There are two impressionistic exceptions.

---

[8]The low figure occurs because of the lull in planting during the 1975 pandanus season and would be mitigated by late harvest of the preceding plantings which correspond to the maximum figure.

Chinese cabbage seemed to be slightly more prevalent in the dry season and Irish potatoes showed at least one unexplained period of prolific production--both planted and volunteers. The magnitudes of these crops, on the other hand, vary with total number of mounds planted so that the <u>relative</u> proportions of nutrients which they contribute to the diet is probably a better figure. All in all, the theoretical production is only suggestive of actual consumption at any time. Reliable information in the highly variable garden situation would require more frequent repetitions of this sort of measure than were done.

The observed dietary intake suffers from grievous difficulties as well. As Appendix 4 explains, the figures in column II of Table 15 are likely to be underestimated due in part to the difficulty of monitoring eating behavior in dispersed residences where a substantial portion of the intake is consumed away from the house on unpredictable occasions. As it turned out, this survey was done as the fifth migration was getting under way. However, only two of the eight families in the sample were planning to leave and their removal from the sample does not increase the calorie figure significantly. This measure, then, fails to provide convincing data from which to evaluate consumption.

There is, however, a third alternative to determine food availability which, if it does not give precise figures, at least indicates relative fluctuations and the critical periods of major food shortage. The garden survey of the sample of 100 plots can be used to calculate the total number of mounds constructed per month after April 1973. Mound construction before that date was estimated from frequencies of "garden parties" and impressionistic observations. The resultant temporal distribution is presented in Figure 9 superimposed on Figure 7 (Kapii population present at Yumbisa). The actual mound counts of 1 April 1975 are also included to indicate the degree of disagreement. The factor for multiplying sample mounds to give total mounds derives from a "best match" between this portion of the two curves. Mound count data rely upon age estimates of the existing mounds and independent observations suggest that records of the ages of sweet potato vines are only accurate to plus or minus one month. In general, the calculated mound construction figures appear to be less sensitive to fluctuations but neither approach can be given primacy. If the time interval constraints are relaxed (i.e., if a two-month interval

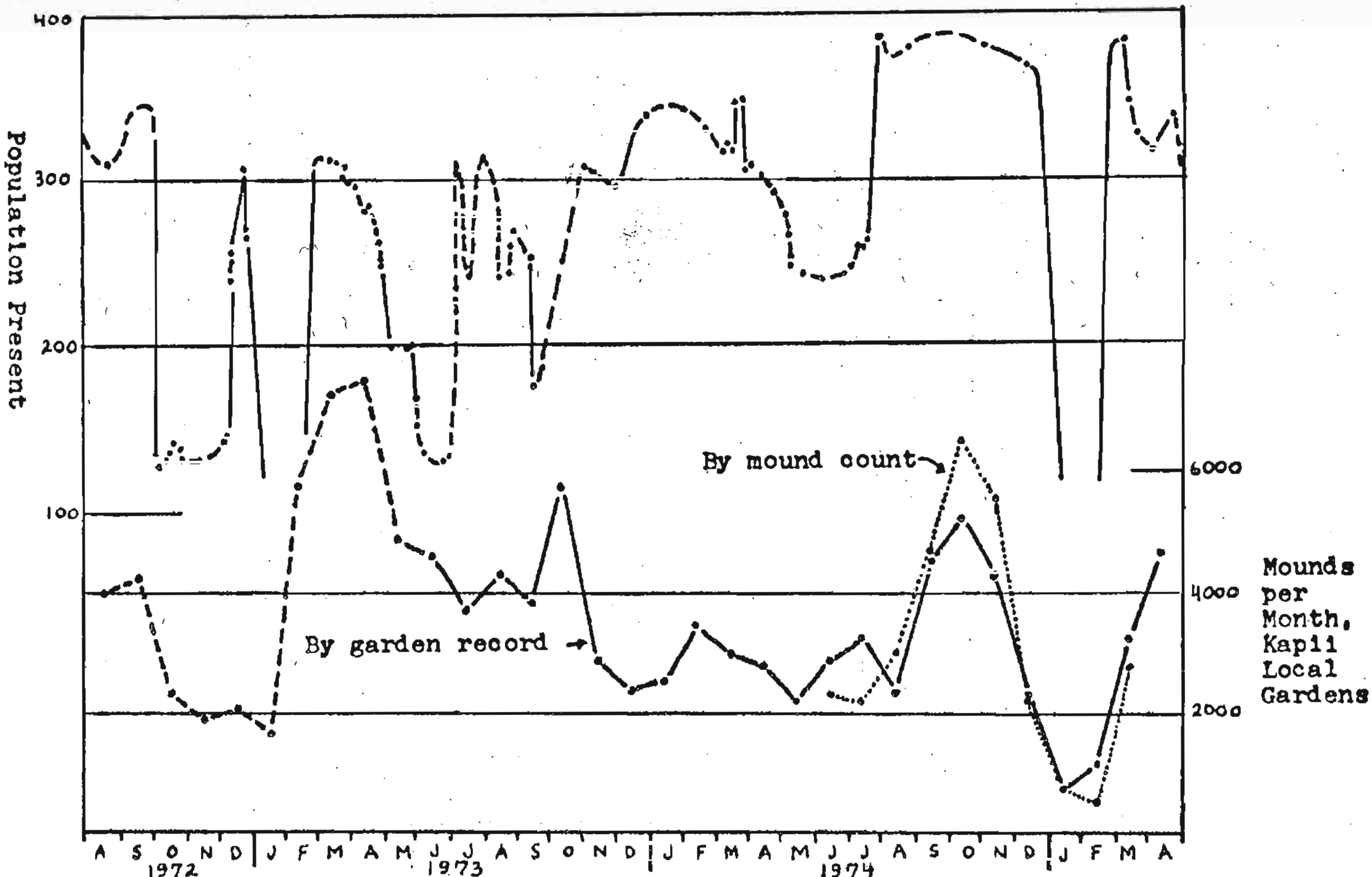


Figure 9: Mound Construction Rate, Kapii Local Gradens

is used) the correlation coefficient between the two groups increases from 0.8 to 0.9. (Appendix 2 explains the uncertainties in the survey data base.)

The next step is to articulate mound construction with sweet potato yield. Figure 10 presents the estimated yields over time indicating the sample points and sample size. Once again the values for periods between measurement are impressionistic but the absence of sweet potatoes in September-October of 1973 are based upon observations of empty or near empty mounds and lack of sweet potatoes in the houses at meal times.

By conjoining these two patterns and moving the results forward in time by the average maturation period of the sweet potato, a graph can be constructed which represents the available quantities of sweet potatoes per Kapii resident (Figure 11). Recall that some families who stayed at Yumbisa and received relief re-established their garden production more rapidly than those who used the cyclical migration option. Such families would presumably have had sweet potatoes in amounts above that indicated in Figure 11 while the "cyclical" migrants would be more likely to have lesser quantities available at the points of migration. Prior to January of 1974, sweet

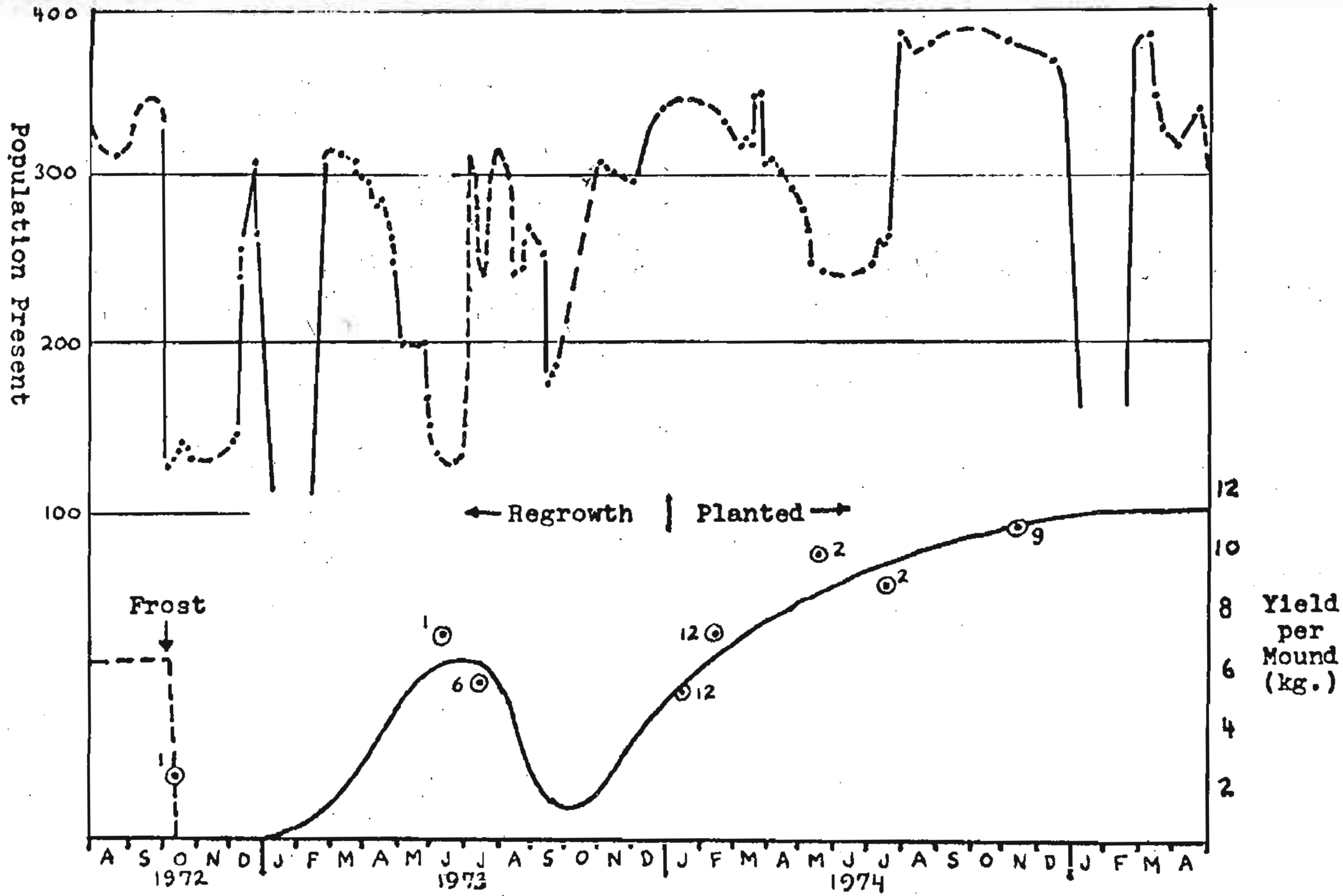


Figure 10: Sweet Potato Yield per Mound

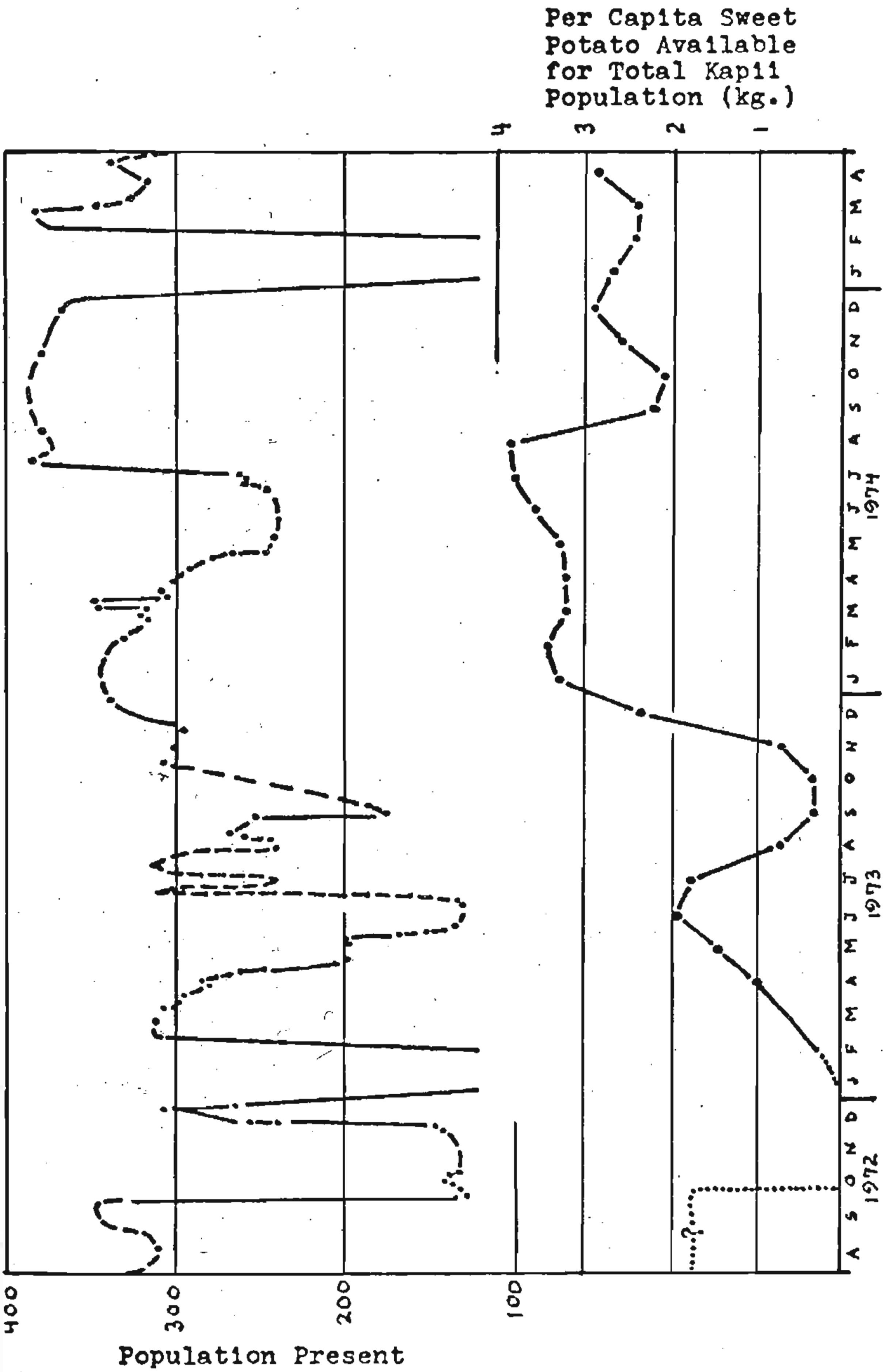


Figure 11: Sweet Potato Availability

potatoes were in decidedly short supply. The household intake survey at the time of the 1973 <u>nia</u> shortage suggests only a few hundred calories daily per capita intake from sweet potatoes. After that time a fluctuating balance is struck at around 2.7 kg. (4,050 C.) per capita per day as more and more families drop out of the migration pattern. It is possible to cover a two-month shortage by extending or retarding harvest intervals, <u>if production is good on either side of the period</u>. This strategy is apparent in Figure 9 where mound construction both before and after the 1975 pandanus season is very high.

The fourth and successive migrations, then, are not solely responses to food shortage at Yumbisa. Other factors not directly related to subsistence are involved such as the desire to utilize already established dispersed gardens. There are at least three reasons to do so. First, using the garden implies intent to keep it and not to use it means someone else would, which weakens the claim. Second, it allows an opportunity to visit relatives. Last, but not least, the second, fourth and fifth migrations correspond with the onset of the dry season which is the traditional time for increased social interaction. This occurs in the form of large dances that continue sporadically for months and bring together people from all over the region. Hence, these migrations must be recognized to have a component which is not directly related to subsistence.

The place of pigs in this adaptation is obviously important to the maintenance of network ties. Yet one might expect the pig herd to be a burden in times of food shortage. Such appears not to be the case. Controlled breeding to minimize pigs on hand (suggested in Section E) may be the key. Referring to Figure 12, which includes the population of pigs owned by Kapii residents, it is apparent that the population was not decimated by slaughter after the frost. Most pigs migrated with the family and 35 were given to hosts, but about 20 percent remained behind with the families who did not migrate. These pigs and those of nonmigrants showed no evidence of suffering from lack of sweet potatoes that I could ascertain. An important factor here is the post frost pandanus season which pigs attend too, during which they were visibly thriving. On the other hand, the stories related about the 1941 frost suggest that unascertainable numbers were slaughtered. It is possible that such a response was the functional equivalent of the government relief in 1972

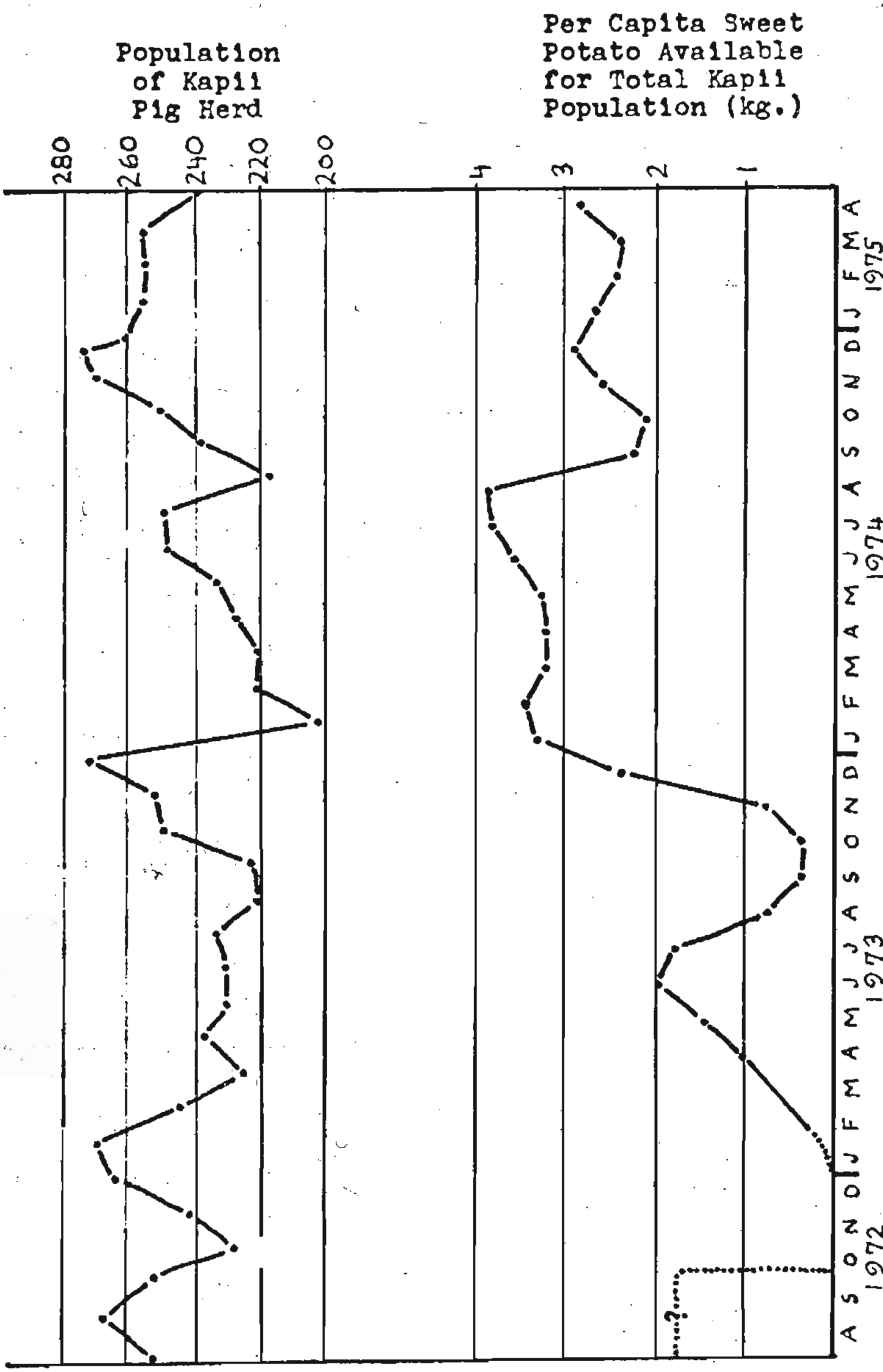


Figure 12: Sweet Potato Availability and Population of Pig Herd

which allowed people to handle transient difficulties associated with migration. The stories also claim that some 46 Kapii people died after that frost. The bulk of them were members of one subclan and were said to have been afraid to migrate for fear of being killed by a group they were fighting with just before the frost. At any rate, the slaughter of pigs and reliance on bush resources appears not to have been a viable option (except for the two men who did survive in this fashion). The reports are unclear since few witnessed it and survived. Even if fairly large numbers of pigs are lost, herd size can be rapidly increased by breeding management as Section E suggests.

There is a second aspect of the pig population fluctuation which is rather interesting. Excepting 1972, each rise in clan pig herd size corresponds with a period of increase in sweet potato availability. To put it another way, whenever garden production drops or is about to drop, large numbers of pigs are given in exchanges.[9]

---

[9]This pattern of rising pig populations followed by a flurry of exchanges is possibly a precursor of exchange systems such as the great _tee_ of Central Enga or similar systems. Any factor which tended to result in exchanges being clustered in time (migration cycles in this case) might contribute to the formalization of coordinating individual payments into larger corporate prestation.

A second variable plausibly affects this pattern strongly. A significantly large portion of the clan population must be in residence for the exchanges to take place. This factor thus "predicts" pig exchanges in early 1973 and the preceding population increase would have to be ascribed to sweet potato availability in the host locale of migrants. It makes eminent sense and strongly suggests that pig population is carefully controlled by the owners who also have a discerning perception of fluctuation in their resources. Having too many pigs can be disadvantageous especially in terms of predation on neighbor's or one's own gardens. The alternative is added labor in fence mending and caring for the pigs. It is also quite possible that having lots of pigs in evidence leads to premature demands for them.

To return to garden subsistence security, the period between October 1972 and January 1974 was clearly the critical interval during which local Kapii resources were insufficient to provide for the total population. Beyond that period some families still came up short in local resources due to their chosen coping strategy while others still pursued the migration response even though they could have remained at Yumbisa if required to. It is, however, the earlier period that serves as a dramatic social instance which illustrates adaptation and option. The individual actors each evaluated his/her various possibilities in the face of an inescapable environmental feature--frost. Their possibilities revolved around acquisition of food by utilizing their particular social articulations. The output of these individual decisions and subsequent actions constituted the broad outlines developed in this section. There was a clearcut environmental variable that had to be dealt with by the people living at Yumbisa. What they did do tells us much about the adaptive advantage of the _way_ they did other things. This chapter thus concludes with a section examining the relationship between subsisting in that environment and other behavior which facilitates coping with the frost.

G. Adaptation and Option

At the end of Chapter II, the social relationships that allow for immediate frost migration to low frost risk areas were examined. In Section D above, the manner in which subsequent migrations relied more on the dispersed garden system was described. I now examine the social component of those outlying gardens. The relationships through which Kapii family heads maintain their dispersed gardens are laid out in Table 16 and stratified by frost risk category. (The distribution among frost categories fairly reflects the number of families with access to each area.) Kapii local gardens are not considered here, but the Kapii gardens (at Kiteli/Bipi) in category II are, as noted, an important resource.

The nonlocal gardens inherited from non-Kapii fathers (i.e. those held by Kapii nonagnates) are evenly distributed through the categories. This relationship is the most significant one for access to category III gardens and these gardens in turn provide a small but valuable nucleus which may support other clansmen in time of need. These gardens, like all others, may be inherited by descendants of each cultivator. Recall the situation described at the end of Chapter II where Meoko clansmen had not kept up their mutual aid obligations with agnates who became their hosts. Similarly here, it is possible to lose the usufruct rights to these gardens but it is rather more difficult to do so. Still, if a generation passes without significant support in exchange and without cultivation, the link will be lost (although it could be

Relationships (Land Comes from Ego's...)	Number of Relationships Activated in Each Frost Risk Category: I	II	III	Totals
Kapii corporate group	all 40 families have Kapii local gardens	20	0	20 (excluding Kapii local)
Non-Kapii father	5	6	5	16
Wife's corporate group	12	2	0	14
Mother's corporate group	9	1	2	12
WiFaMo	1	0	0	1
DaHu	1	0	0	1
WiMo (?)	0	1	0	1
MoSiHu or Sn (?)	0	1	1	2
FaWi (?)	0	1	0	1
No data	2	1	0	3
Totals	30 (excluding Kapii local)	33	8	71 relationships for 40 families

I: Frost risk equivalent to Yumbisa local clan gardens.

II: Frost risk significantly lower than at Yumbisa (yield may be higher and maturation times shorter).

III: Frost risk minimal (yields likely higher and maturation periods shorter).

<u>NOTE</u>: For all corporate groups, the focal individual who gives the landgrant may not be a proper agnate of that group but he is a proper (resident) member of the group.

Table 16: Relationships by which Kapii Family Heads Maintain Dispersed Gardens (by Frost Risk Category)

reactivated by descendants).

The relationships which derive from wife's and mother's corporate groups are intimately associated with death compensation obligations. Ego gives _laita_ _pingi_ to these relatives. Although a few ties result in gardens in categories II and III, the bulk of these grants are in category I and thus of minimal use for frost migration. As noted earlier, such gardens are useful to counter the effects of minor local frost damage. The connections through wives are created with each marriage and when inherited become links through mothers. There is a low attrition rate--the "mother" category being nearly as large as the "wife" category. Note however that the next inheritance which would likely appear as "father's mother's corporate group" has no representatives (with the exception of the wife's father's mother version. There are at least three possible explanations for this. First, the affinal component of the dispersed garden system may be a recent development (though clearly predating contact). This possibility is considered in Chapter IV. Second, _laita_ obligations to father's mother's (and mother's mother's) people are less frequently honored in practice and need be less heavily compensated in principle. Perhaps extra pigs that might serve to secure such claims are simply not worth the return after the two preceding generations in which primary <u>laita</u> obligations should be met regardless. Third, these gardens may lose their fertility as explained later.

To understand the direct affinal ties better, one must evaluate possibilities that <u>do not occur</u>. Table 17 stratifies the number of current marriages according to the regional source of the bride and the number of such relationships which have resulted in grants of usufruct garden rights for Kapii agnates and nonagnates.

First note that there is no great difference between agnates and nonagnates in Table 17. Second, 20-25 percent of the potential direct affinal links result in category I gardens but only 7-8 percent in the more valuable (for frost retreat) category II areas. The eleven family heads that account for the twelve relationships which yield gardens in category I, through direct affinal links, are notably short of slope land at Yumbisa. Although their valley holdings exceed the average significantly (1.41 ha. vs. 1.04 ha. for all of Kapii), nine of the eleven men have no slope gardens at Yumbisa (82% compared to 38 percent for all of Kapii). The areas in which

Frost Risk Category	Number of Brides from Each Category[1]		Number of such Relationships Resulting in Dispersed Gardens		Percent of Possible (Direct) Grants Actually Made	
	Married to Agnates	Married to Nonagnates	Married to Agnates	Married to Nonagnates	Married to Agnates	Married to Nonagnates
I[2]	24	29	6	6	25	21
II	13	15	1	1	8	7
III	4	1	0	0	0	0
IV	0	1	0	0	-	0

[1] Excludes divorces, includes women (married to living men) who have died but bore children.

[2] Excludes marriages and land grants within Kapii local territory (30 brides).

Table 17: Source of Brides and Land Grants for Agnates/Nonagnates (by Frost Risk Category)

they acquire dispersed gardens are predominantly slope sites.[10] Whether or not this is an intentional response, it clearly serves to provide slope gardens which buffer frost and overly wet periods.

It would appear that there is not a strong pressure to acquire dispersed gardens in category II or III through direct affinal links despite a high potential for doing so. In a similar way, ties to mother's corporate group are not emphasized in categories II or III either and remaining relationships fall mainly into categories I and II. The more distant a dispersed garden is, the more valuable it is for frost retreat. It is, however, more disruptive to local gardening to use it and requires the careful management of relationships with representatives of the corporate group making the grant. These relationships are secure where mutual aid or exchange occurs through nonfrost related interaction. People at Yumbisa are utilizing only a small part of their full potential in terms of acquiring dispersed gardens in lower frost risk areas. Moreover, the actual ties fluctuate through

---

[10]There are two possible exceptions where I do not know the exact location of the gardens--one of which is likely to be on the slope.

time as new marriages are contracted, garden usufruct rights are inherited and then relinquished. It is significant that this low "level of investment" can provide for a large portion of the resident Yumbisa population if need be and that it is very elastic to expansion. To see how this is achieved we must examine the distribution of dispersed gardens in terms of the population that can be supported by them.

Tables 18 and 19 show the average land resources of Kapii married men both locally and in the dispersed garden system. Table 20 indicates the estimated total area[11] of nonlocal gardens by social category and the number of families supportable on those holdings. Nonagnates are stratified in Table 18 and 20 according to how many generations the current holdings have been cultivated since incorporation occurred. Thus "GØ" indicates an individual who himself joined the group while "G2" indicates that the current cultivator's father's father was a migrant to Kapii. In Chapter IV the dynamics of incorporation will be examined. Here let me only say that the differences in

---

[11]Areas of the 196 nonlocal gardens are estimated by mound counts in 34 Kiteli/Bipi gardens and observations of a similar number in various locations.

Social Category	Number of Families	Mean Area of Valley Gardens (ha.)	Mean Area of Slope Gardens (ha.)	Mean Estimated Area of Dispersed Gardens by Frost Risk Category (ha.)		
				I	II	III
GØ	9	.48	.42	.44	.08	.01
G1	10	1.34	.15	.18	.16	.14
G2	4	.70	.28	.06	.27	.12
All	23	.89	.28	.26	.15	.09

Table 18: Land Resources (Cleared) of Kapii Nonagnates by Garden Location

Social Category	Number of Families	Mean Area of Valley Gardens (ha.)	Mean Area of Slope Gardens (ha.)	Mean Estimated Area of Dispersed Gardens by Frost Risk Category (ha.)		
				I	II	III
Non-Agnates	23	.89	.28	.26	.15	.09
Agnates	18	1.52	.57	.25	.37	.04
Subtotal: With Dispersed Gardens	41	1.16	.41	.25	.24	.07
All Others With No Dispersed Gardens	35	.86	.87	0	0	0
TOTAL: All Families	76	1.02	.62	.13	.13	.04

Table 19: Land Resources (Cleared) of Kapii Families by Social Category and Garden Location

Social Category	Estimated Total Area per Category			Number of Families at 0.34 ha./Family		Number of Families in II and III as Percent of Social Category
	I	II	III	I, II and III	II and III	
GØ	3.96	.72	.12	14.1	2.5	28
G1	1.80	1.56	1.44	14.1	8.8	88
G2	.24	1.08	.48	5.3	4.6	115
Non-agnates	6.00	3.36	2.04	33.5	15.9	69
Agnates	4.44	6.69	.72	34.6	21.5	119
Both	10.44	9.96	2.76	68.1	37.4	91
Percent of Kapii Population Supportable	40%	39%	11%	90%	49%	

Table 20: Areas of Dispersed Gardens and Theoretical Number of Families Supportable

local valley garden resources for nonagnates of various generational depth varies with the rate of incorporation of outsiders and land availability. When the rate was high and land was plentiful, migrants received larger grants and less slope. Subsequent acquisitions were dissipated through inheritance.

The significance of these areas can be appreciated in the following way. Using yields and production rates from early 1975, an average family of 5.23 individuals require 0.34 ha. of valley garden continuously in cultivation The GØ nonagnates with a mean of 0.48 ha. (Table 18) are clearly pressing the limit. Their additional 0.44 ha. in category I areas allow them some fallow time.

Category I gardens, then, serve as an extension of local resources and relax the continuous cultivation requirements allowing GØ nonagnates an average cultivation factor[12] of 2.7 without using local slope gardens. All slope gardens belonging to families in this category are utilized. If slope gardens were comparable in productivity to valley gardens (which they are not), the GØ nonagnates

---

[12]Cultivation factor (C) is (Fallow Period + Cultivation Period) ÷ Cultivation Period.

would maximally achieve a combined cultivation factor on local land plus category I land of 3.9. This compares with a figure of 6.9 for agnates (with the same conditions applying). These considerations are based on averages for the social categories and imply some families are degrading their gardens more rapidly than others. Families desperately short of land are invariably part of a multi-family household. As a result of the shortage in local land, GØ nonagnates have the highest proportion of their land in dispersed gardens (37%) and most of it is in category I areas.

G1 nonagnates (Table 18) have adequate local resources of valley land but lack slope. Thus their category I holdings are fairly high and serve to buffer localized frost. They have also acquired or retained significant garden areas in low frost risk categories. G2 nonagnates are short of local slope and category I gardens and thus have the lowest cultivation factor, but they make up for it in category II. Such a situation would suggest that these category II gardens would be kept in production more continuously and as a result the family would be obliged to move frequently to cultivate and harvest them. This is the observed case. The four G2 families made on the average 5.5 such moves during the post frost period while the overall average was 3.8. One family in whole or in part, made nine trips in two and a half years requiring an overnight stop on the way. The G2 nonagnates thereby achieve a cultivation factor of 3.9.

Nonagnates as a group have significantly less local land than agnates (Table 19). Both are comparable in category I, but agnates, due to their advantage in Kiteli/Bipi clan land, have larger holdings in category II. Kapii nonagnates have a small edge in category III since several retain land from their own agnates. Finally, families with dispersed gardens of any sort have, on the average, larger valley holdings than those without but are somewhat short of slope. Their category I holdings fill this gap.

It remains to estimate the population that could be supported by the nonlocal garden system. If one continues to assume that 0.34 ha. of land will support an average family as it does at Yumbisa, an estimate of the maximum population that the dispersed garden system could support can be made. The figure of 0.34 ha. is a conservative estimate allowing large quantities of sweet potatoes for pigs. If total food production is higher at lower elevations, it is even more conservative. On the other hand, the frequency of frost results in repeated usage of gardens. Fallow may not be adequate, especially since many gardens are on the slope. This is supported by the earlier observation that dispersed gardens deriving from nonagnatic ties rarely last more than two generations. More fertile gardens must be constantly acquired. With those cautions in mind, one may turn to Table 20 which shows the theoretical maximum number of families that could be supported for fairly long periods in various categories of dispersed gardens. Thus 40 percent of the Kapii resident population could be supported on category I land and about 50 percent in categories II and III. The latter is, of course, the post-frost migration retreat area. Only agnates and G2 nonagnates can support more than their own numbers on their categories II and III gardens and, as a whole, individuals with dispersed gardens cannot quite support their full population. As a result, even if categories II and III dispersed gardens were maintained in constant readiness, families without such would be obliged to find hosts in the event of a serious frost at Yumbisa.

Observations of actual practice in the post-frost migration cycles demonstrate that the dispersed garden resources in categories II and III can support a much larger population than indicated in Table 20, at least for short-term migrations such as occurred during fieldwork. The twenty families who utilized their gardens at Kiteli/Bipi in post-frost migrations brought with them eleven other Kapii families. The garden area there (not all of which was in production) is about 6 ha. or less than 0.19 ha. per family. Using this figure and assuming the Kiteli/Bipi gardens to be typical of all categories II and III gardens, Table 21 results.

The strategy of hosting members of one's own corporate group has the effect of using for human consumption the sweet potatoes (or part thereof) ordinarily given to pigs. Since pig pasturage in some dispersed garden areas such as Kiteli/Bipi is scarcer than at Yumbisa, one way to mitigate that situation is to leave some pigs behind as is commonly done. Another possibility is to make exchange compensation to relatives in the area of migration. Since the kinsmen who accompany migrants are usually important helpers in exchange, one might amass sufficient pigs to make compensation.

	Number of Families	Number of Families Supportable in Categories II and III	Percent of Population in Social Group Supportable in Categories II and III	Population Supportable as Percent of Total Kapii Population	Percent of Population Supportable over Own Needs
Nonagnates	23	28.4	123	37	7
Agnates	18	38.5	214	51	27
Total Families with Dispersed Gardens	41	66.9	163	88	34
Families without Dispersed Gardens	35	0	0	0	-46
All Kapii Families	76	66.9	88	88	-12

Table 21: Number of Families Supportable on Category II and III Gardens (from Observed Data)

Alternatively one can reduce the pig "burden" by directly aiding relatives in their exchange. Likely candidates are corporate group representatives who granted cultivation rights for the dispersed gardens in use. The resemblance to pig "payments" for first migration gardens is striking. I cannot evaluate these possibilities in detail but all did occur. Table 21 also indicates the percent of Kapii families each social category can support beyond those who actually have cultivation rights. Agnates clearly account for the largest support to families without dispersed gardens. They support 27 percent of the population, 20.5 families, in addition to themselves. Overall, then, it appears that 88 percent of the population could maximally be supported for short-term migration if all dispersed gardens in categories II and III were in cultivation. Since they frequently are not, the host option must be used.

These results can be compared to an independent estimate made by a government agricultural officer for groups in the upper Lagaipa watershed for the 1971 frost (Scouller 1971). His observations led him to estimate that two-thirds of those populations could migrate. Over half of the remainder could survive on local resources therefore only 13 percent required relief. My early inquiries at Yumbisa yielded a similar figure of 14 percent. However, data from the full three years of fieldwork plus reported migrations for the 1971 frost at Yumbisa indicate that only thirteen <u>individuals</u> never migrated to hosts or dispersed gardens over that four-year period. About half of these were old and unable to make such a journey easily. It would appear that where frost is more common and more severe, coping mechanisms are more adequate.

Subsistence security at Yumbisa itself is achieved in a manner similar to such horticultural groups at lower elevations. But at Yumbisa, people have the added burden of coping with recurrent frosts. Their adaptation as a whole is one of utilizing various options as individuals. Not putting all of one's sweet potatoes in the same garden is clearly a central strategy.

On the individual level the possibilities are several. If one is short of land he may seek to acquire more by grants from relatives in or out of the local group. This is often achieved by obtaining gardens in category I. If one acquires gardens elsewhere, there is the disadvantage of frequent migration. Nonlocal gardens, however, provide the advantage of being prepared for locally severe to widespread frost depending on the location of the gardens. If one is short of slope land at Yumbisa, he loses the advantage of having some gardens escape spotty local frosts. The distribution of valley gardens even within Kapii local territory can confer a slight advantage in this regard. An extra category I garden can do the same and doubly so if it is on the slope. If one has no local ties, a more distant grant yields different options as above. If one is short of valley land, a category I grant can help. If one is not short of any local land, he still benefits from more distant dispersed gardens for frost migration. If one has plots of all types, he has several options. (Only one such family exists.) If one has no dispersed gardens, he still has "brothers" who do, with whom he can migrate. Last, but not least, if one has a relative with whom he has maintained good relationships or (at least) rectifiable relationships, he can migrate to that host or accompany a kinsman to his host.

Three notable social features are central to these possibilities. First, the exchange activities at Yumbisa are amenable to either acquiring dispersed gardens or finding hosts. Second, the prominent role of bigmen in exchange should result in a large number of dispersed gardens beyond their immediate needs. An average bigman can support 2.3 families on his categories II and III gardens while the overall mean is 0.9 families. The "surplus" nonlocal gardens of the ten bigmen would support 17 percent of the population at 0.19 ha. per family. The remaining 30 families with nonlocal gardens support another 17 percent in a similar fashion. Third, the corporate group ideology of segment solidarity encourages a migrant to host his fellow clansman or take the latter along to his own host. Both exchange activities and clan solidarity are basically similar to those of communities at lower elevations, but at Yumbisa they are also used to buttress the adaptation to frost.

This completes the examination of current subsistence related behavior. I have emphasized the dispersed garden system because it is crucial to the peoples' current adaptation to their environment. However, it fails to meet requirements for all families at all times because even those families who have gardens do not always maintain them in cultivation. Hence, the hosting option is equally critical. Both are contingent upon cultivation, maintenance or re-establishment of interpersonal kinship ties. It should be noted that nonagnates, who might be expected to have more ties because of their origins outside of Yumbisa, do not provide significant "surplus" land which their new kinsmen use (Table 21). They do have more category III gardens but overall they provide only for themselves during post-frost retreats. And they are decidedly short of land in comparison to agnates.

I may now return to the principal line of inquiry and examine the dynamics of group composition at Yumbisa. The adaptation described here must of necessity be part of these deliberations if we are to consider "pressure on land" in a meaningful way.

ECOLOGY, AGRICULTURE AND SOCIAL ORGANIZATION:

THE DYNAMICS OF GROUP COMPOSITION

IN THE HIGHLANDS OF PAPUA NEW GUINEA

A THESIS

SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL

OF THE UNIVERSITY OF MINNESOTA

By

Paul Brandin Wohlt

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

August 1978

CHAPTER IV

THE DYNAMICS OF GROUP COMPOSITION

A. Forest Clearing and Population Growth

In this chapter, I am concerned primarily with a reconstruction and analysis of the local agricultural system and its social components, in terms of group composition, since the area was pioneered. The basic data derive from three interrelated observations. First, the spatial referent is a complete map of all Kapii garden land on local territory (Map 2). The area was mapped with handheld compass and tape augmented by air photographs (see Appendix 5 for details). This resulted in the delineation of all garden plots by current ownership boundaries and/or forest clearance boundaries. Second, the social referent is a composite genealogy of Kapii clan. Genealogies were elicited which tie living residents and nonresident cultivators to all known but deceased cultivators. (See Appendix 6 for the composite genealogy of Kapii clan and methodological considerations.) Third, conjoining these two basic referents is a record of the clearance of each plot (who cleared it and his place in the genealogy) and all subsequent recalled inheritances and usufruct grants down to the present (see Appendix 6).

On the basis of these data, two reconstructions through time can be made: histories of forest clearing and population. The first yields a measure of area of cultivable land and the second a population estimate so that density on cleared land can be calculated. This, in turn, can be compared to the group composition at any point in time (Section B).

I must begin with the genealogy since it is the only one of the three data bases which offers the possibility of a reasonably accurate chronology. Kapii, the purported original pioneer, is from four to six generations before current married individuals. Some of these descent lines are purely agnatic and others include up to three female links. As noted earlier, current marriage practices are such that men marry around the age of 25 and women around 18. Men may father children until about 55 and women cease to bear children before 43 (to judge from a limited number of observations). As a result, a simple generational collation would not be a very sensitive time measure.

The alternative is to estimate the ages of all individuals now living and project ages back to Kapii. This was done using the marriage ages indicated above and assuming a birth spacing of four years when no recalled information suggested otherwise. By this estimate, Kapii would have had to father children for 41 years (until he was 66) which is beyond any observed case (maximum of 53). Kapii's first son, Yurimi, would have had to father children for 55 years, Kepa for 37 and Pao for 33. These individuals are the first rank of the standard litany of ancestors which symbolize group relationships.

It is likely then that the actual pioneers of the valley were several families whose names have been lost and that they are simply lumped by corporate group membership. The distribution of estimated birth dates of their named descendants has some prominent gaps (12 to 23 years) which could mean multiple generations lumped together and/or multiple families. For purposes of completing the picture and estimating initial settlement time, my "best guess" has Yurimi represented as two generations; Kepa and Pao as two families each. When this view is taken several anomalies in the cultivation record are resolved. Prominent individuals who previously had no recorded clearance activity can be assigned areas which fit the ensuing patterns. The areal distributions then also reflect certain lineage associations and three previously meaningless land boundaries make sense.

Not all of the people recorded in the genealogies lived at Yumbisa, according to the cultivation history. The settlement probably occurred as people used the area first as a pandanus source, then a dispersed garden site, then permanent residence. The actual relationships of the founding families may not be well preserved. They may not have been proper agnates in the ancestral group. Nonetheless, the assumption is made that names in the first generation after the subclan founder all refer to real people who were agnates, unless other information was given. The situation before 1840 is thus uncertain and the analysis presented here relies on subsequent periods.

It has been long established that genealogies are not necessarily records of what has been but of what descendants want the case to have been. In recent years, oral historians have begun to sort out the circumstances under which such alterations occur. As Kuschel and Monberg (1977) point out, nonpolitical stories (i.e., those not concerned with "charters" for existing order) are least likely to be altered and may preserve remarkable detail for a hundred years. Such a time depth covers the major portion of the period under consideration here. However, the "political" importance of Kapii genealogies may have varied with land pressure and group membership criteria. This is, of course, the major area of investigation in this thesis. A consideration must then be made of what sorts of information are most likely to be accurately transmitted.

There is indirect evidence to support the veracity of Kapii claims below subclan founders. To begin with, Yumbisa informants were rarely reluctant to admit their ignorance or to refer me to a more knowledgeable person. They were not unwilling to admit that an antecedent was a woman rather than a man. Conversion to agnates seems thus unlikely. With the exception of two cases, which were subsequently resolved, no one seemed to be attempting to deceive me. There was, moreover, considerable agreement, as is evident in the genealogies (Appendix 6). Unintended error is not thereby ruled out. But, like their Huli neighbors (Glasse 1968), the people of Yumbisa are very interested in recalling all ties at whatever generation removed because they may be used to establish network links with surrounding individuals. It is thus to one's advantage to recall the details of genealogy to expand one's potential claims. If anything, one may attempt to add relationships. This, indeed, may be the impetus for the "dual agnatic descent" phenomenon mentioned earlier. Certain individuals might reduce obligations by deleting relatives, but it would be difficult to do so without a concerted group effort in cases where the relative had cultivated land at Yumbisa. Claims to land, pandanus and pigs given in exchange all rest on these recollections _and_ community recognition of them.

Although I do not think the genealogical record I elicited is correct in every instance, it would seem that it fairly replicates the historical case as local men see it. Systematic errors are likely to be of two types. First, the unintentional alteration of females of ascending generations to males may occur. If an ancestor's name is not sex specific, and there is no other information, the ideal model of agnation implies that the ancestor is male. I judge these errors to be rare unless they fall into the second type. That is, individuals who did not leave descendants, did not clear land or did not die in warfare may well have been lost from memory. This removes any individuals in the more remote ascending generations of the genealogy who died as children. Women who married outsiders with whom relationships were not maintained also fall into this type of omission. The individuals who are most likely to be fairly represented are those who cleared land at Yumbisa, cultivated land and/or left descendants there. It is just these individuals with whom I am concerned.

Having estimated ages of all pertinent individuals, a further assumption needs to be made. Current practices and recall information from living men suggest that the precontact practice of forest clearance was as follows. At about age 18 or earlier, a young man helped his male relatives to clear new gardens. Before marriage he commonly cleared the first of his own gardens. For the next twenty or more years, precontact men cleared land more or less continually. Large trees were ringed and allowed to die long before felling. With a stone axe this was lengthy work, but the constant demand for firewood may have led to the thinning of peripheral areas before garden preparations. This partial clearing is more likely to have been a significant factor in recent years when population was high and forest clearing less. The last stage was to clear the smaller trees, burn the brush and dig out all but the largest stumps which persisted for some time, but were ultimately removed.

The process of clearing the present garden area, even when spread over 170 years, represents a huge labor investment when working with stone axes. Living older men are quick to point out that, although the steel axe is a much more efficient tool, young men of the present do not help their elders as they should and used to. They attribute a component of poor garden yield to the decline in forest clearing. In the past, forest clearing was an activity which occupied all men, especially young men, a good portion of the time. As a man neared fifty, land was cleared in his name though the main labor came from his sons, his daughters' suitors or spouses and other non-agnates or group members who were tied to him because of his status as a bigman. The clearers had a claim on the cleared land, though not a certain one, and may have inherited it soon thereafter. As a result, the clearing of land said to have been done by a man was fairly evenly distributed over the years between his twentieth and fifty-fifth birthdays (beyond for bigmen). This fits with the information from a few living older men whose life histories I was able to gather with reasonable accuracy and is assumed to be the pattern in this reconstruction when no other information was given.

With the names, ages and time span of clearing for each individual, the clearance history can be superimposed on the map. Where a man cleared many gardens and no information was available as to the sequence of clearing, I ordered them from the periphery of the already cleared area outward which corresponds with the pattern revealed elsewhere. Thus, some gardens are likely to be temporally incorrect to varying degrees, but the overall pattern would seem to be reasonably accurate. By the above reconstruction, then, Kapii cleared part of Yumbisa hill between 1806 and 1832. His sons then cleared the remainder of the hill and worked eastward along the valley edge. Subsequent clearing expanded from several points into the valley until recent times when it occurs mainly on the slope (see Map 3).

The next step of this analysis requires an estimate of the number of resident cultivators for any time segment. This relies on the record of clearance, inheritance and land grants. Any married male (age 25 to 60) who had garden land from those sources was assumed to represent a family at any particular time unless he was reported to have been a nonresident cultivator, or the amount of land was too small to support residence (in which case he was classified as a nonresident cultivator). Ego is always male as the husbands of female clan members are used as the referent person. To get overall population estimates, these figures were simply multiplied by an average family size of 5.69. (This is somewhat larger than the current average since it counts only cultivators between age 25 and 60.)

Current marriages result in 3.2 children per family surviving at all ages. The genealogy of remembered individuals who are deceased yields 2.6 children per family. Family size diminishes as one proceeds to analyze the more remote ascending generations but one would expect this as some individuals of the more distant past are forgotten. Daughters who married out are poorly represented in the older generations unless they resided locally or one of their descendants did so. I know of no good reason to suppose that family size differed significantly in the past but I cannot demonstrate that it did not. However, informants insisted that the number of bigmen in the past was smaller. If that were the case, the average number of wives per man might also be smaller. From genealogies, marriages contracted by Kapii men born from 1831 to 1920 average 1.4 with a sharp decline between 1861 and 1880, before which only Kapii is recorded to have more than one wife. The men born between 1921 and 1940 averaged 1.7 marriages and this rate is steady from 1881 to 1940. The mean of wives ever for all living men for all marriages (including divorces etc.) is 1.85. However, the mean number of <u>current unions</u> is 1.3. Since divorced childless or shortlived women are likely forgotten, it would appear that a dramatic difference in family size deriving from changes in the number of wives per man is unlikely.

The gathering and reduction of these data required considerable time but the overall results can be presented simply. The clearance history is graphically displayed in Map 3 which codes areas cleared during twenty year intervals. A graph for the same intervals is shown in Figure 13 which stratifies for slope and valley land. Clearing purportedly began on the slopes and slowly increased in area per period, then peaked sharply around 1940 and declined. Valley clearing started later but increased more rapidly, reached a maximum about the same time, then declined.

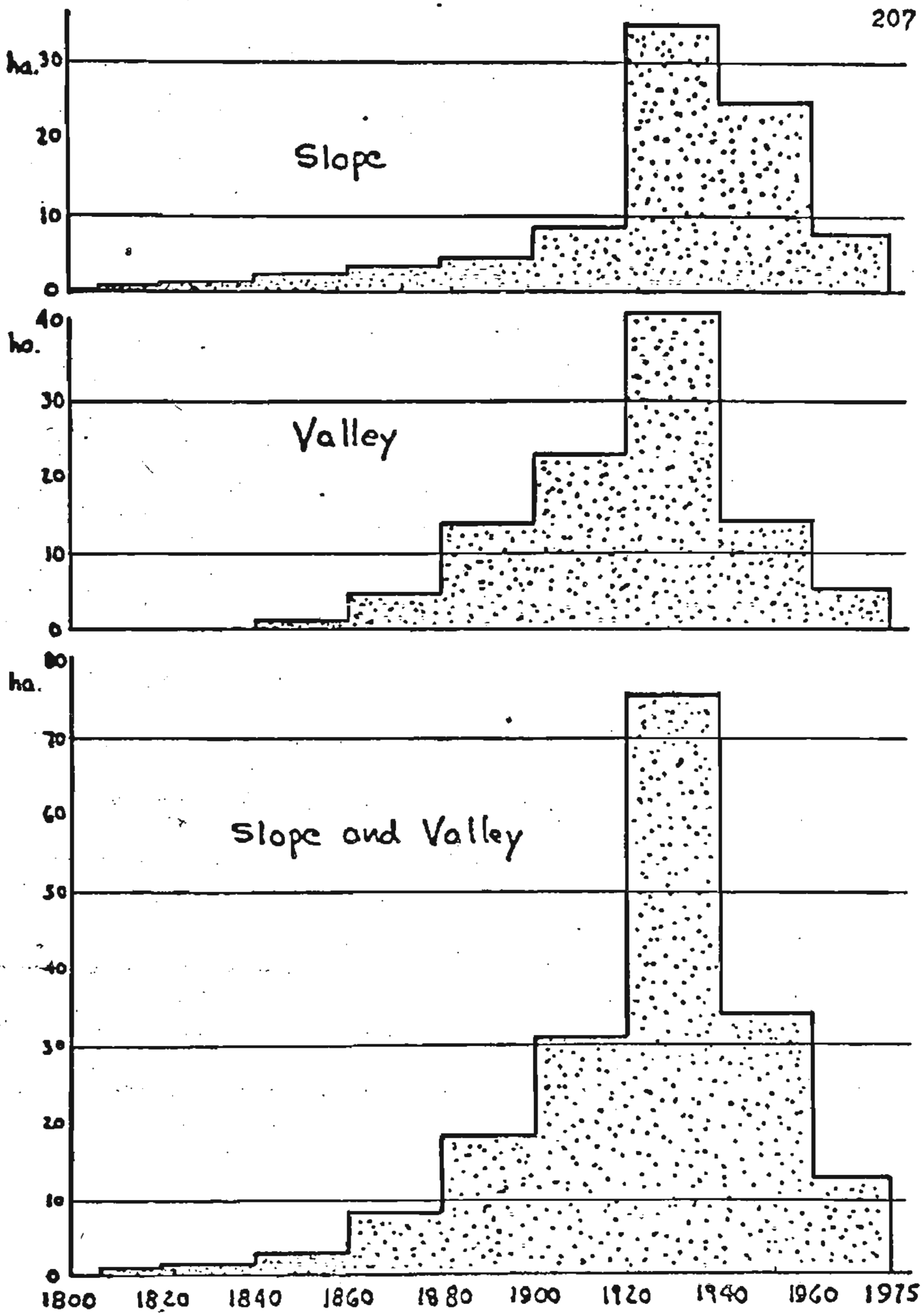


Figure 13: Area Cleared per Period on Slope and Valley

The estimated populations that this land supported can be inferred from the cultivation history. Counting the resident families and multiplying by 5.69 yields the temporal pattern in Figure 14. Population grew relatively smoothly from first settlement to 1895. From 1900 to 1950 a tremendous population explosion occurred, reaching an increase of 7.5 percent per year between 1920 and 1925. As will be explained this rapid increase derived largely from the incorporation of nonagnates.

First contact occurred in 1938 when Taylor and Black probably passed through the valley on their Hagen-Telefomin-Sepik patrols (Meggitt 1956). In 1941 a major frost occurred accounting for 46 Kapii deaths according to informants. These were said to have been "old" people, some children, and a few in between (33 adults, 13 children; 25 males, 21 females). By 1945 dysentery was reported by Blood (Ibid.) which likely accounts for a significant population decrease. The progressive restriction on nonagnatic immigrants also contributed importantly despite the growing proportion of the population that were children of earlier immigrants. During fieldwork the population grew at a rate of 1.25 percent per year. The establishment of a medical outpost at Katikati in the late

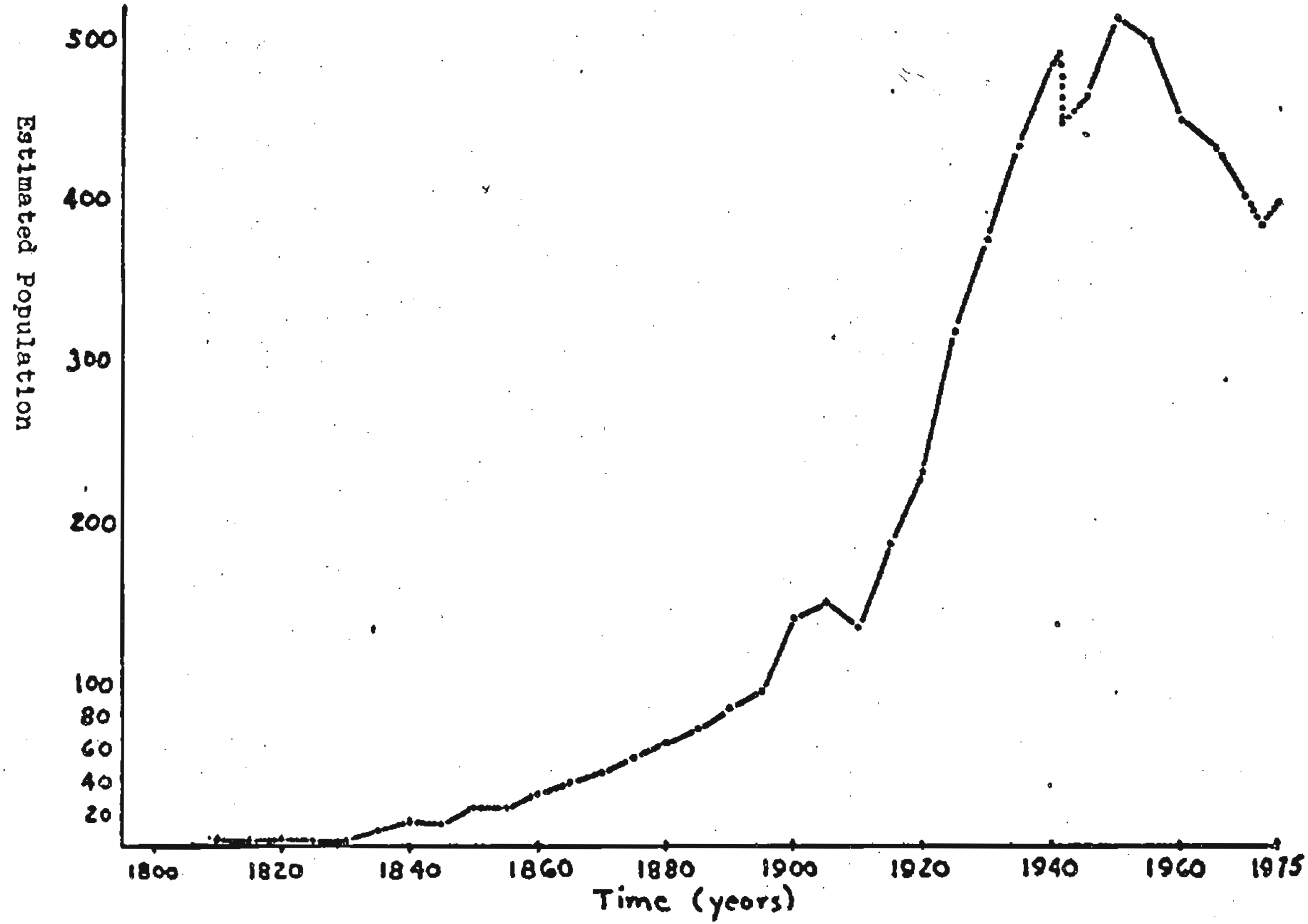


Figure 14: Reconstructed Population of Kapil Clan

1960s possibly contributes to some recent growth although Kapii people are rather hesitant to make use of that facility.

Density on cleared land (D_c) dropped steadily as more land was cleared and became available for fallow (see Figure 15). Between 1890 and the peak of population in 1950 a "plateau" occurred and density fluctuated around 370 $\pm$ 68. Although the abandoned slope areas account for 45 percent of the cleared area in 1975, the actual garden area supporting the population is much smaller (see below). The crude density (D) on clan land is directly proportional to population and, in this case, serves only to indicate that in terms of Meggitt's original indicator of pressure on land, Kapii clan would occupy a very low position in his ranking.

A forest clearing rate (r_c) can be calculated which is simply the result of dividing area cleared in the <u>five years</u> preceding a sample time by the estimated male labor force and five times 365 days. The labor force is assumed to be 25.4 percent of the total population as it was in 1975. A maximum clearing rate of 1.2 square meters per day ($m.^2/d.$) occurs during five five-year periods between 1890 and 1940. The following observations give an idea

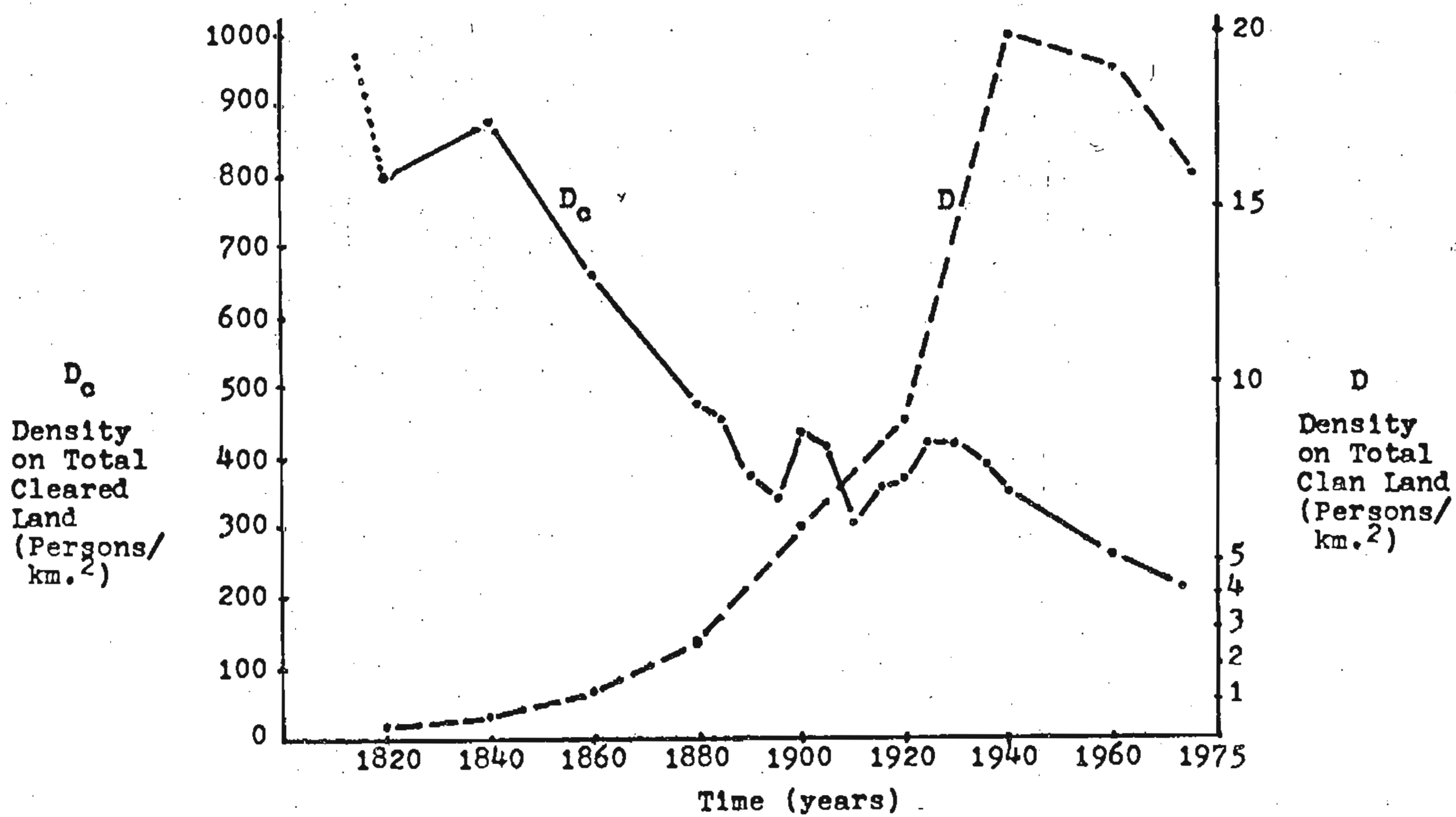


Figure 15: Density on Cleared Land and on Total Clan Land

of the magnitude of this labor. The average rate for clearing eight plots totaling 1.26 ha. between 1972 and 1974 with steel tools was about 10 $m.^2/d.$ (range 2.5 to 15) per man. This included variable time for participatic in the normal social activities that occurred during the period of clearing. All of the gardens were in light bush from which some trees had previously been cut for firewood. Informants' impressions of the time required to fell a large tree with stone technology suggest that steel axes require one-third to one-quarter of the time of stone. This agrees with Salisbury's (1962) reports for the Siane. Using the figure of one-third time, a clearing rate for stone technology of 3.3 $m.^2/d.$ would seem to be reasonable. However, the forest cleared by early Yumbisa residents may have been somewhat denser depending on the relative rates of clearing, firewood consumption and population growth. Moreover, the valley land that was cleared required ditching. No new construction of ditches was observed, but my impressions from other digging activities suggest that this task is much less work than clearing (perhaps on the order of 5% to 10% as much labor per garden plot). Fencing had also to be done but it would be difficult to estimate this component without a fence history. I judge it to be small in comparison to clearing especially since clearing provides the material for fence construction and maintenance. A peak period of clearing (a rate of 1.2 $m.^2$/d. per male laborer) might be visualized in terms of the following hypothetical time distribution.

If every member of the labor force cleared 3.3 $m.^2$ with a stone axe when he worked one day, each would have to work four out of every eleven days. Ditching, fencing and other gardening activities probably added another day. Thus on any day, one would expect to find at least 45 percent of the labor force at work and often more since frost retreats, fights, deaths and pig exchanges usually bring subsistence activities to a halt. Sustained over long periods, preparation of garden ground from the forest was an immense task occupying a major part of most men's time up until 1940.

Labor expended on the slopes resulted in gardens which lasted, at the outside, twenty years during which yields decreased significantly. The same effort in the valley plus that for ditching, resulted in an enduring resource. Yields diminish over time in valley gardens too but not as rapidly. The wet fallow rotation is said to rejuvenate these gardens though not to the level of newly cleared areas. In short, the "dead labor" of earlier generations is an important contribution to the livelihood of succeeding generations.

Because garden production progressively deteriorate after clearance and varies with slope-valley aspect, the relative productive capacity of the total horticultural system over time needs to be estimated. That capacity in comparison to the estimated consumption of the existing population serves as a measure of pressure on available agrarian resources. Central to this consideration is the role of fallow and, more pointedly, the perceptions of what an ideal fallow pattern ought to be. If, indeed, the pioneering population at Yumbisa came from Kiteli/Bipi (and there would seem to be no good reason to doubt it), they came from an area which in valley-slope aspect is quite like Yumbisa. The major agricultural techniques developed there could have been transferred to Yumbisa without modification (possibly excepting the greater necessity for dispersed gardens at Yumbisa where frost effect is more pronounced). This suggests that patterns of fallowing and slope and valley utilization may derive from the same basic cognitive principles. If, then, there is an ideal model for fallowing it was likely consistent through the history of Yumbisa.

Under this assumption it is instructive to calculate the population that could have been supported on the land cleared at Yumbisa (through time) with the constraints of ideal fallow and then to compare to the estimated population. This can be achieved as follows. The ideal fallow pattern for slope gardens calls for cultivation for about three years and fallow for the same period. This alternation usually persists for less than twenty years after which the plot is abandoned. For valley land, the cultivation and short fallow periods are also of equal length but around four years duration, and the 20-year wet fallow follows a 20-year short fallow-cultivation cycle. Actual fallow in valley gardens closely approximates the ideal in 1975. A 20-year wet fallow would imply that one-half of the area would be in the short fallow cycle of which half would be in actual crops at any time. Thus 25 percent of the cleared valley should be in cultivation. In April of 1975, Kapii residents were cultivating 21 percent of their land which suggests that somewhat less land was in use than expected. Some of this difference can be attributed to individuals who were still in the migration cycle.

Gardens are not fallowed on the basis of a certain number of plantings but by observation of decreasing yields. When the gardener perceives that yields are dropping off, she moves to a new plot. New gardens, then, may be replanted more often during the first cultivation period and less often as time goes by. The amount of land available to any family, inheritance patterns, warfare, frost migration, land disputes or any of a host of other factors may influence the actual cultivation history of any one plot. If a family is short of land, local dispersed gardens can be utilized or usufruct grants within the contiguous clan territory can usually be acquired.

Yields vary with slope and age of plot. Over the twenty years of a slope garden's usefulness, yields average around 6.8 kilograms per mound to judge from a limited sample of mounds that I observed. Valley mounds in old gardens (over twenty years since clearance) run around 11.3 kg./mound in good times, while newly cleared valley gardens probably average about 13.6 kg./mound for twenty years. Using these approximations for yield, dividing cleared areas into new slope, new valley and old valley for the past 170 years and using the ideal fallow patterns, one can calculate the population which that land could support under those constraints and with a per capita daily "consumption" of 2.7 kg. of sweet potato. This is a consumption figure characteristic of the "good times" of 1975 and allows ample sweet potatoes for pigs.

The results are given in Table 22. The first figures represent populations that could be supported solely on the local cleared clan land of various types at indicated sample times with the above constraints. An occupational density index <u>on cleared land</u> (OD_c)[1] can be

---

[1]The formula for this index of occupational density is as follows:

$$OD_c = \frac{P(M)(C_s)}{\sum_{1-n} \frac{A_i Y_i}{C_i}}$$

where: P = extant population utilizing the area under consideration

M = mean maturation/harvest period of dominant crop in days (the formula must be expanded in the case where multiple major crops are used)

C_s = mean per capita daily "consumption" including portions for pigs (kg/P/day)

A_i = area in class "i" land/technique (ha.)

Y_i = yield for class "i" land/technique (kg./ha.)

C_i = cultivation factor = $\frac{\text{cultivation period} + \text{fallow period}}{\text{cultivation period}}$

The summation is carried out over the different classes of land/technique.

		1820	1840	1860	1880	1900	1920	1940	1960	1975
Maximum Population with Ideal Fallow (by Garden Type)	New Slope	3.6	5.3	10.2	17	20	39	163	115	36
	New Valley	0	0.5	9.9	43	134	219	389	141	49
	Old Valley	0	0	0.2	4	22	76	164	321	378
Totals (Carrying Capacity)		3.6	5.8	20.3	64	176	334	716	577	463
Estimated Population		6	17	34	63	142	233	484	449	398
Index of Occupational Density on Cleared Land		1.7	2.9	1.7	1.0	0.8	0.7	0.7	0.8	0.9

Table 22: Occupational Density on Cleared Land

calculated by dividing the estimated population by the population that could be supported on the garden land. (This should not be confused with an index of occupational density commonly calculated over total cultivable land, including uncleared areas, such as Brookfield and Brown [1963:119] use.) An occupational density of 1.0 implies that the associated population is using all cleared land to full potential under existing technology and with ideal fallow. Figures exceeding 1.0 imply that fallow is being shortened to meet desired output levels and thus, presumably, production is falling over time as soil deteriorates. Values below 1.0 provide for a longer fallow period.

Although the population estimates for 1820, and to a lesser degree 1840, are suspect, a pattern is apparent of early high occupational density dropping to a fairly stable value in 1920-1940 then climbing again despite a declining population. The relationship between this pattern and the incorporation of nonagnates is examined in Section C. Here I set the stage for that analysis of clan dynamics by looking at the proportion of the population that could be supported on each type of land per period. Table 23 presents this array expressed as a percentage of the estimated population. First, note that cleared land

Percent of Population

	1820	1840	1860	1880	1900	1920	1940	1960	1975
New Slope	60	31	30	27	15	17	34	26	9
New Valley	0	3	29	68	99	94	80	31	12
Old Valley	0	0	1	6	16	33	34	71	95
Subtotal Valley Only	0	3	30	74	115	127	114	102	107
TOTAL	60	34	60	101	130	144	148	128	116

Table 23: Percentage of Population Supportable by Garden Type

was insufficient to meet ideal fallow requirements until some time between 1860 and 1880. In other words, clearing was not rapid enough to offset the deterioration of yields in slope gardens which provided the major support until after 1860. This does not imply that food was short during this period but that more frequent cropping may have been necessary to provide adequate production.

As valley clearance began in earnest (1860) major reliance shifted to valley gardens which provide a continuing resource, unlike slope gardens. However, the long wet fallow practice resulted in a retarded accumulation of usable old valley land and new valley clearance provided the dominant resource base especially as population grew rapidly. With the post 1950 decline in population, new forest clearance dropped off and old valley land was more and more abundant so that in 1975 there was little pressure to clear new areas. No single land type supported all of the population at any time although new valley in 1900 and 1920 and old valley in 1975 come very close.

After about 1900, the valley resources by themselves (both old and new) would have sufficed to support the population as a whole, but this was not true for every social group within the population. Thus by 1940 population growth had hemmed in some of the lineages so that certain families were obliged to clear increasing areas of slope. In fact, 68 percent of the slope was cleared from 1920 to 1960 and the bulk of it by five of the twelve lineages that had nearly exhausted their uncleared valley land. But these areas have a limited temporal usefulness and, as population declined, people returned to major reliance on the valley.

If the same relationships continue to be held among fallow, cultivation, yield, etc., the population could grow to 600 individuals in 33 years (an increase of 1 1/4% per year--the rate observed during the fieldwork period) and could be supported by clearing the remaining 52 ha. of valley land. After that, slope clearing must be again utilized, slope must be recultivated, valley agricultural techniques must become more intensive, outmigration must occur or people must employ some combination of these strategies. It is easy, on this basis, to see how a Yumbisa of the future might come to resemble the Laiapu Enga, that Waddell (1972) describes, with an area of intense agriculture on rich land and dispersed farmsteads spread throughout the usable slopes nearly to the limits of clan territory.

Contact-related economic and social processes currently in action will likely modify this trajectory.

This occupational density index (OD_c) provides a useful measure of pressure on land because it summarizes the basal density relationship and incorporates variation in land types and associated technology, yield, fallow patterns, maturation times and per capita consumption. Unlike a simple density figure, it indicates the degree of deviation from the balanced relationship between population and area (under the assumptions used in its calculation). However, an important factor is missing--labor input. Another index is needed which adds that dimension and a measure of agricultural intensity would be a useful way of expressing it.

There are several ways of measuring intensity[2] but basically it is the ratio of energy put into the agricultural subsystem by human action (hence excluding that from the sun) to the energy recovered (I_e). Thus high intensity agriculture may recover two calories for every one expended in the process ($I_e = 0.5$: high intensity U. S. corn,

---

[2]There are at least five; see Brookfield with Hart 1971; Cowgill 1975.

for example--Steinhart and Steinhart 1974). A low intensity relationship for swidden agriculture may recover 20 calories for each calorie of input (I_e = .05--ibid.).

It is difficult enough to acquire good figures on energy input when present with the laborers. Projection into the past can at best be an approximation. However, in the case of Kapii clan history I have already developed a very strong indicator in the form of clearing rate (r_c). Since this is but one part of the total energy input to the agricultural subsystem, one must evaluate the other components as well.

Women formerly used wooden spades in garden work which were rapidly replaced by steel, probably in the late 1950s. My wife and I had some of the former made and observed the relative differences in mound construction. Two major advantages of the steel spade became apparent. It cuts the earth more easily and it can be used to shovel dirt onto the mound. Since the wooden spade is thick at the core and tapers to the edges, very little earth can be lifted with it. Hands are thus used instead but they are also commonly used with the steel spade especially when it is worn down to a small blade. The number of shovel strokes required to break the earth for a mound with a steel shovel is about 70 percent of that with a wooden spade. Mounds constructed with steel technology take about 80 percent of the time required for wood. In terms of total labor input per mound for preparation, construction, planting, harvesting, weeding and carrying produce this would mean that a precontact valley mound cost about 720 calories while observed inputs were estimated at 660 calories per mound (see Appendix 7). Per capita inputs by members of the female labor force from construction of the mound to consumption of its produce must have been fairly constant over time since as population changed the size of the labor force was altered proportionally.[3]

By contrast, forest clearing, ditching and fencing required something like 4,600 calories per mound of garden space with stone technology (vs. 1,260 calories with steel). That male activity occurred only once for any given area while the female input was repetitive. Thus, for total agricultural labor input by the population, clearing was a large component prior to 1940 and was variable. The variation in the rate of clearing then reflects the variability in the total labor input being added on to the

---

[3]If population structure was significantly different than that observed, variation could have occurred and I have no way of estimating that variable.

fairly constant female input in proportions appropriate to the technology in use at any time. (See Chapter V for further consideration.)

Output would be affected both by human and pig populations. If we assume that the fluctuating pig population had the same proportion to the human population as that observed, and that gardening provided just sufficient energy for these populations (i.e. no export of foodstuffs), the output must be proportional to population. Output per human being can then be considered constant and thus the rate of clearing approximates the intensity function in form (but not in numerical value). This is a rough approximation but little else can be done. Appendix 7 provides numerical estimates for energy inputs and outputs and shows the deviation between the theoretical pattern of I_e and r_c.

In Figure 16, OD_c and r_c are plotted against time, and several different phases are apparent. Phase I is based upon questionable data but if it shows anything it indicates that intensity was fairly high while only slopes were utilized as garden sites. In phase II, valley clearing began and here the data are more reliable since individuals are more likely to have been actual persons

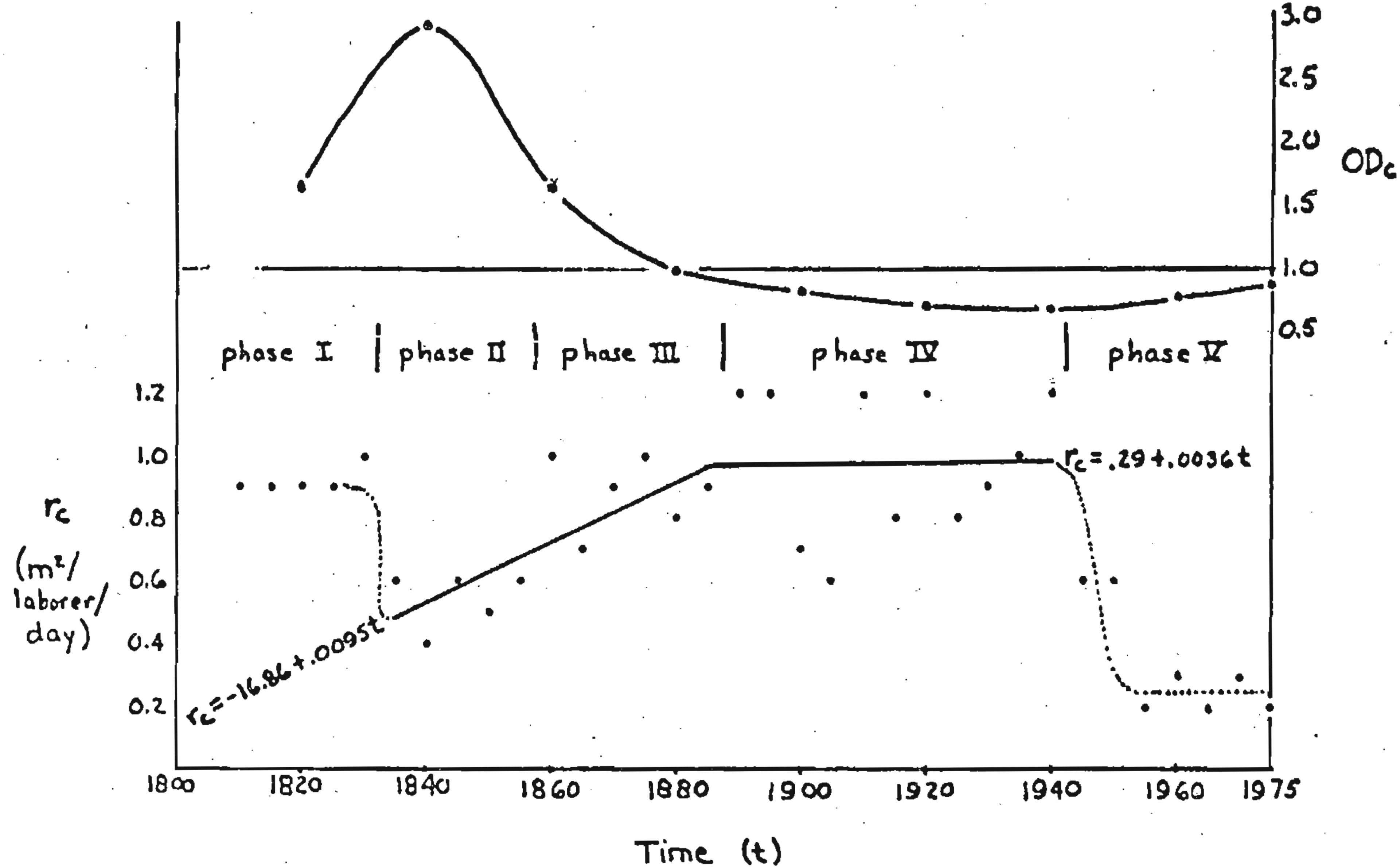


Figure 16: Occupational Density and Clearing Rate

(rather than the segment founders of phase I). As cultivation shifted to valley lands, the high yields and low population resulted in decreased clearing rates. OD_c was high during this phase because its calculation encompasses the wet fallow time constraints but production of new gardens was independent of OD_c. It would appear that early inhabitants of the valley did not at this point adhere to the ideal fallow model. Indeed, in the next generation (phase III), since yields dropped land went into wet fallow and clearing increased until OD_c fell to sustainable levels. By phase IV a balance was achieved which continued throughout the florescent period of incorporating nonagnates while OD_c continued to drop (see next section). After 1940 and the beginning of phase V, the reduction of incorporation, disease which reduced both human and pig population, the frost of 1941, steel technology, pacification, compulsory roadwork in the 1960s, other contact disturbances <u>and</u> the cumulation of previously cleared valley land all conspire to make it possible or necessary for a large portion of the population to all but cease clearing. Despite the decline in population, OD_c begins to rise again since new clearance did not offset the deterioration of productivity. Throughout this sequence the relationship between I_e and OD_c is not constant.

Theoretically, where a growing population just clears enough land to provide for new persons, the rate of clearing (a function of area per population) should be a function of the inverse of density (population per area). The correlation coefficient up to 1940 is -.71. The deviation from the theoretical pattern is of interest.

One tends to think of high density situations as prime candidates for intense agricultural practices and that, to a lesser extent, low density implies low intensity. In the case of Kapii clan history, both the highest and lowest intensity (implied by r_c) occur when OD_c is quite low (phases IV and V). Current cultivators are living on borrowed time at Yumbisa (borrowed from their ancestors who cleared so much land). In phase II, fairly low intensities occurred and OD_c was high, with the consequences indicated above. _Ceteris paribus_, if population now grows at Yumbisa, OD_c must increase or some form of intensification must occur, clearing, for example.

Occupational density and intensity are interrelated indices but not simply so. A fuller treatment of the implications of the Kapii pattern must be postponed until comparative material is examined in Chapter V. Let me reiterate here, that the highest intensity occurred when OD_c was low (below 1.0) and when population growth was the greatest through incorporation of nonagnates. One thing is apparent. Had Kapii clan continued to incorporate outsiders at the peak rate of 1920 to 1940, the current population (reduced at the same rate as the 1950-1970 decline) would now be on the order of 600 people and there would be little or no valley land left uncleared.

I have demonstrated how a measure of land scarcity can be developed in terms of OD_c over time, its relationship to the exhaustion of a fixed resource (uncleared valley land) and the pattern of intensity. To understand the concomitant variation in social factors, the dynamics of intraclan composition is examined.

B. Agnates and Nonagnates

In the previous section the reconstructed population of Kapii clan as a whole was juxtaposed on the major resource base. In this section, the focus is on the incorporation of nonagnates from 1890 to the present. The first step is to break down the population into the social categories of agnates and nonagnates. The latter may be subdivided into the families of immigrants, temporary immigrants and the descendants of both. Immigrants and temporary immigrants are for convenience, referred to jointly as migrants. A third social category consists of nonresidents who maintain their own dispersed gardens on Kapii land or at least have short-term usufruct rights there. Most are nonagnates but the category includes three agnates who currently reside elsewhere.[4] These components of the population are displayed in Figure 17 by five-year intervals. As before, the population is given as a cultivator multiplied by an "average" family size and these families begin with marriage and persist until the male head of household dies, exceeds 60 years of age or relinquishes cultivation rights by out migration or simply letting them revert. A family that begins in one classification is always so classified except four temporary migrants who changed to nonresident status and the three agnates who recently changed to nonresident cultivators (i.e., migrated out, at least temporarily).

The agnatic population replicates the form of the

---

[4]Two of these are short of land at Yumbisa while the third holds a large area. One of the former (age 47), will not return but the other two say they have not left for good.

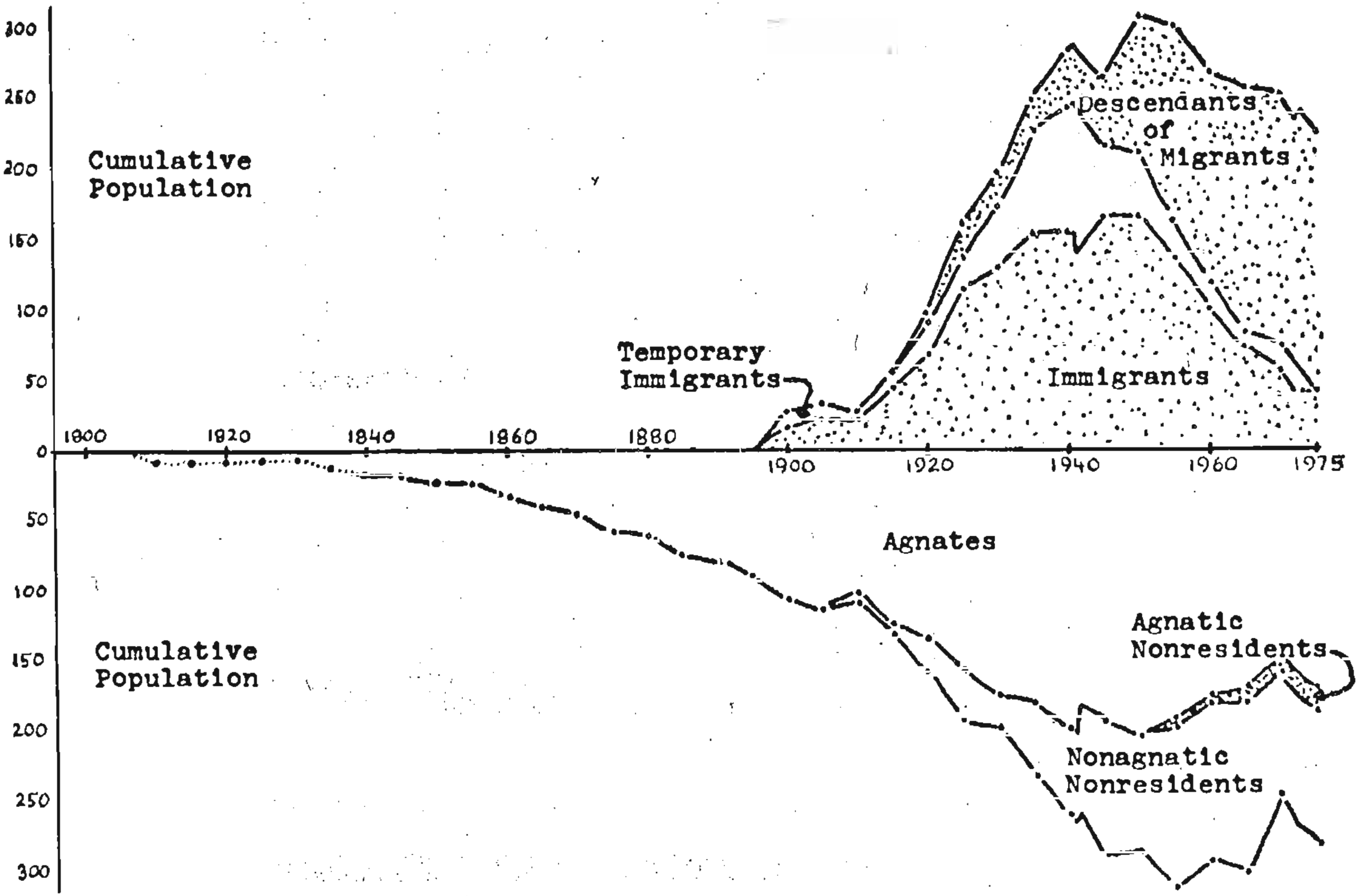


Figure 17: Population by Social Category of Kapii Land Holders

overall population curve peaking in 1950, after the disastrous 1941 frost, then declining until 1970. Immigration began between 1895 and 1900 at about the time of the earliest known major frost. Informants made no connection between these two events and neither can I. One might suspect that frost retreat hosts or their relatives could have come to Yumbisa and been given land there. Three of the first five migrants were from the Kandepe area; unlikely hosts. At any rate, informants also report a major epidemic (possibly influenza) and the population model "independently" produces a decline between 1905 and 1910.

Incorporation and temporary residence of nonagnates was high until 1940, after which incorporation declined sharply and the immigrant portion of the population tapered off as the original nonagnates died and temporary immigrants left. The population of their descendants continued to grow as new families were established. The practice of giving usufruct grants to nonresident cultivators began slowly and reached a peak after incorporation was restricted. Since these grants account for less land than those to migrants, the pattern suggests that nonresident cultivation is an alternative to incorporation as relative land scarcity occurs.

Group composition, expressed as the percentage of the population that belonged to families of resident agnatic cultivators, became progressively "less agnatic" from first incorporation until about 1940. After that date, the proportion remained very steady with just the hint of a rise in 1975 (see Figure 18). This stabilization resulted from a close balance between restrictions on new immigration and the burgeoning population of second and third generation descendants of earlier migrants. It is most unlikely to have been a direct, conscious manipulation.

If population declined because of introduced disease, the results would have been felt in all social categories equally. Then what occurred, in effect, was a steady replacement of immigrant "niches" by natal nonagnates independent of population fluctuation. Recall that the amount of land held by agnates, nonagnates, and migrants was the major difference among them in terms of social and economic characteristics (Tables 7 and 8). This suggests the possibility that nonagnates serve as a "client" population to a core group of agnates. According to informants this is overtly true for exchange aid, but the role nonagnates played in agricultural expansion

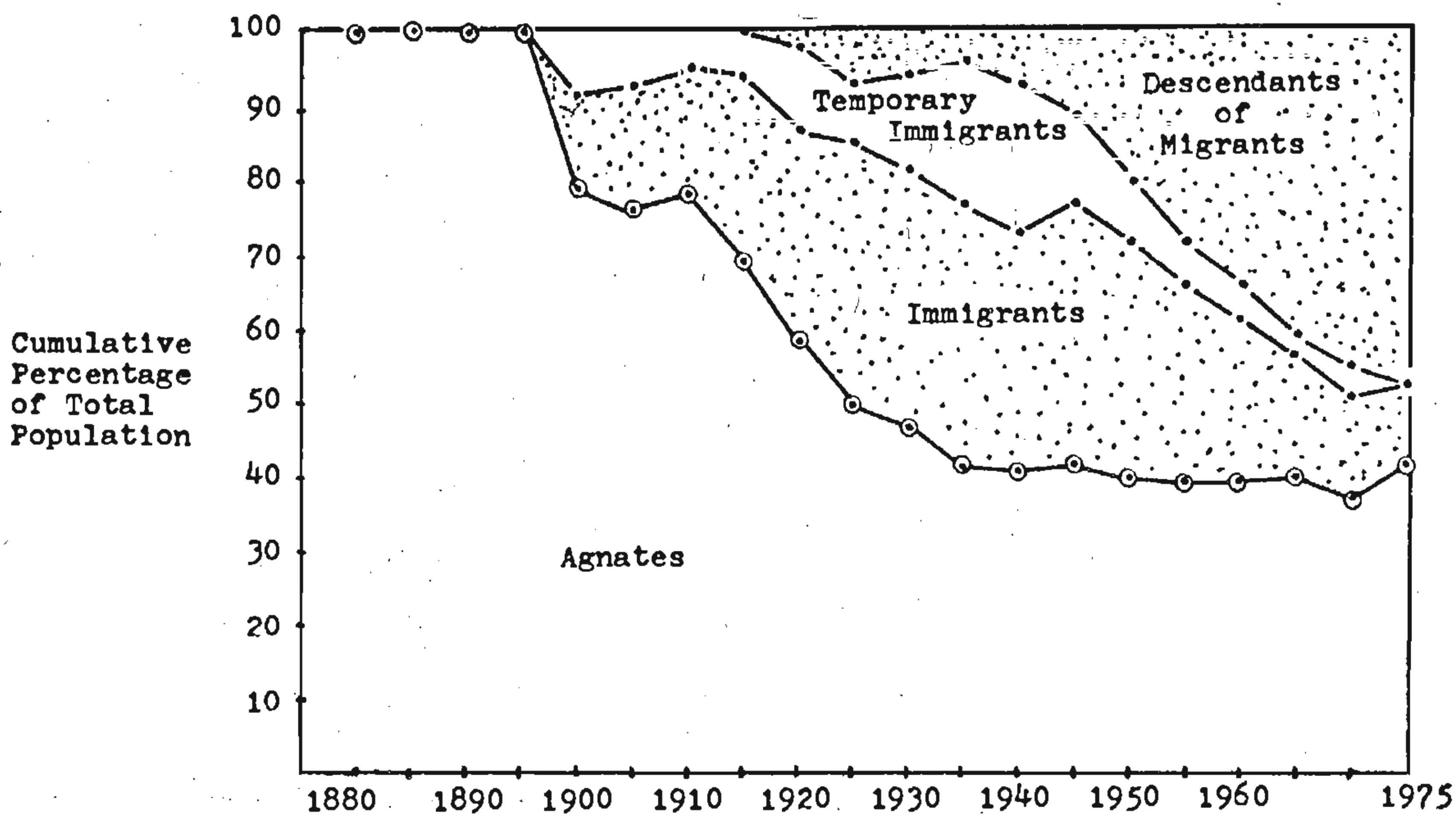


Figure 18: Group Composition by Social Category

needs clarification. Given the large tract of uncleared forest, one might expect labor to have been exchanged for land. This possibility can be investigated from the field data and illustrates much about the relationships of agnates and nonagnates.

The explication of these relationships requires fairly detailed consideration of various stratifications/categories of the population. The classification of social categories described above will be crosscut by further stratifications based on amount of land cleared and hosting practices. My intent is to show how individuals in a variety of circumstances tend to respond by utilizing a limited number of strategies and how such behavior generates the temporal patterns for the clan as a whole. The material will be illustrated by considering cases of particular individuals and lineages as appropriate.

Average area cleared per laborer per day can be calculated for the period preceding sample times and is presented in Table 24 for each social category. In no case does the rate exceed that established as reasonable in Section A. In other words, each social category had sufficient internal labor resources to clear its own land. The temporal patterns show a fairly strong

	Clearing Rate (m.²/day)								
	1820	1840	1860	1880	1900	1920	1940	1960	1975
Agnates	0.7	0.7	0.6	0.8	0.9	1.0	1.4	0.4	0.2
Immigrants	-	-	-	-	0.3	1.0	0.7	0.2	0.1
Temporary Immigrants	-	-	-	-	0.1	0.3	0.7	0.1	-
Descendants of Nonagnates	-	-	-	-	-	0.1	1.1	0.6	0.3
Nonresidents	-	-	-	-	-	0.2	0.2	0.1	-

Table 24: Mean Area Cleared by each Member of Labor Force per Day

correlation between any two categories ($r = 0.7$ to 0.9) suggesting that all are responding to the same situation in a fixed relationship. There is one glaring difference. Descendants of nonagnates exhibit the highest clearing rate of nonagnates and prolong higher rates beyond any other category. Having been born in Yumbisa, these individuals are fully incorporated into the clan. Their land resources are nonetheless limited since their fathers were migrants. They can gain access to forest because they are clan members (as will be indicated) and thus clear more to secure their productive base.

Although agnates could have cleared their own land, they cleared at mean rates decidedly higher than those for other categories. The peak rate of 1.4 m.^{2}/day during the 1920 to 1940 period assumes that agnates operate as a unit throughout the clan. If we look at individual lineages (a more likely cooperative unit), one finds the highest lineage clearing rate to be 3.3 m.^{2}/day for Kalome lineage in that same period. This is exactly the mean clearance rate calculated for stone technology from field observations. If the nonagnates in that lineage shared the labor, the rate drops to 1.8 m.^{2}/day (see below).

Informants report that major clearers (who were likely to be agnates prior to 1940) were assisted by their sons, other young men of the lineage, daughter's suitors and other "relatives" including both lineage men attached to a bigman and other migrants. Over one-quarter of the migrants were daughter's husbands.

If we now stratify the population by amount of land cleared and incorporation patterns, we can further comprehend the likelihood of nonagnates assisting certain individuals. I hereafter refer to individuals who cleared or directed the clearing of more than 2.00 ha. of land in their lifetime as "major clearers." Some individuals ("hosts") hosted migrants or gave grants to nonresident cultivators and some did not ("nonhosts"). In either category there were major clearers. It is also useful to refer to thirteen men who were major clearers and hosts but who hosted only migrants. These I call "bigman hosts" (BM hosts for brevity). Although I cannot be certain they were all bigmen by local reckoning, those who were not reported to have been still exhibit a major characteristic of that status--abundant land. There were also, as there are now, bigmen who sponsored only nonresident cultivators.

If we examine the data on the 26 individuals in the clearance histories who allegedly cleared over 2.00 ha. each ($A_c > 2.00$--major clearers-- r_c = 2.2 m.^{2}/day for 25 years) we find that 13 of them (BM hosts) were hosts to 39 immigrants or temporary immigrants, three hosted only nonresidents and 10 were never hosts. There were 54 hosts in all, so the 13 BM hosts (24% of all hosts) were responsible for 52 percent of the incorporations or temporary attachments for the entire clan history. Eleven of the 13 BM hosts were agnates, one an immigrant himself and one a nonagnatic descendant. On the average, they directed the clearing of 3.02 ha. each, and if they had done it alone, their mean clearance rate would have been 3.3 m.^{2}/day for 25 years. Table 25 shows means of area cleared, clearance rates and number of nonagnates incorporated by these 13 BM hosts and comparative figures for the remaining hosts and nonhosts.[5] On the average, then, a BM host had three extra families whose labor he could possibly draw on in addition to his own lineage agnates, while other hosts had 1.2. Note, too, that the other 41

[5]The three men who cleared over 2.00 ha. but sponsored only nonresident cultivators are included in "41 hosts" in Table 25 to reduce possible confusion.

	Mean A_c (ha.)	Mean A_{c25}	Mean Number of Immigrants and Temporary Immigrants Per Host	Number of Immigrants	Number of Temporary Immigrants	Number of Non-Residents
13 BM Hosts with $A_c > 2.00$ ha.	3.02	3.3	3.0	22	17	8
41 Hosts with A_c variable	1.14	1.2	0.9	24	12	32
10 Nonhosts with $A_c > 2.00$ ha.	2.56	2.8	0	0	0	0
201 Nonhosts with $A_c < 2.00$ ha.	.36	0.4	0	0	0	0

Table 25: Area Cleared, Clearance Rate and Migrants for Hosts and Nonhosts

hosts were much more likely to grant usufruct rights to nonresidents who require less land than migrants and are less likely to be present to aid in clearance.

Although the mean area cleared for other hosts is less than for BM hosts, the range is much greater. In fact, the all-time record clearer comes from the former category (Mapelee with 5.98 ha.). His only external land grants were to two nonresidents. His father (Yotelee with 5.24 ha.) was first runner up (three migrants, three temporary migrants and two nonresidents) and his brother (Laioo with 4.45 ha.) was next (one temporary migrant). Mapelee and Laioo cleared during the peak rate indicated in Table 24 and belonged to Kalome lineage mentioned above. Mapelee by himself would have had to clear at a rate of 6.6 $m.^2$/day for 25 years to achieve 5.98 ha. This exceeds the maximum observed rate (5.00 $m.^2$/day when translated to stone technology) and is most unlikely for 25 years. Mapelee's older living children (he had ten wives and eight sons who survived to adulthood, seven still living) recall helping their father clear land when he was in his forties. At that time he had already cleared most of the land. Mapelee was the last of the legendary bigmen of Yumbisa and, indeed, he was said to have been a big (tall) man as well. Although his prowess at social manipulation may have been extraordinary, his ability to swing an axe was apparently within human bounds. He "simply" took advantage of his father's social network. Yotelee had recruited three immigrants and two temporary immigrants in his later days. These individuals came to Yumbisa just before Mapelee's first marriage. He thus stepped into the social niche his father had created, as far as the migrants' obligations were concerned, a position he must have shared with his three older brothers. How he came to outshine his siblings is not recalled. But it is clear that these nine men, plus the temporary immigrant hosted by Laio, provided a tightly interrelated social group that could only have comfortably handled their total cleared area (14.99 ha.) with significant assistance from the nonagnates beyond the latter's own cleared areas (2.29 ha.). Until the four brothers had sons of age entering the labor pool, which is (perhaps not coincidentally) the time of the temporary immigrant departures, this unit could have achieved a clearance rate of 2.0 m.^{2}/day. This figure might be even lower if some of Yotelee's many daughters were born late in his life and their suitors assisted Mapelee. The cultivation history gives no indication of this, but it would not unless they subsequently gardened there.

Young men of a lineage and, at least, some daughter's suitors certainly aided in clearing. The Kalome case strongly suggests that some migrants did too, even in the exceptional case of Mapelee. Still, the thirteen major clearers who were not BM hosts (hosted only nonresidents or were not hosts) were apparently not all as skillful or fortunate as Mapelee. An examination of their labor resources further exemplifies some important relationships. Like Mapelee, two others hosted only nonresident cultivators. One of them, Waipa, was essentially "squeezed out" of Ipaine lineage's limited territory although he did complete its clearance first. He then cleared in the area of Yurimi/Yandape lineage. The second, Wando, is an immigrant to Kapii. Both men were associated with Kotato, a BM host, who granted them land to clear. Kotato was not such a renowned bigman as Mapelee, but he and his father had a tremendous impact on clan composition. They sponsored nine immigrants, three temporary immigrants, one nonresident cultivator and Waipa and his brother who were assisted by a nonagnatic descendant of the third subclan, Pao. This crew cleared 16.42 ha. in Yurimi subclan territory, most of which was adjacent land, plus more elsewhere (giving a group mean $r_{c25} = 1.1$ m.^{2}/day). Moreover, five of the individuals that Kotato and his father hosted, themselves sponsored fourteen further nonagnates. Waipa and Wando came into Kotato's sphere of influence when he was in his forties. They likely helped him clear and subsequently received assistance from his helpers.

The remaining ten major clearers ($A_c > 2.00$ ha.) who were not BM hosts were six agnates, one immigrant and three descendants of nonagnates. The agnates had in each case a sufficient number of brothers or natal nonagnates (see below) to achieve reasonable clearing rates on the order of 1.5 m.^{2}/day. The immigrant was associated with a smaller clearing group such as Kotato's. As noted earlier, descendants of nonagnates were usually short of land unless their fathers were exceptionally active clearers <u>and</u> their brothers were few. The first two of the three nonagnatic descendants who were major clearers cleared when Pao subclan had nearly exhausted its valley forest. They were obliged to clear on the slope. One, Kanalii, had five brothers, three of whom died in fights in their twenties. The fourth eventually returned to his father's natal clan while the fifth died at age 45. Kanalii thus benefited from their early assistance but not their later competition. The other, Wapii, like Kanalii, was the son of an immigrant from Sakata clan of the Lagaipa. It is quite likely, since they were Sakata agnates, that they cleared both (adjacent) plots in mutual cooperation. Moreover, the next adjacent plot was cleared by an agnate whose father's wife was Sakata. Wapii was assisted in his later years by his son and, possibly, by two young agnates who subsequently received land from him. The third nonagnatic descendant benefited from the steel axe and, in later years, the help of his daughter's suitor (now husband).

If one examines lineage compositions when these 26 major clearers were about forty and further stratifies hosts from nonhosts, Table 26 is generated. The mean number of natal cultivators (agnates plus nonagnatic descendants) is the same for both as is the proportion of agnates to nonagnates, but they are very differently distributed. Hosts tended to occur in lineages where natal nonagnates were few. The mean dates for these individuals are 1933 ($\sigma = 12$) for hosts vs. 1938 ($\sigma = 28$) for nonhosts. In other words, the nonhosts were somewhat more likely to be later in time and thus they would have had more natal nonagnates in the lineage. However, the time difference

Lineage Composition at Midpoint of Clearer's Career (age 40): Mean Number of Cultivators

Clearers	Agnates	Descendants of Nonagnates	Immi-grants	Temporary Immigrants	Nonresident Cultivators	Proportion of Agnates to all Resident Cultivators
16 Hosted Nonagnates	3.6	0.5	2.2	1.9	1.1	44%
10 Did Not Host	2.2	1.9	0.7	0.1	1.0	45%

Table 26: Lineage Composition for Major Clearers (A_c > 2.00 ha.)

is small and the range of nonhost dates encompasses that of hosts. If migrants helped their hosts, as was strongly implied above, the natal nonagnates were prime candidates for assisting nonhosts. This is especially true if the nonhost was an agnate since he could have given land to the natal nonagnate who helped him. It does not show strongly for the three nonagnatic descendants who were major clearers described above, because they themselves were short of land and thus unlikely to have been able to have made grants to helpers. Had Kanalii's brothers survived, the Kanalii-Wapii group would have exhibited the appropriate sort of assistance, but to themselves and likely to their Sakata relative.

Any man with land stood a good chance of acquiring assistance from land hungry natal nonagnates. Wapii and Kanalii possibly secured clearance rights on the Pao slope from Sakalene (whose wife was Sakata) and could have encouraged that by aiding him (or his son as noted above). Mapelee gave old valley gardens to four natal nonagnates who had likely helped him. Data on 21 clearers (Table 27) suggest that 31 natal nonagnates helped them (and thus received land grants beyond that from their own fathers). Table 27 shows frequencies for different types of grants

Grantor	Number of Individuals who Received Land Cleared by Grantor	Number of Individuals who Received "Old Valley" from Grantor	Number of Individuals Given Clearance Rights by Grantor
5 Agnates (A_c > 2.00 ha.)	1	5	2
7 Agnates (A_c < 2.00 ha.)	5	4	4
9 Others (5 immigrants, 2 descendants of nonagnates, 1 temporary immigrant, 1 nonresident cultivator)	8	0	2

Table 27: Types and Frequencies of Land Grants to Natal Nonagnates

and the status of grantors. Potential natal nonagnatic helpers in this table are only those of an appropriate age to assist (i.e., 18 to 25). Nonagnates usually gave land they had cleared since they had little else. Similarly, low clearing agnates have a bimodal distribution such that four with almost no valley inheritance gave land they cleared themselves while three others who had inherited plenty of valley land gave it. High clearing agnates gave few grants of cleared land at all, excepting Mapelee who made four from old valley. Old valley would appear to be the favorite reward to young helpers if available. Moreover, four of the five major agnatic clearers in Table 27 worked under or from conditions of relative lineage land shortage. One was Waipa mentioned earlier, one was Mapelee hemmed in on all sides by his many brothers, and two were in the process of pioneering new areas separate from the constricted lineage homeground. The fifth major clearer now works on slope land with a steel axe while his considerable valley inheritance lies mostly in wet fallow.

The preceding analysis suggests an emergent pattern in which four different strategies of organizing labor resources for male garden work can be analytically separated.

1. A man might (presumably) do the work entirely by himself.

2. He might rely on assistance from coresident agnates--his own sons in his later years and agnatic "nephews" earlier, but possibly including older "attached" agnates and cooperative labor exchanges with other clearers.

3. He might rely upon nonagnates who he sponsors as new clan members or, possibly, nonresident cultivators.

4. He might rely on descendants of nonagnates.

In practice these strategies are mixed for any one individual and transient, informal work groups of varying social composition result. However, the trend from reliance on migrants to reliance on nonagnatic descendants emerged as a major shift in emphasis as incorporation was constricted. The growing numbers of nonagnatic descendants replaced the dwindling numbers of migrants and the proportion of agnates to nonagnates stabilized after 1935 (Figure 18). Note that the period from the beginning of incorporation to constriction (1890-1940) was the period in which male contribution to agricultural subsistence was at the maximum (i.e., maximum mean clearing rate in Figure 16). After 1940, less land was cleared and male labor intensity dropped. Nonagnatic descendants provided the labor force and required, in turn, land grants for their own support. Differential, relative shortage of land sufficient for long-term use appears to be a major factor in this process of forest clearance.

If hosts of all sorts are stratified as a separate social category, the dynamics of incorporation in relationship to land can be clarified. Table 28 tabulates the frequencies of hosts (number of individuals who sponsored nonagnates per period), new migrants and nonresident cultivators per period. The rapid decline in immigration after 1940 is apparent. The number of hosts increased thereafter but seven of them sponsored only nonresident cultivators. In the 1961-1975 period four of the eight hosts did likewise. After 1940 the mean number of external nonagnates per host was generally less than before and was 1.0-1.1 for migrants only. Thus nonresident cultivation peaked later than immigration and was the dominant hosting strategy after immigrant constriction.

The proportion of hosts to total number of resident cultivators remained fairly steady until recent times when it is apparently losing popularity. During fieldwork, two nonresident grants were tentatively made to new

	Number of Families				
	1881-1900	1901-1920	1921-1940	1941-1960	1961-1975
Active Hosts	4	8	16	19	8
New Immigrants and Temporary Immigrants	5	19	29	14	3
Nonhosts	4	6	6	17	66
New Nonresident Cultivators	0	3	9	17	12
Hosts as Percentage of Total Resident Cultivators (at end of period)	25	28	23	21	11
Mean Number of External Nonagnates per Host	1.3	2.8	2.4	1.6	1.9

Table 28: Frequencies of Hosts, Migrants and Nonresident Cultivators

husbands of out-marrying Kapii women, one nonresident cultivator was "expelled" and one temporary immigrant became a nonresident landholder. The latter two derived from one acrimonious dispute not focused on usufruct rights.

Relative land resources of hosts, migrants and other nonhosts can be estimated by calculating theoretical occupational densities (OD_{ct}) for these social categories. To do so, cleared land resources (area) of active hosts (having sponsored at least one external nonagnate during the period) were tabulated for their whole lifetime and recorded in the major period when outsiders were sponsored. Grants to migrants and nonresidents were removed from consideration and carrying capacity of the remaining cleared land (new and old slope, new and old valley) was calculated, then converted to OD_{ct} for a family of 5.69 people. A similar procedure was used for the other categories. Migrants were recorded in the period of their incorporation and others at age 40, the time of their major involvement in clan affairs. Both categories ignore intraclan grants which ultimately reduce the whole through inheritance. As a result, these OD_{ct} figures represent the lowest average value that could have been achieved for each category in each period (given recorded clearing, grants, and populations). Hence they are below the values for the total clan given earlier in Figure 16. They are not "true" OD_c values as used before. Rather, they serve as a measure of land resources after interclan grants, standardized for differential outputs and fallow patterns. The results, though somewhat crude, are rather striking (Table 29).

The land resources of hosts (i.e. the land they controlled within the clan, less grants to external non-agnates) followed closely the pattern of clan OD_c to 1940. Afterwards the values rose more rapidly because hosting reduced land resources when clearing activity was not great, even though ample old valley was inherited. (Table 30 summarizes the size of valley grants for the social categories and should be referred to with Table 29 for this discussion.) The other side of this coin is seen between 1900 and 1940 when small valley inheritance combined with grants to migrants resulted in large valley clearance. In fact, host valley inheritance showed a strong inverse correlation with valley clearance ($r = -.91$). Before 1900 when hosts received no valley land from their fathers, they cleared at moderate rates but gave less valley land away, incorporated fewer individuals and had

	"Theoretical Occupational Density" (OD_{ct})				
	1881-1900	1901-1920	1921-1940	1941-1960	1961-1975
Active Hosts	0.7	0.4	0.4	0.7	0.9
Immigrants and Temporary Immigrants	1.1	0.7	1.3	1.8	3.2*
Hosts, Immigrants and Temporary Immigrants Together	0.9	0.6	1.0	1.1	1.7*
Nonhosts: Descendants of Nonagnates	-	-	0.4	0.5	1.0*
Nonhosts: Agnates	0.3	0.5	0.6	0.7	0.9*
Clan OD_c at Midpoint of Period	0.90	0.75	0.69	0.74	0.84

* Probably inflated--see text.

Table 29: Theoretical Occupational Densities for Hosts, Migrants and Nonhosts

	Mean Area (ha.)				
	1881-1900	1901-1920	1921-1940	1941-1960	1961-1975
Cleared by Hosts	.73	1.09	.96	.46	.43
Grants to Hosts	0	.26	.60	.93	.78
Grants by Hosts	.36	.74	.58	.59	.57
Grants to Immigrants and Temporary Immigrants	.24	.25	.22	.46	.39
Grants to Nonresident Cultivators	-	.15	.33	.28	.27

Table 30: Mean Area of Valley Grants

a higher OD_{ct}.

Migrants did not fare nearly as well. Excepting 1901-1920 they never achieved (on the average) a sufficient long-term resource base. In fact, OD_{ct} began deteriorating before incorporation was constricted, and culminated in a very high value of 3.2. That figure would imply about 3.3 kg. of sweet potato per person per day (2.7 is adequate with pigs in ratios similar to 1975) _if_ the gardens were kept in continuous production. Three of these migrants are members of multifamily households and the fourth only recently left such to reside in his garden now being cleared. The others show no evidence of increasing their resource base and could become temporary immigrants. At least three of the thirteen migrants from the previous period are still members of multifamily households. Note that this situation occurred despite the fact that grants to migrants were nearly twice as large after 1940 than before. If an individual is to make it at all, he must be given more land than before 1940 since in the earlier periods almost any host could guarantee forest land to clear. Recently that has not been so. Also, new migrants are customarily given a cleared valley plot as a "starter." These grants before 1940 uniformly averaged around 0.25 ha. which would have supported a family of four for only a few years after which the migrant would have had to clear forest. They cleared both slope and valley, but many of them never achieved sufficient land for long-term stability. They were thus quite likely to be strongly tied to their host who could buffer periods of shortage. Table 29 shows that the combined resources of hosts and migrants approached the ideal population-land relationship before 1960. This dependency likely manifested itself in shared garden labor by women, as observed during fieldwork, and in assistance to the host for any activities including clearing.

As noted earlier, the lack of migrant land resources resulted in a spate of acquisitions by their descendants who were quite clearly seen as proper clan members. In 1921-1940, while forest was abundant, they cleared to increase their resources. As forest decreased they received progressively more old valley and old slope. The former derived to some extent from land abandoned by temporary immigrants. The success of their effort was apparent until the last period. Actually the whole 1961-1975 column is somewhat inflated since most of these individuals are still living and have not finished clearing.

Hosts, being older, are probably correctly represented. On the other hand, the low rate of current clearing suggests that the values may not be greatly altered in the near future. Of fifteen clearers active during fieldwork, ten are descendants of nonagnates.

To complete the analysis of Table 29, agnates who were not hosts exhibited adequate resources for all times. The degree of "surplus" land deteriorated through time as major reliance shifted gradually from cleared valley to inherited valley. The correlation coefficient between inherited valley and clearing for nonhosting agnates is -.65. The difference, in comparison to hosts, is a result of the latter's increased valley clearing which offset the increased valley inheritance of agnatic nonhosts and this was aided, for some hosts at least, by using the labor of migrants. Nonhosts commonly inherited from one-quarter to one-third more valley land, but this was not sufficient in the long run for a family and they had to clear too. The earliest period is again anomalous with nonhosts having cleared large areas. In 1880 there were only eleven cultivators and their degree of cooperation and level of segmentation is unclear. Three of the four hosts were brothers, the others their parallel cousins and if they were tightly integrated had an overall OD_{ct} of 0.8 after migrants were incorporated. However, three brothers formed a unit with migrants while the other "subclan"[6] was an agnatic unit. The fourth host gave rise to the third subclan. The "cost" to hosts was a higher OD_{ct}; the "cost" to nonhosts was a higher clearing rate. These two options are both viable as OD_{ct} indicates in Table 29. The former gained popularity until 1940 after which hosting declined (Table 28) and OD_{ct} is now the same for both categories. <u>I suggest that these options reflect two fundamental strategies widely utilized in various situations and strongly conditioned by land resources</u>.

One final observation regarding social categories and land helps to clarify the long-term inheritance of garden plots within the clan territory. Table 31 divides current valley and slope land by social category to compare the proportions cleared by individuals in the past to the proportions held by individuals of each category in 1975. A large part of the slope is in lineage fallow. This land could be claimed by any of several descendants

---

[6]It is impossible to know how these individuals viewed their relationship. The divisions eventually became subclans though they may then have behaved as lineage members do now. They, at least, occupied geographically separate areas.

	Valley		Slope	
	Percent cleared in past	Percent held in 1975	Percent cleared in past	Percent held in 1975
Agnates	67	49	55	28
Descendants of Nonagnates	7	33	22	24
Immigrants	20	6	14	5
Temporary Immigrants	5	0	5	0
Nonresident Cultivators	2	12	3	4
Lineage Fallow	-	0	-	39
	100%	100%	100%	100%

Table 31: Land Flow within Kapii Clan

of clearers or later cultivators but there is currently no general reason to do so. However, descendants of non-agnates, in their quest for land during recent decades, retain relatively more slope than other categories of individuals. The major pattern of land flow can be seen in valley garden plots. Although small transfers between any two categories occur, the principle beneficiaries are the descendants of nonagnates who receive most of the land cleared by migrants (usually their fathers) plus a large portion from agnatic clearers. Agnates are literally losing ground as a result of the incorporation of non-agnates in the past.

Any individual cultivator at any particular time regardless of his social category is faced with the same problem of securing sufficient ground to maintain adequate long-term production. Current Yumbisa cultivators are, not surprisingly, very much aware of garden outputs, land resources and their potential for securing further land. Land is unequally distributed among residents and the imbalance can be appreciated as follows. For a family of 5.69 to achieve an OD_{ct} of 1.0 for twenty-five years would require one of the following or some equivalent combination: 1.48 ha. of old valley, 0.72 ha. of newly cleared valley, 1.43 ha. of new slope or roughly 2.4 ha. of old slope. Currently, 26 percent of the families hold that much or more in any one type of land or equivalent combination. Over the whole history of Yumbisa, 75 percent of the hosts had such resources, 49 percent of nonhosts (nonmigrants) and 28 percent of the migrants. As indicated earlier, these hosts were commonly large clearers despite large land reserves. If their fathers were large clearers as well, much of the land went into fallow as the sons came of age. Thus even amidst plenty for some there were always those who would benefit from clearing. Incorporating nonagnates added further impetus to clearing since they rarely received sufficient cleared land. Their descendants were even more obliged to seek additional land. But because the overall clan resources were unequally distributed among lineages, by the time nonagnatic descendants become numerous many were obliged to acquire grants from clansmen. This tended to reinforce the practice of attachment to older resident cultivators in order to acquire grants of forest and thus nonagnatic descendants were the major clearers after 1940. The synergistic effect of land acquisition and unequal distribution provided a strong pressure to clear forest until recently.

Declining population and increased amounts of available old valley land have rendered the clearing option less attractive. In addition, the bulk of the remaining uncleared valley is held by two men of one lineage (Yurimi/Yandape)[7] with defensible claims by two others. These men are not parting easily with their resources, but their eleven sons (who would get 2.5 ha. each on the average) may find that their clansmen will be more insistent in the future.

Although incorporating nonagnates has its primary rationale in exchange, the process results in an acceleration of clearing for at least two generations. There are further reasons why land should be cleared. Clearing land not only implies control over its disposal but often constitutes claim to a strip of forest land behind the plot. Valley strips were relatively short in the past since they were rapidly "cut off" by other clearers. Currently such claims extend into the slope forest until they abut a pandanus grove.

A particular case illustrates further implications of this tactic. Recall the massive clearing endeavor of

---

[7]Yurimi/Yandape: Subclan/Lineage

Kotato, his father and their migrants of Yurimi/Yandape lineage. They together accounted for one quarter of all land cleared between 1920 and 1940. Moreover, they sponsored a nucleus of immigrants from Pindaine phratry in the Lagaipa valley, now functionally almost a lineage in Kapii. (A total of fourteen Pindaine people eventually immigrated and were distributed throughout the clan.) At the same time Kepa/Alaka lineage and part of Yurimi/Sambe were pioneering a new area nearby. Alaka lineage had not flourished and was squeezed out of the early valley clearing push by Kepa/Kalome. Makolii and his aging father were the sole representatives of Alaka in the early 1900s. He attempted to claim land by clearing in what is now Kepa/Ambone land and although Makolii's son tried too, they were unsuccessful. Makolii had an option. He utilized a "dual agnatic descent" claim (his father being the child of doubtful parentage) to get land beyond the clan boundary to the south. (See map 2b--the old boundary ran along the southern most major garden drain that runs well into the swamp.) This virgin bush was claimed by a segment of the erstwhile enemies from Katikati who were also expanding in all directions. His claim was not contested and he subsequently allowed his <u>wanenge talipi</u> (WiSiHu--in this case perhaps a classificatory sister), a migrant's son from Yurimi/Sambe, to share the area. The sisters that these two men married were from another segment of the Katikati clans. Within a few years Kotato's father sponsored the first of his Pindaine immigrants and they cleared in the farthest reaches of his strip (actually on the slope edge, probably because there were insufficient workers to drain the swamp without existing major ditches) which was well within enemy territory. Thereafter, this new area was rapidly cleared, cutting off the original Alaka claim and a large part of the work was done by the migrants of Yandape. The present major uncleared valley resources lie in the attached area. After returning from the 1941 frost retreat, a fight with the Katikati people largely settled the affair although animosities persist--the last brawl occurred just prior to fieldwork.

A strategy of giving land grants to nonlineage members on the periphery of territories is apparent even within the clan. In a case of clan expansion, it is doubly useful to secure the claim and to provide fighters with a vested interest in the area.

At this point, the role of dispersed Kapii gardens can be briefly reconsidered in relation to the history of local land resources. A nonrandomized sample of fifteen living men reported that their fathers had maintained outlying gardens at thirteen locations (excluding temporary frost retreat gardens belonging to hosts). Although the sample is small the distribution of these gardens by frost category is quite similar to that of the 1975 survey (Table 32). The fourteen of these fifteen men who held such gardens had an average data of birth of 1902 (s=10) so this sample reflects the distribution around 1940 when they were well established in clan affairs. As in 1975, families lacking local slope land tended to have extraclan gardens in category I. Six of the seven men with category I gardens averaged 0.05 ha. of slope (the seventh was Mapelee with 3.93 ha.) while their lifetime valley holdings averaged 2.04 ha. For the five men with category II gardens but none in category I, their slope land averaged 1.25 ha. with 1.81 ha. of valley. Also as in 1975, two of eight men with direct affinal ties to category I areas activated such ties for usufruct rights.

I have little data from which to infer earlier patterns. However, it seems unlikely that Yumbisa could ever have been occupied without some sort of dispersed garden strategy for post-frost migration refuge in categories II

	Families with Gardens in Each Category			
	1940--sample of 15 families		1975--40 families	
Frost Risk Category	Number	Percent	Number	Percent
I	7	35	22	39
II	12	60	29	51
III	1	5	6	11
IV	0	0	0	0

Table 32: Distribution of Dispersed Gardens

and/or III. Even if the hosting option were initially relied on, acquisition of garden plots from those hosts would readily have been converted to dispersed gardens. Extraclan gardening is commonly reported throughout the Kandepe area and would appear to be an "old" adaptation. The ancestral home (Kiteli/Bipi) is no exception. Furthermore, Yumbisa residents are said to have utilized that homeland up into the 1940s when a fight led to its abandonment. Living men recultivated the area.

The history of category I gardens is somewhat different. The whole of category I was allegedly pioneered at about the same time. If the other groups developed in much the same manner as Kapii, they too may well have restricted early immigration. The pattern of nonresident cultivation grants from Kapii would then approximate the acquisition of grants by Kapii men from surrounding clans. Such garden acquisition would be a strategy employed by individuals within any clan who, for various reasons, might require further land and especially slope. Rather than tapping corporate group ties, they utilized their extraclan network.

A very rough estimate of the importance of such a process on land resources of Kapii families can be made by assuming that the number of local gardeners who maintained category I gardens was proportionally the same as the number of nonresident cultivators who had gardens on Kapii land and that plot sizes were the same as now. If so, the OD_c for Kapii for 1975 drops from 0.9 to 0.8 on the basis of fairly reliable data and the 1940 OD_c would be 0.7 instead of 0.8. The earlier two periods change less than 0.1 since nonresident cultivation was rare (but see Section C).

These observations suggest why nonresident cultivation persists beyond incorporation. Incorporation is constricted because fewer individuals have surplus land (cleared or uncleared) and because the strategy of granting to natal nonagnates supplants hosting migrants. The group becomes more "agnatic" even though they are not all proper agnates. Nonresident cultivation grants, however, are less "expensive" to the host, in terms of land, than incorporation but yield smaller social returns. Yet they serve to strengthen the bond with recipients. For the nonresident cultivator they serve to provide some extra gardens near at hand and, in particular, slope gardens which buffer frost. Even plots that are not on the slope may be spared in light frosts as mentioned earlier.

Increasing land shortage in 1975 threatens to restrict this option as well.

In this section I have highlighted the dynamics of group expansion and composition deriving largely from the incorporation of outsiders. It is important to emphasize that this developmental trajectory occurred in a situation of classic low density by gross regional measurements. I would not claim such a density measure to be irrelevant. Certainly, the history of Yumbisa would have been quite different if, somehow, the clan territory had been surrounded on all sides by other groups. On the contrary, even though early extraclan competition (at least) was slight, certain individuals and certain categories of individuals found themselves in a high density situation. Various strategies were employed to alleviate land shortage with greater or lesser success as indicated above. The result for the clan as a whole was a positive feedback loop which, exacerbated by the incorporation of nonagnates, led rapidly to a reduction of forest land. That in turn was ultimately checked by the simple expedient of nearly terminating incorporation practices. This was not achieved by a concerted design but as a systemic output of individuals pursuing various strategies in relation to constraints on their physical (land) and social (relational) resources and possibilities of alleviating both. The major alternative is another cycle of agricultural intensification which appears to be just around the corner. When that corner is turned (assuming a growing population), a new complex of factors will be introduced. The valley will have been totally cleared and slope land will increase in value. Male labor for clearing will increase for a while with slope utilization and soon female labor must follow suit as more area is planted to compensate for declining yields. This increase in female labor inputs leads to rather far reaching implications and is considered in Chapter V.

Throughout the history of Kapii clan two alternative "adaptive gambits" (Stuart 1971) vied for dominance. On the one hand, the "clan" probably began with a core group of agnates who utilized their own labor resources to secure sufficient cleared land to meet long-term needs as they perceived them. They were, at the least, functionally a tightly articulated group, as agnates are supposed to be. This "gambit" persists throughout the history and waxes and wanes as a successful strategy. When the pioneers had secured a foothold (i.e. when OD_C dropped to 1.0) the second "gambit" became viable. Incorporating nonagnates became a dominant strategy for decades before the seeds of its own destruction bore fruit. In the end the "agnatic" strategy was reasserted and (possibly as in the beginning) the core group that restricts rights in land is now made up of both agnates and nonagnatic descendants largely indistinguishable in day-to-day activities and indeed upon close analysis. They function as agnates are supposed to and might well come to be thought of as such as they are among the Mae Enga (Meggitt 1965). We may now turn to a closer inspection of the social relationships of incorporation.

C. Nonagnates and Nonresidents

I have described how various individuals cope with land shortages and the results of their collective actions. I now return to the clan as a whole to examine the social relationships of incorporated and attached men to resident hosts, the way these relationships change through time and their association with occupational density.

First, the ideology of male residence must be reconsidered in greater detail. In Chapter II, Section G, the elicited, current, ideal alternative, male residence possibilities were described from the migrants' point of view. It is the migrant himself who instigates the move, according to informants. Kapii men disclaim any proselytization. Immigrants may seek new group affiliations for a variety of reasons (e.g., the new place has good gardens, lack of land in their natal area, trouble with agnates, etc.) and they are by no means uniformly men of little social stature. They run the gamut from "rubbish men" to dynamic individuals who fulfill the criteria of bigmen in their new homes. Yumbisa informants claim they were "happy" when a relative began to indicate interest in migrating. When, for example, the would-be migrant asked his mother if she had land at Yumbisa (important matters are never broached directly), prospective hosts and other lineage men encouraged him with every possible inducement (food, pigs, land, etc.) in a manner very reminiscent of the "rehearsal" behavior of prospective marriage partners. At some point, the host lineage may make large contributions to his brideprice. He later makes _laita_ to them. The fullest expression of reciprocal assistance in all activities is crucial. To be a clan member an individual must act like one and his adopted group must respond in kind. Unlike a natal clan member, the migrant signals his change of status by giving his own _laita_ (ideally) or a laita for his children (usually). That laita is a necessary but not sufficient condition for ideal incorporation. He must above all act like a brother.

Since pig prestations require assistance and since most migrants were apparently young, unmarried or recently married men, the giving of laita was sometimes delayed. The mutual assistance aspect of the relationship manifests first--in the past, assistance in forest clearing was a prominent possibility. Some men may in fact never have given laita or assisted in other exchanges. This fact may in part account for the fairly large number of migrants who were not fully incorporated and left (temporary immigrants). When the relationship works well, though, both host and migrant benefit--the former through reliable assistance in exchange, warfare and political manipulations; and the latter in a reciprocal fashion and from land grants. This mutually reinforcing spiral is what makes the potential host "happy." When a migrant gives his own (or his children's) laita to a host, that is only one part of the process but an important one because it completes his obligation as an outsider. He may apparently be assisted by his natal group if they ultimately "owe" the laita anyway and, if the migrant is successful in his new place, he will not "forget" his original clansmen. Occasionally, a man may thus have nearly balanced rights and obligations in two clans. The usual case, though, seems to be one in which a gradual change to full reliance on the adopted clan occurs and the migrant does "forget" his home, i.e., his major allegiance is to the adopted clan.

If the migrant moves to his mother's natal home, makes laita for himself, assists his new "brothers" well and is then killed in a fight, his "brothers" are extremely angry. They seek revenge more strongly, it is said, than for the death of an agnate since they are both mother's and father's clan of the deceased. They would accept a laita for him from his father's clan in the post-fight settlement. They would not accept laita for his children (as father's mother's clan) because the children are natal clan members. Thus a cognate who can make his own laita is rapidly incorporated and his children are without question group members. On the other hand, male affines who make their children's laita (or their wife's) are usually not as well integrated. Their children would have been immigrant candidates had they lived elsewhere. Because their father made their laita, and because they were nurtured and raised in the clan territory, they are full members.

From a potential host's point of view, there are likely to be several individuals who have genealogical connections which would allow for their incorporation into his group by ideal criteria. Such may be divided into two categories: cognates who give their own laita to the host, and affines who give a laita for their children.

The first type is held to be basic. These men can be directly incorporated becoming members in their own lifetime though rarely acquiring a full complement of land. Any son or grandson of a female agnate of the host's lineage is a candidate. Individuals one generation older than the host or two generations younger are unlikely to be of the appropriate age for immigration during the period (host's age 30-50) when he would be most likely to sponsor them. That leaves only SiSn, FaSiSnSn, FaSiDaSn, FaSiSn, FaFaSiSnSn, and FaFaSiDaSn. The real and ideal are far apart in this case. None of the 111 nonagnates who cultivated Kapii soil were unambiguously reported to have been of the last three relationships. Moreover, the first three account for only nine nonagnates, seven of which were SiSn, and classificatory equivalents include only one more individual of uncertain genealogical connection (probably FaFaBrDaSn).

This gap between informants' notions of an archetypal immigrant and numerical frequency requires some comment. All three of the nonoccurring relationships refer to individuals of the same generation as the host. If they sought new affiliations, the host's father would likely have sponsored them. FaFaSiDaSn is most likely to be older than the host since the descent line includes two women and women marry younger than men. But age alone cannot account for the nonoccurrence, since even FaSiSn could be up to 25 years younger than the host.

All individuals in this category of potential immigrants are closely allied with the host, especially the sons of female agnates. The three "missing" positions are among the host's primary exchange partners and, indeed, FaSiSn is one of the prototypes from which the descriptive term <u>auu</u> <u>kaiingi</u> 'exchange partner' comes--<u>kaiingi</u> being a cross cousin. It may thus be that it is more advantageous for the would-be migrant to pick a different host to maximize his assistance in exchange endeavors. This would contravene the would-be host's expectations of acquiring a local reliable helper, but from the migrant's point of view that is not necessarily the best strategy. If the migrant attaches himself to a man other than his MoBrSn, he may draw upon the assistance of that host, his natal lineage and his mother's clan (his MoBrSn). The latter are obliged to assist their FaSiSn anyway. Whether this would be a conscious calculation by a young unmarried man contemplating migration or whether he would heed some elder's advice or general knowledge, I cannot say.

The second category of ideal immigrants (affines who can give a laita for their children) is represented strongly (52 out of 111). Any husband of a female agnate of the host's lineage or husband of her daughter falls into this category. As before, individuals of host's own or first descending generation are most likely to be of the appropriate age. (DaHu accounts for 31 cases, SiDaHu for five, SiHu for 16--including four classificatory equivalents.) These immigrants are in effect giving the laita for the incorporation of their children, and the principle of conversion by death compensation payment for the living is preserved. Several such men have been dominant forces in their adopted clan but by and large these immigrants play lesser roles.

These two categories of relationships (hereafter referred to as Primary relationships, see Figure 19) were utilized by 52 percent of all immigrants, temporary immigrants or nonresident cultivators for all times. The remaining 48 percent can be assigned to three classes with various internal categories.

Secondary relationships (see Figure 19) are those which fall outside of the ideal but which employ an extension of the principle that a migrant "follows" a laita payment he gives. A host's FaFaSiSnDaHu may make laita for his wife since the host is the appropriate receiver of laita for her as the focal individual in her father's mother's clan. Other relationships are among those previously referred to as involving a "representative" of the appropriate social group. Typically, a man hosts his parallel subclan "daughter's" husband. Similarly, six individuals utilized their relationship of helper to someone who could give some sort of laita to Kapii host. Four such were the host's DaHuBr who probably benefited from their brother's incorporation. Two others were clansmen of men with Primary relationships. They assist their "brother" in the laita he gives and receive their own land grants from the host.

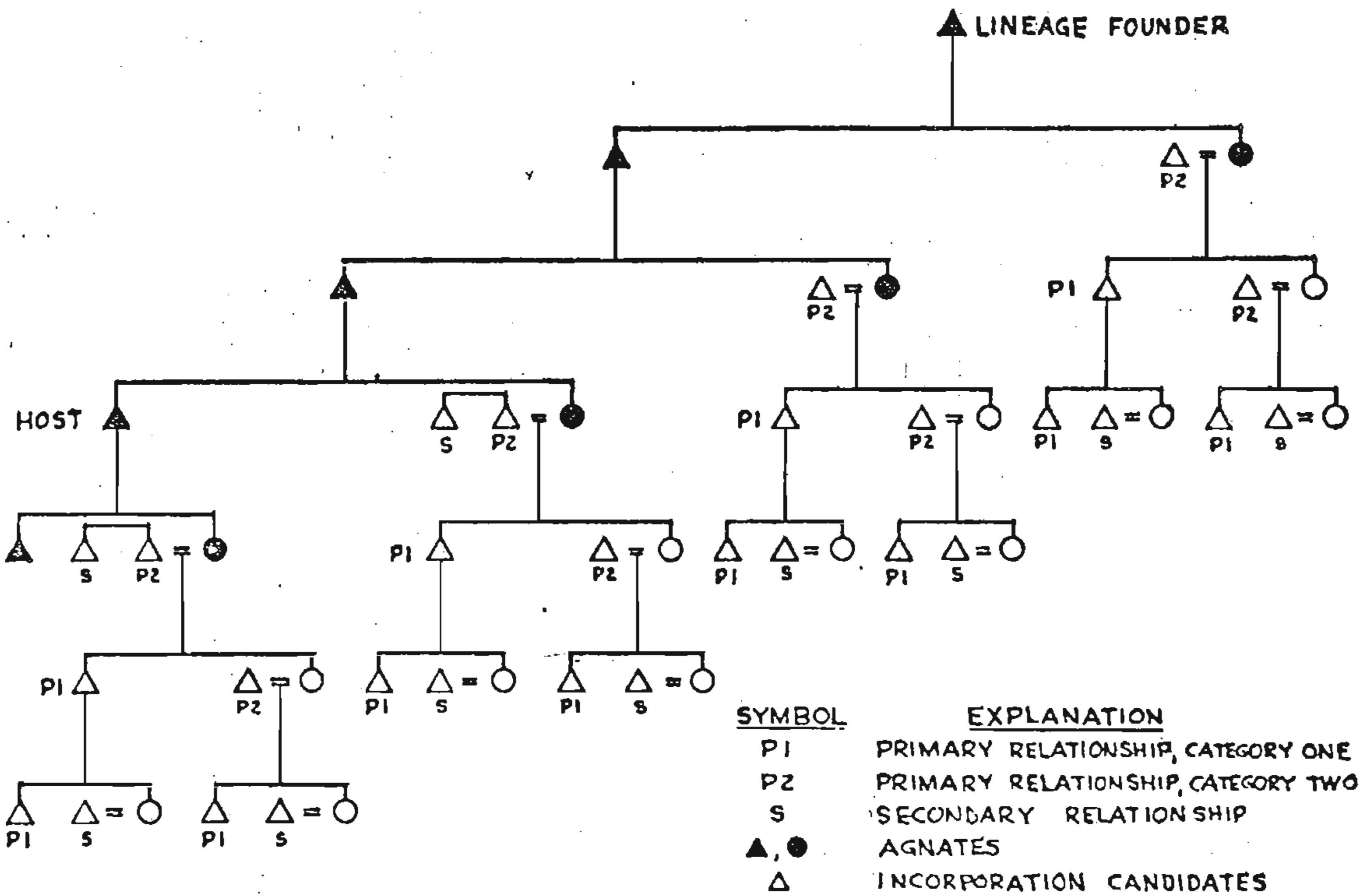


Figure 19: Incorporation Candidates, Primary and Secondary Classes

The third class of relationships (Improper, see Figure 20) accounts for thirty individuals. The first category in this class is made up of relationships which involve two or more female links. Here men serve as "representatives" of an appropriate clan for improper exchanges. Thus the special relationship of wanenge talipi (WiSiHu) occurs twice. The two men who married sisters can exchange laita for their children which bypasses their wife's brother, if she has one, each taking the latter's place. Tarange talipi (MoSiSn) can do the same for their own or children's laita (also two cases). Other relationships reflect this pattern as well. The host who sponsored his WiMoSiSn takes the place of WiBr in the tarange talipi relationship. Similarly a host's WiFaSiSn or WiFaSiDaSn may make laita to the host as a standin for WiBr. In such a case, the host's wife may be given the pigs and will exert unusual control over their disposition. An extreme case of Improper hosting resulted in a permanent immigrant who was his sponsor's MoFaSiDaSn. The host apparently represented his own MoBrSn in receiving laita from the migrant. I cannot be certain that all of these relationships actually resulted in a death compensation payment by migrants in the past, but they are typical of

SYMBOL	EXPLANATION
I1	Improper Relationship, Category One
I2	Improper Relationship, Category Two
(solid shaded triangle)	Agnates
(open triangle)	Incorporation Candidates
(dotted triangle)	Individuals for whom Host may Substitute

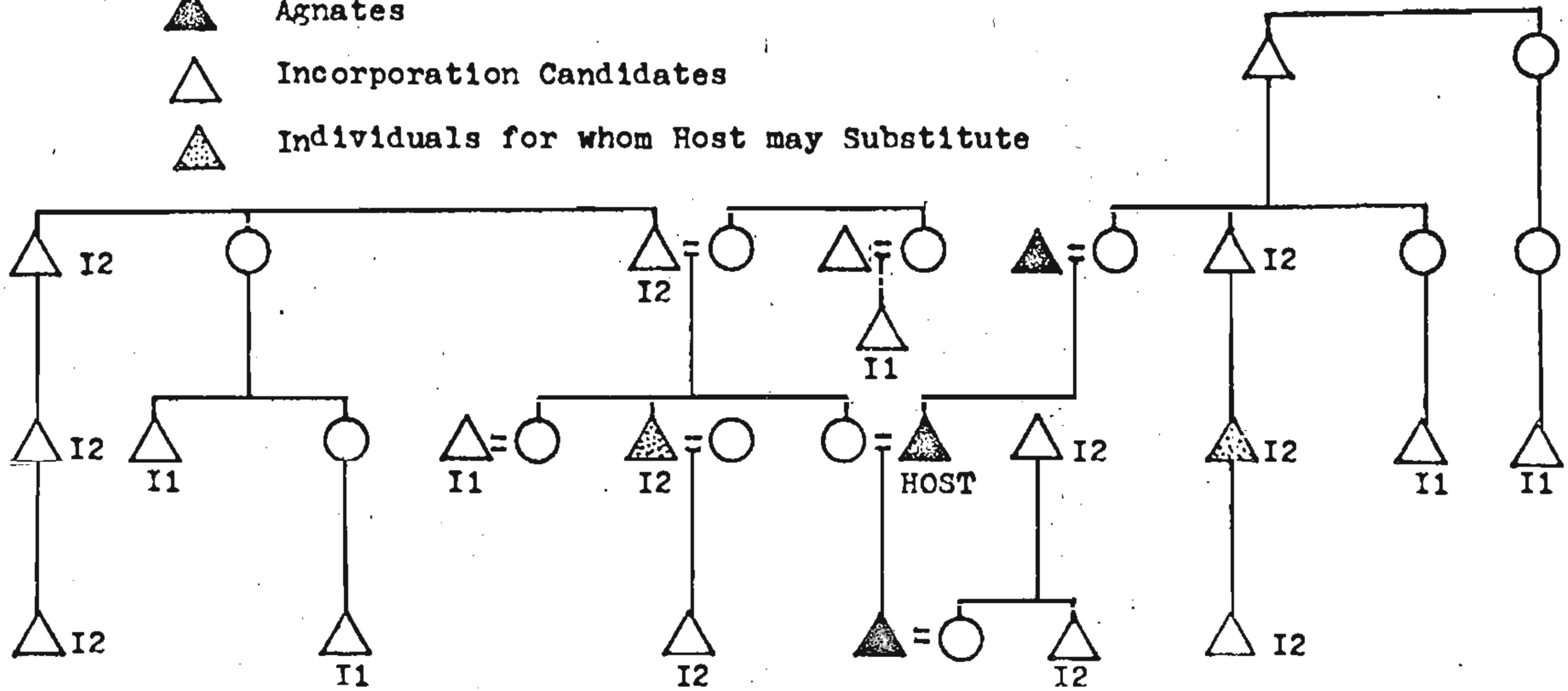


Figure 20: Some Improper Class Incorporation Candidates

the manipulations that were observed in 1972-1975.

The second category includes agnates of the host's mother, wife and son's wife who receive laita from the host and as such are his own prospective hosts. The host does not, of course, himself receive a laita in this case, but I cannot say whether he gives one to the immigrant he sponsors. The one such existing link was utilized for a nonresident garden plot and such grants do not necessarily entail incorporation. As with the next class, this category relies on the mutual assistance principle to 'validate' new group membership.

A final class of immigrant relationships can be specified (Agnatic). There are three ways that host's agnates can become clan members or be reintegrated into the clan. None requires a pig exchange; rather, they focus on the mutual assistance criterion. In the first category are the "dual agnatic descent" relationships in which one or more descendants of the apical women were not members of Kapii clan (four cases). The second category is made up of three BrSn or FaBr of an immigrant who hosted his own agnates. The last category accounts for seven men who are alleged to have no relationship other than membership in a parallel clan or subclan outside of

Yumbisa.

All of the migrants (i.e. individuals who began the incorporation process, thus excluding nonresident cultivators) are brought into the group through some extension of at least one of the two basic principles: laita giving and mutual assistance. Primary, Secondary and Category 1 Improper incorporations constitute an ordered set in which the principle of laita giving progressively deviates from the ideal. For Secondary relationships, the laita is properly given but either the migrant is a helper to an appropriate giver or the host is a receiver of the redistribution of the laita. For Category 1 Improper relationships, the host is plainly not a proper receiver but represents one of his relatives in a different corporate group.

Agnatic and Category 2 Improper relationships are more difficult to order in this scheme. In neither case can the migrant justify a laita to the host and in both cases the migrant is likely to be an important helper to the host for the latter's own exchange activities. Because no laita can be given, incorporation is validated solely by the mutual assistance principle. However, Category 2 Improper relationships represent the antithesis to the *laita* principle since migrants are *laita* receivers not givers. This category would thus appear to rank below Category 1 as the maximal deviation from the ideal. Descent ideology would seem to offer sufficient reasons to support the ready conversion of distant agnates to local group membership. But in terms of *laita*, Agnatic relationships lie between Categories 1 and 2 of the Improper class. I judge this to be so on the grounds that the relationships cannot be used for a *laita* to host (i.e. they are less ideal than Category 1) but they are not as aberrant as Category 2 (i.e. the individuals are potential co-receivers of a *laita* that the host receives but they are not possible recipients of a *laita* given by the host).

Thus I would rank order the relationships from most to least ideal as follows: Primary, Secondary, Category 1 Improper, Agnatic, Category 2 Improper. This arrangement is predicated on the elicited information concerning ideal migrant relationships and observed manipulations in exchanges. This ordering was not itself derived from informants. The requirement that the migrant "act as a brother" insures that incorporation will be secured and is applicable in all cases regardless of the *laita* relationship by which the migrant entered the group (or the lack of such a relationship).

Taken as a whole, it would appear that almost any relative could be incorporated by some interpretation of exchange relationship or mutual assistance idioms. However, when occurrence of the above classes of relationships are stratified in twenty-year intervals a clear pattern emerges (see Tables 33, 34, and 35). Some 22 individuals had or have multiple relationships to Kapii clan members. When such cases were compiled they were assigned as a "fractional relationship" in each of the appropriate classes. From that tabulation, the proportion of non-natal men in each class to the total with known relationships for each time period was expressed as a percentage. The unknown relationships are equivalent to 8.5 non-natal men. The results are further stratified for immigrants, temporary immigrants and nonresident cultivators.

In Tables 33 and 34, the proportion of individuals entering Kapii clan through Primary relationships begins high, drops as incorporation increases and rises again with constriction. For immigrants, Secondary and Agnatic ties only occur in the florescent periods of incorporation while for temporary immigrants they persist somewhat

Class of Relationships	Percent of Total per Time Period					Number of Immigrants
	1881-1900	1901-1920	1921-1940	1941-1960	1961-1975	1881-1975
Primary	100	48	47	69	100	22
Secondary	-	6	3	-	-	1.2
Agnatic	-	12	27	-	-	5.5
Improper	-	34	23	31	-	9.8
Number of Immigrants of All Classes per Time Period	2	12.5	15	6.5	2.5	38.5

Table 33: Change in Percentage of Immigrants of Different Classes of Relationships

	Percent of Total per Time Period					Number of Immigrants
Class of Relationships	1881-1900	1901-1920	1921-1940	1941-1960	1961-1975	1881-1975
Primary	100	50	10	57	100	11
Secondary	-	17	20	14	-	4
Agnatic	-	17	-	14	-	2
Improper	-	17	70	14	-	9
Number of Immigrants of All Classes per Time Period	2	6	10	7	1	26

Table 34: Change in Percentage of Temporary Immigrants of Different Classes of Relationships

	1881-1900	1901-1920	1921-1940	1941-1960	1961-1975
Percent in Primary Class Relationships	100	49	32	63	100
OD_o	.88	.75	.68	.72	.82

Table 35: Percentage of Immigrants and Temporary Immigrants in the Ideal Category and Occupational Density

longer. The relationships of temporary immigrants deviate from the ideal towards Secondary relationships and between 1921 and 1940 show a strong reliance on Improper incorporation. During the whole time 33 individuals in Primary relationships were sponsored, of whom 22 became permanent immigrants while 11 were temporary. The other relationships result in 16.5 permanent immigrants and 15 who later left. Thus Primary relationships are much more likely to result in permanent residence while all other relationships (and relationships of the category Improper alone) are equally likely to last or not. There can be many reasons for departure, generally involving a deterioration of relationships with host or simply a better option elsewhere, including the migrant's natal home.

As near as I could ascertain, both immigrants and temporary immigrants initiated their change of affiliation in exactly the same way. Nonresident cultivation can apparently lead to incorporation but it is difficult to determine such cases in the past. Nonresident cultivators in this compilation have not been incorporated and thus constitute a special case considered below. Immigrants and temporary immigrants taken together, represent the incorporation phenomenon in total for known Kapii clan history.

If, then, this process is related to pressure on land as herein conceived, occupational density on cleared land should bear an ascertainable relationship to the alterations in incorporation practice over time. Such a relationship can be adduced. Basically, I suggest that the degree of correspondence between the ideal alternative recruitment principles and relationships of hosts to incorporated individuals in practice, covaries directly with pressure on land. Where pressure on land approaches that for an $OD_c = 1.0$, incorporated individuals tend to have Primary relationships while lower pressure is associated with the admission of individuals having other relationships. The degree of correspondence variable can be measured from Tables 33 and 34 and pressure on land can be operationalized as the index of occupational density on cleared land.

We may assess this association for Kapii clan data as follows. Table 35 combines immigrants and temporary immigrants from Tables 33 and 34 for Primary relationships (expressed as a percentage of all known relationships for each period). The occupational density at the midpoint of the time intervals by smoothed curve interpolation provides the other variable. The correlation coefficient (r) for these five pairs of points is 0.92 which suggests a highly linear relationship (direct) and implies that there is a strong association (significant at the 0.05 level).

The nature of the association can be examined more closely. The temporal pattern of Primary relationships shows a stronger displacement during the peak incorporation period than before or after. In other words, although the numbers of Primary immigrants varies between eight and nine for the middle three time intervals, there are more relationships of other classes utilized. The Primary criteria remain intact and others are additions as indicated earlier. As pressure on land drops, selectivity of migrant relationships relaxes. This is apparent by inspection of Table 36 which gives the frequencies of relationships in the various classes for each time period.

A quantitative estimate of the degree of displacement from Primary relationships can be made as follows. First, some numerical value must be assigned to the ranks in the ordering of the classes. I have used 5 for the Primary class and decreased the value by one for each class or category down through the rank order previously

Class of Relationships	1881-1900	1901-1920	1921-1940	1941-1960	1961-1975	Rank Value of Class
Primary	4	9	8	8.5	3.5	5
Secondary	0	1.7	2.5	1	0	4
Improper (Category 1)	0	3	6	1	0	3
Agnatic	0	2.5	4	1	0	2
Improper (Category 2)	0	2.3	4.5	2	0	1
Weighted Mean	5.00	3.68	3.22	3.96	5.00	

Table 36: Frequencies of Relationships in Classes and Weighted Means for Immigrants and Temporary Immigrants

explained. One then calculates the "weighted mean"[8] for each time period. This represents the mean rank value for each time period considering the frequencies in each class and the dispersion with respect to rank value (see Table 36).

For the 1901-1920 period the weighted mean is 3.68, it drops to 3.22 in the least restrictive period, then rises sharply to 3.96 as incorporation is restricted. There is a slight indication that incorporation more rapidly deviated from the ideal in 1901-1920 (weighted mean = 3.68) then it returned toward it in 1941-1960 (weighted mean = 3.96). If this weighted mean is correlated with OD_c, a strong association is suggested: r = 0.93 (significant at the 0.05 level).

Whether or not this numerical evaluation of the degree of deviation from the ideal category between 1901-1960 is accepted, one thing is clear. Before OD_c dropped below 1.0, no incorporations were reported. The first cases are all in the Primary class and during the next three time periods in which OD_c was lowest the maximum

---

[8]

$$\text{Weighted mean} = \frac{\text{(rank value of clas)X(frequency in class)}}{\text{(frequencies in all classes)}}$$

number of non-Primary incorporations occurred. When OD_c rose again, Primary relationships alone were represented.

We may now consider the relationships of nonresident cultivators. Since these individuals are not incorporated and since the gardens serve auxiliary functions, a different pattern can be expected. Table 37 shows that Primary relationships accounted for the first grants and that, over all time, nonresident relationships correspond more closely to the ideal than do the other two social categories (Tables 34 and 35). This would suggest that grants to these nonagnates are more likely to be given to "reliable" relatives--those most likely to give _laita_. The maximum deviation from the ideal occurs between 1921 and 1940 which was the least restrictive period for all social categories. The weighted means for this case from the 1901-1920 period to the present are respectively: 5.00, 3.41, 4.21, 4.25. As before, the degree of deviation from the ideal is maximal in 1921-1940 and progressively shifts back toward Primary relationships. However, the most recent time period shows a resurgent deviation from the ideal in the percentage figures and very little change from the preceding period by weighted mean. This derives from the different role of nonresident gardens in

Class of Relationships	1881-1900	1901-1920	1921-1940	1941-1960	1961-1975	Number of Immigrants 1881-1975
Primary	-	100	59	70	55	25
Secondary	-	-	-	6	25	3.5
Agnatic	-	-	6	24	10	5.5
Improper	-	-	35	-	10	4
Number of Nonresident Cultivators of All Classes per Time Period	-	3	8.5	16.5	10	38

Table 37: Change in Percentage of Nonresident Cultivators of Different Classes of Relationships

social interaction. Since such grants do not entail incorporation and require smaller amounts of land for shorter periods, the practice of giving usufruct rights to nonresidents is less sensitive to land pressure. (The correlation coefficient of the weighted means and OD_c is 0.51.) In addition, during the 1961-1975 period, valley land is relatively abundant for some residents because of declining population even though an overall reduction in productivity due to lack of clearing activity raises the OD_c. Incorporation would be unwise but a temporary grant to a nonresident may be useful in the manipulation of interpersonal relationships. Nevertheless, the overall pattern suggests that if OD_c continues to rise, this option too will be curtailed.

A second relationship can be perceived in the Kapii data which is quite simple. <u>The number of individuals who are admitted to the group varies inversely with occupational density</u>. This should be understood to apply only to the period in which OD_c is less than 1.0 and, as before, immigrants and temporary immigrants constitute the major case while nonresident cultivators are differently articulated. Table 38 gives frequencies of migrants, nonresident cultivators as a separate category and

	1881-1900	1901-1920	1921-1940	1941-1960	1961-1975
Number of Immigrants and Temporary Immigrants	5	19	29	13.5	3.5
Nonresident Cultivators	0	3	8.5	17.5	12
OD_c	.88	.75	.68	.72	.82

Table 38: Frequencies of Immigration and Nonresident Cultivation

OD_c.[9]

The correlation coefficient for this relationship is -.87 (significant at 0.05 level). As in the previous relationship, the frequency of incorporation is restricted somewhat more sharply than it is expanded.

The pattern for nonresident cultivators lags behind that for migrants but otherwise shows the same form. The correlation coefficient is -.49 which supports the notion that nonresident grants serve a related but different purpose, as explained previously. In the preceding section the effect of dispersed gardens in category I areas on OD_c was estimated. If that measure of OD_c is used for the correlation to frequency of migrants, r drops to -.75. Similarly, for the "degree of correspondence to recruitment ideal" (percentage of Primary relationships), r drops to 0.80. This would be an expectable result if dispersed gardens were viewed as transient or insecure

[9]The fractional frequencies in the last three columns derive from immigrants who were closely associated with two lineages, one earlier and one later. As in other such cases it is difficult to determine which one an immigrant belongs to in his own lifetime. His children usually show one primary lineage affiliation. Since this comparison is made to OD_c and both hosts give land it seems reasonable to "divide" such men between their two relatives.

resources. Then a prospective host's decision to sponsor a migrant would be based largely on an evaluation of his local resources and OD_c on local areas would better predict incorporation behavior. I cannot evaluate this possibility in detail, but I did observe that a nonresident was expelled while, in the same incident, a temporary migrant became a nonresident cultivator. The difficulties were later ironed out and it appeared that the temporary migrant could, if he chose, return to Kapii but the expelled nonresident could not or would not. Add to this the observation that most category I gardens are on the slope and thus unlikely to be very productive for long. Such gardens would appear to be insecure and transient.

This completes the analysis of the major Kapii data. Before proceeding to draw generalizations, a recapitulation of the central argument and attendant assumptions with respect to this one historical process is in order. Energy harnessing capacity at Yumbisa is determined by the adequacy of the subsistence adaptation. Among many coping strategies that serve to guarantee subsistence security, two stand out. The phenomenon of migration to hosts at lower elevations after severe frosts can be seen as a response to rarely occurring, maximal disruptions in subsistence production (Leibig's "Law of the Minimum") although it also serves for lesser numbers of people on more frequent occasions (when their dispersed gardens are not in production or they have none). The dispersed garden system is, however, the dominant response to more frequent food shortages. Various lower level strategies have been outlined which complete the picture.

Both of these responses rely on the same general constellation of social relationships and their concomitant exchange activities. These networks, actualized by exchange of pigs and other valuables for women and death compensation, facilitate temporary movement out of Yumbisa for subsistence purposes. They also facilitate the reverse flow--immigrants into Kapii clan and garden grants to nonresidents. The incorporated individuals and their descendants, in turn, establish the same relationship with their subsistence base. But the process of incorporation provides a positive feedback loop which accelerates the clearance of forest, in itself allowing for further incorporation. Even so, land is differentially distributed among individuals and lineages which leads to further clearance, category I gardens and ultimately the constriction of incorporation.

Thus, what appears to be a low density adaptation can be seen to alter over time in response to both land shortage and surplus land. The overall system output deriving from myriad individual decisions and evaluations exhibits a clear pattern of relationship between clan "pressure on land" and group composition in terms of membership criteria. This composition is an unintended (though not unrecognized) result while the evaluation of subsistence resources and practice is a day-to-day theme--the perception of which is acute.

I say the relationship is clear, but it can be so only in relation to the assumptions from which it was generated. I have attempted to specify the analytic process of arriving at these allegations. In that regard it should be noted that the final correlations demonstrated in this section, which are fairly simply stated, are the end product of a lengthy series of approximations each with its own assumptions. The variable "number of migrants incorporated" seems fairly straightforward. Yet it rests upon the population model used to reconstruct the temporal pattern which, of course, derives from current observations. The classification of relationships is similarly grounded but entails as well the integration of elicited preferences in relationships and a hierarchical organization. In both cases the other term of the relationship is an occupational density index which rests upon a discernment of various features of the subsistence subsystem, principally garden types, yields and fallow patterns. The latter, especially, contains several variables and the population/cultivation model is critical to the OD_c calculation.

It may then be somewhat surprising to some to find such strong correlation coefficients. A calculation of confidence intervals for these correlations shows that the small number of data pairs results in a broad interval so that one can be "95 percent certain" that each correlation is positive or negative as appropriate but not much more. Yet it would seem unwise to divide the time categories much finer due to the difficulties in estimating peoples' ages. I am not trying to "prove" these relationships in any rigorous sense since that can only be done adequately with independent data. I am, however, concerned to establish their plausibility and to show a consistent pattern of interrelations.

It is certainly not my intention to belittle the results. I have attempted to show the (nonstatistical) rationale for alleged relationships in each case. Rather, harkening back to remarks in the introductory chapter, I wish to reaffirm the necessity for articulating many factors in specifiable relationships of some complexity--factors which, moreover, can be operationalized. That procedure, however, still suffers the inherent difficulty of evaluating residual variance or, to put it differently, the effect of factors not considered. In this particular case, the variable complex most conspicuous by its absence (necessarily) is that of ideology. One would be ill-advised to assume a correspondence between practice and ideology. In two cases I have been directly concerned with ideological parameters. In the first case, the calculation of OD_c relies on the determination of fallow patterns sufficient to produce yields of the sort approximated. The current fallow pattern happens to correspond fairly well with implications of that pattern and people allege that it is the ideal pattern. They may not always have thought thus. The ideal pattern nevertheless serves as an invariant frame of reference against which to measure deviation. In this case it is likely that people actually held this ideal except as indicated earlier. Certainly there is a lower limit on their expectations but the upper limit is open-ended. One cannot say for certain.

The second case is that of ideal relationships of migrants. Just as OD_c should not be taken to imply preferential fallow period rising and falling through the history of cultivation, neither should variation in number of migrants incorporated nor their relationships necessarily imply an alteration in the way people conceive of incorporation. This study is concerned mainly with the role of subsistence as a mediator between environment and social behavior. The very important relationship between social organization and ideology would be an inappropriate area of speculation simply on the basis of ecological and demographic patterns. However, the current ideology and current social organization may be articulated and compared to ecological factors. This, then, allows for some degree of generalization from the Kapii case to wider areas. That endeavor begins in the next chapter.

CHAPTER V

COMPARISON AND IMPLICATIONS

A. Forest and Frost

Up to this point I have been concerned with extracting the general temporal pattern of developments exclusive to Kapii clan and indicating the implied relationships between regularities of behavior and ecology. It is now necessary to recast those particularistic findings into relationships which have greater general applicability in order to suggest a more encompassing pattern of relationships which may shed light on process and structure over a wider cultural and geographical range. Such a step sacrifices much of the detail of the particularistic study. Directly comparable material for other highland societies is, with a few exceptions, not available, especially details of agricultural dynamics. Kapii clan represents only one of numerous social units each imbedded in a matrix of cultural, demographic and ecological factors not quite the same as any other. Whatever was "missing" in the history of Kapii clan must be supplied by cross-cultural comparison and/or reference to other cases if we are to develop a framework with which to analyze the varying patterns of different highland societies. Clearly such a task can never completely be accomplished. Thus, I confine my conclusions and speculations to a few common concerns that reappear in the literature on HNG. I state what I think Kapii clan history reveals about relationships between people and place, show how other cases are similar and different and finally speculate spacial and temporal patterns in general for HNG cultures.

There are two features of the Kapii case which are fairly unusual in highland ethnography and are fundamental to understanding agricultural dynamics at Yumbisa in comparison to other areas: 1) the people recently pioneered an uninhabited forest; 2) damaging frost is common. The first feature stands in stark contrast to "high density" adaptations commonly described in the literature where forest is often restricted to remnants on ridge tops. I take this to be of positive value for comparative purposes, and it also provides the possibility of glimpsing comparable circumstances in the early development of current "high density" groups.

The second feature has received a certain amount of notoriety since the 1972 frost (Waddell 1974, 1975; also Waddell's Sirunki work before the frost, 1972). The analysis of social relationships used to cope with this environmental stress is instructive because it reveals the role of exchange in maintaining ties outside of the local group and the multiple functions of these ties.

As Kapii clan grew, even in the face of recurrent subsistence disruptions, increased population was always provided for by clearing into the forest. This was true before as well as during the period of incorporation. Out-migration has been minor. Informants insist that natal residents never leave. The genealogies, however, indicate that several individuals in the first few decades, when occupational density was high, did leave. Currently three agnates live nonlocally and one is certain to stay away. For the most part, however, the allegation holds. Despite recurrent frost, Yumbisa has been a receptor of migrants, not a source. As indicated, incorporation accelerated the population growth and forest clearance.

Life must not have been all that bad at Yumbisa in comparison to surrounding areas which provided migrants. Nevertheless, the local adaptation entailed a careful attention to maintenance of network ties outside Yumbisa in order to provide frost retreat hosts and dispersed gardens. The brideprice-death compensation exchange system characteristic of the greater region provided the "game board" for these ties. Within these constraints, individuals were perforce engaged in activating interpersonal relationships or relying on relatives who were better able to do so. Bigmen (or at least "bigmanish" behavior) provided greater subsistence security for individual families as well as their kinsmen through more and better (more certain) ties and relied on the creation or manipulation of a following. Once the pioneer phase was over at Yumbisa, incorporation of outsiders could be used to enhance such groups of followers and provide labor in forest clearing as well. The next generation had to clear their own gardens. With impending land shortage, followers tended to be nonagnatic descendants because incorporation became constricted. The process was deflected by contact related population decline.

Clearly such a situation is not directly comparable to central Enga or other well-documented highland groups which lack substantial forest resources. However, broadly conceived relationships may be abstracted from the Kapii data which illuminate those other areas by contrast. The two major "variables" I wish to focus on are pressure on land (OD_c heretofore) and agricultural intensity (I_e).

The number of people inhabiting a delimited space has in one fashion or another been seen as a fundamental factor in attempting to account for some aspect of their behavior. In HNG the pivotal issue concerns the mechanisms by which a ratio of people to space is adjusted, to what ends and failing those ends, with what consequences. Meggitt's hypothesis and derivative reflections (1965, 1977 and elsewhere), Rappaport's pioneering analysis of the role of ritual (1968), Kelly's examination of demography and descent group structure (1968), Watson's seminal concept of society as "organized flow" (1970), Brookfield's regional distributions (Brookfield with Hart 1971) and Waddell's synthesis (1973) are central examples of this interest. The migration of individuals and groups from "high density" areas to lower density locales has been seen as the major form of population adjustment (as opposed to checks on population growth). The necessity for these movements is commonly attributed to warfare rather than soil exhaustion, for example. Reported instances of groups fleeing their homeland after defeat are common in many areas, sometimes with permanent loss of land, sometimes not. Additionally, malaria may have been a factor and the introduction of the sweet potato played a role not yet fully evaluated (Watson 1965, Brookfield and White 1968). Voluntary migration is less frequently noted and the frequency of movements from a low density social group to a higher one is unevaluated.

It is Waddell who most cogently and concisely sums up the "density functions" from the ecological viewpoint and in so doing implicates agricultural intensity, migration and various social features. He suggests that variation between group territories in population size and density "accounts for" variation in intergroup relationships (1973:41). Echoing Brookfield and Watson, Waddell suggests that relative scarcity of resources stimulates migration which tends to right density imbalances regionally and thus to reduce warfare over land. Agnatic ideologies are "flexible mechanisms" which may be used to restrict or open corporate group membership, as A. Strathern (1968) emphasized. Obligations of membership serve to maintain group territory and make agricultural intensification possible and worthwhile. Moreover "it is precisely those societies that effect substantial improvements to agricultural land through tillage that place the greatest emphasis on agnatic status" (Waddell 1973:51). Group solidarity must be maintained but flexibility in membership is required to sustain numerical strength. Thus population pressure expressed as intensification of agriculture leads to stress on agnation in terms of "the measures which are taken to encourage immigrants to acquire agnatic status--that is, the extent to which the local population are pressed to conform to the model" (Ibid:52). In this sense, Waddell concludes, Meggitt's ranking of "stress on agnation" stands and "organized flow" is independent of generalized density. It is local circumstances that determine mobility which can be significant under either high or low density. Assimilation practices vary with intensity.

In this light I return to the Kapii case to suggest its relevance to wider implications. Allow me to reinterate that Kapii gardeners, like most subsistence agriculturalists, are intimately familiar with their resources. People are active participants in their lives and rarely pawns of their environment. I do not wish to belabor a point which may be obvious, but it is necessary when attempting to describe regularities of behavior in the large to specify the behavioral context which generates such regularities. Hence my concern with describing various "strategies" employed by individuals or classes of individuals who experience particular constraints and options. Nevertheless, it is as certainly the case too that the composit behavior of social groups is not necessarily the same as that of any individual. That is to say, there are emergent changes in circumstances, unintended consequences of various strategies, with which individuals must cope as a result of their own and other individual's actions. From this nexus, the "directional drift" that yields spacial and temporal distributions of social behaviors must be examined to determine sociocultural regularities.

A concept such as "pressure on land," as operationalized by OD_c in this study, will not have the same implications when applied to central Enga. Strategies there which might be utilized to secure land or food will likely vary from those reported for Yumbisa even where numerical values of OD_c are identical. Clearing forest is not a viable strategy for most Mae Enga. On the other hand, something will be done to alleviate perceived shortages--to make ends meet. In the last analysis, people do what they have to do to get along and by and large they succeed. What they do is constrained both by cultural and physical factors and encouraged by the same two spheres so that "having to" is rarely a question of brute survival.

The history of Yumbisa is characterized by differential distribution of land resources. Before 1870, no family was reported to have had land resources which would yield an $OD_{ct} > 1.0$. By 1910, the number of such families had risen to 63 percent, then dropped to 20 percent in 1950 and rose to 50 percent in 1975. Incorporation began during the first upswing in the number of families with an $OD_{ct} > 1.0$ and peaked just before the 1950 trough. Pressure on land as measured for the clan, however, is not the same as that for any individual. The clan as a whole was short of cleared land before 1870 and not thereafter. But during all periods, some families were short of adequate ideal long-term resources. The general clan circumstance likely has an influence on individual behavior since there exists (at least currently) an idea approximating our notion of a corporate landholding unit. The individuals who were short of land pursued the strategies previously described (clearing, acquiring grants of cleared land, association with other households, local dispersed gardens), and many of those with large holdings cleared as well, especially if they were hosts. Hence there was pressure on land at all times even when land distribution was most equal and regardless of incorporation practice.

Forest clearing was ultimately the major response to provide for an increase in population. Each generation provided substantially for itself by clearing new land, until recently. The Kapii adaptation up to about 1945 was, in effect, very much like that of shifting cultivation, especially during incorporation. In addition to the positive feedback phenomena of incorporation and its consequences, it would appear that the ideal fallow restriction alone would result in a similar pattern. Families who never satisfied the $OD_{ct} > 1.0$ criteria were unlikely to have been short of food. They may, however, have had to work somewhat harder. If more frequent cultivation of their plots led to deteriorating yields per area, more mounds would have to be constructed per individual. In short, these families may have had to intensify their labor inputs. I am not certain that they did so to any large degree because options such as joint households and internal temporary grants from clansmen may not have been well remembered (probably were not) in the cultivation histories. The ideal fallow pattern would seem to be more than adequate, and it may be that cultivation can be continued longer than informants suggest with minimal deterioration in yield. Careful measurements and accurate histories of cultivation would be required to settle this question.

Forest clearing itself should be considered in terms of agricultural intensity but in a somewhat different way than it is ordinarily viewed. The difference at Yumbisa is that forest clearing occurs only once. Shifting cultivation requires a periodic but relatively frequent labor input for clearing as well as the post-clearance gardening inputs. To the degree that Kapii clan was involved in clearance for most of its history, it approximated this adaptation. Once clearing ceased to be a major response, the situation with land took on a totally new character. As Waddell indicates for Mondopa, a substantial improvement had been made in land--cleared, ditched, and fenced valley land at Yumbisa. It was no accident that incorporation was restricted at the same time that most social groups all but completed valley clearance. Although this change is well reflected in the correspondence between the OD_c measure and patterns of incorporation practice, the change is probably more far reaching. Valley land resources are fixed, and this fact will dominate future developments and strongly condition land pressures. A period of essentially swidden slope utilization will occur and concomitant valley intensification as the two types of gardens grow farther apart in distance.

Contact factors and the frost of 1941 tend to cloud the picture. For the former, population decline released some valley land and, for the latter, the frost may have led to the loss of some temporary immigrants. Frequency of temporary immigrant departures peaks just after that frost but this may also have been part of restrictions on incorporation. Had contact not occurred, constriction soon leading to termination of incorporation would have to have happened anyway unless significant outmigration also occurred. In either case, given the inferior long-term productivity of slope alternatives, valley land becomes the major investment in land resources and current cultivators provide the gardening input to utilize a resource secured by earlier generations.

During the period of forest clearing at Yumbisa, differential distribution of land and incorporation practices led to fairly constant activities in developing the land resource. Labor inputs were high in this process. Currently, the labor of ancestors and steel technology allow for a low labor input. If population now grows, agricultural intensity must rise as slopes are utilized. Clearing and intensification of gardening are similar strategies with different results.

Because Yumbisa has most likely been cultivated by mounding techniques since its settlement, the level of agricultural intensity has presumably always been higher than that of simple swidden without significant tillage. In Appendix 7 I have attempted to estimate the fluctuation of intensity through time. The calculations yield a "group intensity" measure and rely on the differential distribution of types of land by slope and age. It is obviously a very rough estimate but suggests the progressive change from a type of shifting cultivation on the slopes to current utilization of a fixed resource in the valley. It is difficult to assess Waddell's notion that assimilation of migrants is more rapid under high intensity from those data. However, as I have noted, restriction of incorporation corresponds temporally with the change from expanding resource base to a more fixed relationship with valley land, even with the drop in population. No attempt to mask descent relationships of immigrants or their descendants is as yet apparent and the ideal incorporation ideology is readily verbalized and alleged to be old. The calculated group intensity figures are nearly constant up to the point of change. Overall intensification does not seem to have occurred at Yumbisa though it clearly must occur when the forest clearing option is gone. Clearing the forest provided the increased yield for the whole group that increased labor in tilling, mulching or more frequent cropping could have provided without expansion.

How such a situation is to be compared to areas without an expandable land base is a difficult question. Clearly one similar option for other areas is warfare for land acquisition, as Meggitt (1977) describes it in central Enga, amounting at the extreme to forced outmigration of the losers. This is just the opposite of clearing forest because developed land is acquired by the victors. Although labor inputs may fall with added land they probably will not do so rapidly unless the acquired territory is exceptionally rich. Labor inputs and yields per area will certainly not increase as much as with clearing.

However, if intensity is taken to mean simple input per output a rough comparison can be made with Waddell's Laiapu observations (1972). (The clan there is called Aruni. The clan parish is Sambakamanda and Mondopa is the name of Waddell's sample community where a portion of the clan lives on a section of terrace land.) At Mondopa, 36 workers spend 37,300 hours in a year on subsistence agriculture (excluding pig care and cash crops). The garden area involved is about 6.8 ha. and the harvest is 117.4 tons of produce. Comparing these figures with my Kapii estimates, it is noted that 227 workers spend 107,000 hours in a year gardening 24.9 ha. and harvesting 359.8 tons of <u>sweet potatoes only</u>. The yield figures used in the Kapii calculation are based on production during "good times" and must be higher than a long-term average because recurrent frost would decrease total output. The production of other vegetables is ignored here as a compensation for the effect of frost for which I have no estimate over the long run. Using my admittedly questionable estimation, Mondopa gardeners produce just over 17 tons/ha./year while Yumbisa produces just over 14 tons/ha./

year. Mondopa workers expend 4,610 person-hours/ha./year compared to 4,300 for Kapii. Thus, one person-hour of labor/ha./year yields 3.8 kg. at Mondopa and 3.4 kg. at Yumbisa. If anything, the figure is probably a little higher for Yumbisa, but the estimates are quite close. In other words, comparable inputs produce comparable outputs when distributed over equal land areas and times, and in this sense agricultural intensity is similar. However, the Mondopa production derives largely from the mondo gardens which are almost continuously cultivated while Kapii gardens use a long fallow (C = about four for valley gardens). Hence, for longer periods, Mondopa intensity must be on the order of four times greater than at Yumbisa because each plot of Kapii old valley land lies uncultivated three-quarters of the time.

If the two places are compared for time inputs alone, the Kapii figures are more trustworthy. A Mondopa worker spends 1,036 hours/year (Ibid.:104-5; Table 26) while a Yumbisa counterpart spends only 471 hours. Breaking this down into male and female labor, a Mondopa woman spends on the average 1,303 hours/year and a man 738 hours/year. This compares to 801 hours/year/woman and 50 hours/year/man at Yumbisa. At Mondopa women account for 66 percent of the agricultural work time while at Yumbisa the figure is nearer 95 percent.

This latter type of calculation is more likely to yield information on individual responses to agricultural practices while the earlier intensity measure represents an "index" (comparable to OD_c) which summarizes a group response and is probably more appropriate for regional or long-term dynamics. As several times indicated, the system output must be articulated with the patterns of individual responses if the dynamics are to be understood.

The amount of male input at Mondopa (mainly clearing, fencing and male yam gardens) might be construed as a necessity of more intensive cultivation--the result of diminishing returns for labor--where women are generally responsible for gardening. However, the male yam gardens serve, in part, a special function--that of providing food for life crisis rites and visiting exchange partners. (They might also provide foodstuff when drought or other disruptions reduce <u>mondo</u> sweet potato output.) Such plots are confined to the dissected gorge slopes and utilized by slash and burn techniques with high labor inputs in ground preparation and fencing. To some extent then, these gardens are "surplus" to the major productive <u>mondo</u>

area and relate to social features of exchange and male activities.

At Yumbisa the current disparity between male and female labor inputs derives from the introduction of steel tools, population decline and abundance of valley land. Just before contact, men probably provided 33 percent of the time inputs much like Mondopa men of 1966, a bit more during the maximum in 1890, and 14 percent during the transition from slope to valley reliance around 1830 when there was little clearing (see Appendix 7). The male labor was in this case directed at clearing, ditching and fencing gardens for basic subsistence. A social response occurs with the incorporation of nonagnates (especially young males) and their contribution to forest clearance. In a way similar to Mondopa male gardens, incorporation to aid exchange and male activities is "surplus" to the major production of foodstuff for natal members but the results of the process contribute to development of the major resource base.

At Mondopa, again, in the absence of rich foraging areas such as those available at Yumbisa, high outputs are necessary to support large pig populations associated with the great tee exchange cycle. Kapii people have other reasons to produce high outputs. Frequent frosts and/or droughts tend to retard sweet potato development. If a family has a large area in production, they simply eat more smaller tubers harvested earlier than usual. If no frost occurs, the pigs readily absorb this production--otherwise they forage.

Waddell's figures give mean daily consumption by pigs of 1.5 kg./day one year before the tee. During the good times of early 1975, pigs at Yumbisa had available 1.8 kg. per head per day by my observations. The difference between Mondopa pig consumption and that at Yumbisa, though small on the average, amounts to food for 55 additional Yumbisa people when pig population is 255, the observed mean. This is a small safety margin but one which minimizes additional labor input. When need be, people eat the pigs' share and pigs can forage without great detriment for several months, to judge from my observations after the frost.

There is no great tee at Yumbisa nor any such large scale "ceremonial" exchange of valuables characteristic of the core (dense) areas in the highlands. There would, however, seem to be no particular ecological reason why such could not occur at Yumbisa. I know of few data on the numbers of pigs (and valuables) exchanged by any social group over times comparable to that compiled in Table 14.[1] Consequently, I cannot judge the relative scale of exchange activities. But pig to people ratios are in general higher outside of Yumbisa (variously 1:1, to 3.3:1). The crucial question is one of long-term effect. It would appear that more pigs are produced in these areas and, presumably, passed around more. The pig population is widely recognized to be an important factor in demographic/ecological considerations. A critical question is this. Are population size, density and agricultural intensity associated with "social intensification" and, if so, in what sense and how? For "social intensification" in this case I suggest an increase in scale and frequency of formal instances of interpersonal and intergroup interaction--basically exchange activities but also warfare, alliance and derivative network and corporate relationships (cf. Watson 1977).

---

[1]Meggitt (1958) provides the information that 406 pigs changed hands at Sari in sixteen months. This gives a measure of .29 pig-movements per month per male over fifteen which compares to .31 at Yumbisa (from Table 14). However, the pig to person ratio at Sari, like Yumbisa, is lower than elsewhere. More extensive data are needed.

I do not intend to pursue this question here but the Yumbisa situation suggests some possible chains of inter-relationships that may contribute to such an investigation for HNG. Yumbisa was undoubtedly settled by people who shared a generalized, basic cultural repertoire of behavior (in the fullest sense) characteristic of the greater Enga area. Whatever transpired in the past 170 years, the outcome is a replication at Yumbisa of many of the basic cultural patterns of that larger group. Neither the "dead hand of tradition" nor "environmental determinism" decreed the current adaptation but culture and environmental adaptation surely played a part. The pan-Highland pattern of exchange as a validator (a maintenance mechanism) of interpersonal and intergroup relationships is put to a slightly different use at Yumbisa. There, acquisition of local dispersed gardens, frost migration hosts, nonlocal dispersed gardens and incorporation of nonagnates are useful or critical to Kapii survival, and all hinge upon satisfactory participation in the exchange system. In the core areas such exchange may be directly analogous by providing haven for individuals after defeat in warfare. It certainly contributes to alliance functions. Bigmen emerging from exchange activities are a critical factor in adjusting people-land ratios, pig population and so forth (see Waddell 1973:43 for a diagram of inter-relationships surrounding the central role of bigmen). As Waddell and others also suggest, migration tends to right demographic imbalance and perhaps mitigate warfare to some extent (though some migration is a direct result of warfare). And, if population density and its entailments intensify exchange, the resultant increase in pig population intensifies agriculture and pressure on land in ascending spirals unless or until regional fluctuations in demographic and/or political relationships achieve a quasi-static balance.

B. Ideology and Agricultural Intensity

At Yumbisa the descent group ideology appears to be basically the same as that for the Mae Enga (Meggitt 1965) in terms of intrasegment behavioral ideals and intergroup oppositions. However, at Yumbisa the overt and formalized alternative recruitment principles for non-agnates differ. I have here defended the notion that incorporation practices are directly conditioned by relative land scarcity when exchange activities and labor resources are considered. The alternate recruitment idioms at Yumbisa resemble an approximate formalization of the incorporation practices among the Mae. According to Meggitt, nonagnates should become "brothers" after incorporation--ideally renouncing membership in their former clan, especially inheritance rights for land. Old men without sons may try to recruit SiSn or DaHu but these migrants are apparently very insecure. The bulk of the migrants associate themselves with a bigman (related as his WiBr or SiHu) and the host aids them in brideprice and exchange. Nonagnates have fewer wives, less land and are in jeopardy of being expelled; many are, in fact. Some 50 percent of nonagnates are from the same phratry (vs. 25% at Yumbisa) and migration may occur en masse after defeat in warfare. In succeeding generations, descendants of nonagnates undergo a progressive conversion so that grandchildren of migrants are considered agnates. Death compensation to mother's clan for the living is apparently not a condition of incorporation.

Although it appears that migrants to Mae clans are in general less secure than at Yumbisa, cognates are in the best position to make good their change of allegiance. These SiSn's are, at Yumbisa, the prototypical migrants though not the numerically dominant ones. The two major Mae relationships, DaHu and SiHu, are Primary class recruits at Yumbisa (as defined in Chapter IV) and numerically account for 41 percent of the relationships. The final relationship that Meggitt mentions, WiBr, is an Improper immigrant category at Yumbisa and in all but one case the individuals were temporary immigrants. In Meggitt's genealogy of Kara clan, I find only one WiBr incorporated (1958:319--Lilyepai) which may indicate rarity among the Mae as well. Thus, the Mae practice closely approximates a core set of relationships for Kapii and, conversely, Yumbisa may well reflect an earlier practice among central Enga clans.

Among the Mae a mother's ghost can cause harm to her child, but in practice only a few percent of the attacks Meggitt reports are attributed to such a ghost. At Yumbisa, a mother's ghost can only help her child. The associated exchanges to matrikin are basically similar in both areas. The Mae seem to have more formal occasions for compensating matrikin and the <u>sepya</u> and <u>laitasanda</u> become a balanced exchange of pork. Overall, the net flow of pigs from the deceased's kinsmen to matrikin is about the same per man per time as at Yumbisa (to judge from Meggitt 1965, Tables 77 and 80) but more pigs are involved and many more are killed in each exchange. Payment of death compensation for Mae migrants is determined by the degree of incorporation of the individuals involved. Apparently if the migrant's agnates bury him, they pay. The recipients of Mae death compensation are: mother's agnates (belonging to parallel segments up to subclan), members of lineages of children of female agnates of mother, a few members of DaHu's lineages of deceased married females and an occasional "exchange partner."[2] Mae givers attempt to direct their pigs and pork to particular individuals, with some success. By contrast, Kapii exchanges go to focal individuals in the deceased's mother's lineage, MoMo's lineage and even FaMo's lineage and these individuals redistribute the pigs widely. Consequently, Kapii givers probably have less control in directing pigs to particular recipients but when they are focal recipients they have considerable influence on redistribution.

---

[2]Meggitt reports a few payments to MoMo's kinsmen saying that such is unusual but permissible. They were also, in the observed instances, "exchange partners" and, as in a few other cases, the occasion was used to settle or create debts.

Some 70 percent of Mae recipients are in the mother's clan and another 18 percent in MoSiSn's subclan (the latter approximating the Kapii _tarange talipi_ (relationship) (Meggitt 1965, Table 80). Although I cannot be sure, it appears that death compensation at Yumbisa is more widely disbursed. By comparison, the proportion of Mae helpers outside of the clan is 19 percent vs. 36 percent at Yumbisa (see Chapter II, Table 6). The Mae "one clan, one allegiance" rule, the feature of paying death compensation for a migrant who is buried on his natal clan land and the concentration of death compensation helpers in the deceased's clan, all suggest a focus on the integrity of the social unit. At Yumbisa, the situation seems to be more open; the corporate nature of the group is diluted by individual networks. If this is true, Waddell's notion that agnation relates to clan integrity and agricultural intensity still remains to be demonstrated.

Meggitt (1958, 1965) provides considerable information from which a rough estimate of the Mae agricultural subsystem at Sari may be inferred. There, 276 people and 200 to 250 pigs subsist on 263 ha. of land of all types (in 1960). Of that area, 48 ha. are in bush and roughly 170 ha. is cultivated land, to judge from his sketch map (1958). About 20 ha. are in sweet potato gardens providing 90 percent of the diet. Meggitt gives two indications of yields for sweet potatoes: 1) an overall estimate of 9.1 tons/ha. for a first crop, and 2) 13.6 to 15.9 kg./mound in average soil (implying 11.1 tons/ha. with his reported mound spacing). River flats produce more (15.9 tons/ha.) and have a short fallow period of one or two years compared to twelve to fourteen years on the upper slopes, with an overall figure of six to seven years. There is apparently a yearly planting cycle with maturation/harvest time of about nine months (range seven to ten) but some sweet potatoes are planted all year and second crops on the slope are so poor they may be reserved for pigs. At 9.1 tons/ha./year yield and an assumed mean human per capita sweet potato consumption of 1.3 kg./day (1950 C.), 225 pigs would each have available 0.6 kg./day. <u>Maximum</u> fallow period would be on the average 8.5 years and per capita cultivated area something over .072 ha.

If these estimates are correct, Kara clan pigs are surviving on rations much lower than elsewhere in HNG. However, 48 ha. of bush and swamp plus foraging in fallow gardens may supply considerable foodstuff. The Kara bush area is similar in size to that which is ordinarily used by Kapii pigs at Yumbisa, and the two herds are similar in size. The per capita area in sweet potato garden is only slightly larger than that at Yumbisa (.063 ha.) and both are below Mondopa (.17 ha.--including subsidiary crops), Chimbu-Naregu (.10 ha.--including subsidiary crops) and various others (.09 to .25, the higher figure including cash crops; see Brookfield and Brown 1963:115). Feeding pigs produces a big difference between Sari and Mondopa. Meggitt reports pigs to be rather small at Sari.

Meggitt also provides us with some labor estimates (1958). If one can assume the male-female labor force to be divided at Sari as it is at Yumbisa and if weeding and harvesting inputs are similar as well, one hour of garden labor at Sari produces 1.7 kg. of food. The average yearly work time per individual in the labor force in 678 hours--1,037 for women and 378 for men as women provide 78 percent of the total time. These estimates (and that for Yumbisa of 1940 below) are admittedly crude, but the differences are large. A comparison of Mondopa, Sari and Yumbisa is presented in Table 39.

Ignoring precontact Yumbisa for a moment, Table 39 shows a gradient of labor from Mondopa down to Yumbisa by

	Mondopa 1966	Sari 1956	Yumbisa 1975	Yumbisa 1935
1) Hours/Laborer/Year	1036	678	471	686
a) Hours/Woman/Year	1303	1037	801	775
b) Hours/Man/Year	738	378	50	573
2) Contribution of All Women as Percent of Total Labor Time	66%	78%	95%	63%
3) Yield (kg.) for one Hour of Labor	3.8 kg.	1.7 kg.	3.4 kg.	1.7 kg.
4) Relative Longterm Intensity	.33	.09	.07	.14

Table 39: Labor Inputs to Subsistence Agriculture for Three Places

hours of input. The proportion of total female contribution reverses the pattern--being high where time inputs are low. The pattern is broken by Meggitt's low production figure (or my interpretation of his data). There are two major possibilities here. If yields at Sari are greater than Meggitt estimated, the output figure would be higher and might suggest that agricultural output in relation to input is only tolerated within a certain range. But yields would have to be doubled to achieve the output of the other two cases. The other possibility, then, suggests that Mae agriculture is more intense; the ratio of input to output is higher. Once again, over the longer run, any particular plot of land is more intensively used at Mondopa than the other two sites in terms of time in cultivation. This difference can be roughly compared by multiplying yield per hour of labor by cultivation factor and taking the inverse (the inputs are unitary--one hour). The results are given in Table 39 in the last row ("relative long-term intensity"). By this measure Mondopa is much more intense than either Sari or Yumbisa.

The figures for precontact Yumbisa suggest labor times similar to Sari, but the distribution of labor by sex is more nearly equivalent, yield per hour is the same and long-term "intensity" is greater. I would not care to make a strong claim concerning the accuracy of these figures or, to a lesser extent, those for the other three cases in Table 39. However, they may serve the purpose of illustrating difficulties in interpreting such data. To do so properly one would ideally have to compare the patterns for different social units within each clan (families, lineages, subclans), different social stratification (agnates, nonagnates, bigmen etc.), between sexes, among regional groups of clans and so forth, not to mention the details of ideology, organization and ecology. Various social categorizations suggest different relationships between the agricultural-demographic base and the social realm.

One thing is clear from the estimates of yearly time inputs: one is not dealing with a case in which survival necessitates long hours in basic subsistence tasks. An average woman at Mondopa spends 25 hours a week in garden work (excluding pig labor and food preparation time). Although life may be "easy" in this regard, the central question is one of how individuals view this amount of work especially between any two locations differently situated. It may well be that the amount of time one can expect to devote to a particular activity is a factor to be considered in contemplating migration from group A to B. Male informants at Yumbisa always claimed that the availability of firewood there was greatly appreciated while their relatives at Kiteli/Bipi bemoaned their own inferior sources. On the other hand, male migrants to Yumbisa could probably count on increasing their work load since they had to clear forest. In central Enga areas, the difference between any two groups may not be great and thus other considerations are more likely paramount; a relative with land is better than nothing even if labor is hard or long.

In this regard, the Bureau of Statistics survey (1967--cited in Waddell 1972:173) indicates 1.4 ha. per capita of gardenable land around Wabag, the lowest in the Wabag subdistrict. Kara clan with about .62 ha. per person and the neighboring Kaimanguna clan at around .78 ha. (Meggitt 1958), apparently represent confined central clans which implies rather spacious possibilities on the periphery. If every bit of Kara land was cultivable, the maximum would be .95 ha./person while Sambakamanda inhabitants have 1.1 ha. available if all unforested clan land is included and Kapii, on the extreme periphery, would have something like 6 ha. per person at the maximum over the whole clan territory.

Presumably, this sort of variation within a region could be reflected in the labor inputs but the productive capacity of each unit's land is probably more important. Meggitt does not report the extent of river flats at Sari but they are small in comparison to the slope area to judge from his yield estimates. Thus slopes must be utilized. At Sambakamanda and Yumbisa (since 1900), a rich delimited area provides or could provide for the total population. Slopes at Yumbisa are used for auxiliary resources (special crops and frost adaptation as well as individual land shortage). The permanent gardens provide a fixed resource base which is limited at Mondopa and just approaching full utilization at Yumbisa. In both cases the efficiencies are on the order of 22 to 25:1 and major fallow slopes are largely ignored. At Sari and in Yumbisa of 1935, slopes are used and efficiencies are on the order of 10:1. In the high efficiency cases, Kapii workers spend less time (being aided by past inputs) than Aruni workers. The lower efficiency cases derive from comparable time inputs differently distributed, more is spent on clearing for Kapii.

Aruni reliance on terrace areas may be ascerbated by a reduction in Sambakamanda territory. In the 1930s nearly a third of their land was lost to neighboring clans including land which must have been fertile terrace. Be that as it may, Aruni tend to concentrate their production on the best soil just as Kapii do at Yumbisa. At Sari, nearly the whole clan territory is used. Although some concentration may occur on the river flats, nearly the whole area must be defended to maintain the current arrangement. In all three cases, the investment must be protected not simply in terms of current garden space, but through some appreciation of the long-term situation with respect to land. This is reflected in the "relative long-term intensity" figures in the last row of Table 39. Sari and Yumbisa of 1975 are both spacially extensive systems while Sambakamanda is spacially intensive by comparison. It is hard to see how Kara clan could improve their situation much except through forcible expansion or outmigration. But the Aruni, like Kapii, have reserves of slope fallow that can presumably be used like those at Sari. Yumbisa has, in addition, considerable forest for further expansion.

It would appear that Kara clan has the least desirable situation of the three. In terms of cultivable area and yields it is inferior to the others and labor inputs are relatively high. A unit of energy into the subsistence subsystem returns only ten units vs. over twenty at Mondopa. Thus short-term intensity is not as high. That each area is less intensively used over longer times than at Mondopa only ascerbates overall scarcity of land since large areas of fallow are required. At Sambakamanda, primary subsistence is adequate by using only the best soil. Similarly at Yumbisa, the best soil is utilized but less intensively. As indicated earlier, the major clearance on Kapii slope land occurred at the peak of population growth when valley land was becoming scarce for some people. Nonagnates and nonagnatic descendants were important clearers even though the valley land, if uniformly distributed, could have supported the whole population.

The key to understanding these agricultural subsystems in relation to their social and cultural counterparts is to be found in fallowing practices. The dynamics of the Kapii system strongly imply that the clan is acting <u>as though</u> it wished to fulfill the ideal fallow pattern elicited in 1972-1975. But clans are not actors in spite of vernacular idioms to that effect and notions of teleological systems. It is individuals who must judge how the land they have compares to how much they think they need or want, and then act accordingly. There are three major analytic categories of factors that bear on such decisions. First, those characteristics of the system that specifically relate to production and consumption, such as have been considered here, are basic parameters. Without such information individual strategies could scarcely be understood. But this information goes only so far. One of the major resources actors tap is social relationships, as exemplified by the Kapii case. These relationships and their supporting ideology complete the trio of categories. None stand alone.

The situation with fallow agriculture must be as follows. For any given area of agricultural land with an associated technique and crops, some fallow period and cover can be determined which result in minimal deterioration in the next planting for a given length of cultivation. To do this is difficult because of the time span involved and because of varieties of techniques, crops and soils. Soil exhaustion trials suggest that cropping can continue well beyond normal cultivation periods (e.g. Carneiro 1961), but longer cropping implies longer recovery times. Greatest efficiency may be achieved with some particular combination of cultivation and fallow periods. This, too, can be experimentally determined with similar difficulties, and would be valuable information against which to compare observed systems, much as a concept of carrying capacity under given constraints was used in the calculation of OD_c. However, in the absence of such detailed agricultural data for HNG systems, there are theoretical reasons to believe that fallow periods are maintained well beyond some minimum time even if the existence of a point of optimum efficiency in consideration of other factors must remain in question.

A theory from animal ecology suggests that overexploitation of resources does not commonly occur. Wynne-Edwards argues that density dependent homeostatic mechanisms successfully prevent such a difficulty. This occurs through the evolution of "conventional" goals for competition such that rivalry is largely focused on commodities which are not critical survival resources but whose shortage serves as an "indicator" of a worsening balance between resource and population size. Indeed, he alleges "that social organization and the primitive seeds of all social behavior have their origin" in this phenomenon (1962:14).

This vision is rich with possibilities but has been roundly criticized in terms of the conflict between group and individual fitness as well as the difficulty of separating external and internal regulation (e.g. Williams 1966; see Ricklefs 1973:493 for a summary). However, in the case of human social groups there are clearly cultural practices which serve to regulate population size (among other things); the post partum intercourse taboo common in the highlands for one. Human populations may thus provide an appropriate application for Wynne-Edwards' theory. Just as clearly, there can be circumstances in which a population exceeds the carrying capacity of a given territory <u>with certain extractive techniques</u>, but the human response is just the kind of behavior under consideration here, agricultural intensification for example. Behavioral responses are obviously more flexible than for most other animal populations.

The basic question in the case under investigation concerns the degree of constraint operating on the agricultural system and how it occurs. It is certainly not the case that each social unit fills its territory to the point of inadequate output before its population is checked in a Malthusian way. Rather there is a mortal concern with maintaining a sufficient resource base long before such a situation occurs, to judge from Meggitt's (1977) accounts of Mae Enga warfare. Despite the Aruni territorial loss in the 1930s the group persists on its reduced area and one wonders if the constriction of productive area relates to intensity. Had Kara clan lost a third of its current holdings they would not starve. It is not known, however, how long they could or would persist with what amount of increased labor inputs or other alterations. Meggitt's material suggests that they would not tolerate such a loss unless they could not avoid it, i.e., unless they were unable to repossess the land directly with the assistance of allies.

Fallow agricultural systems perforce provide a buffer in cultivable land not in use. Yumbisa gardeners are very much aware of what, in their view, constitutes an adequate land holding and the consequences of having less. Although I am uncertain as to just how they conceive of the spacial relationships, men had no difficulty in appraising me of the adequacy of their holdings in relation to the number of their sons who would inherit the land. They could readily explain that there was not enough land or that there was, but not enough for daughters' husbands too. I am encouraged then to suggest that the land requirements I calculated from Kapii descriptions of ideal fallow periods fairly reflects their perception. This is further supported by the observation that when the clan OD_c dropped below 1.0 and when the distribution of land was most egalitarian, incorporation began. Conversely it began to be constricted near the following period of maximum imbalance in land distribution, and OD_c rose with constriction. Moreover, the exception that "proves the rule" occurred during the transition from slope utilization to valley reliance. In this case, the length of fallow was apparently shortened with the result that the next generation had to clear at increasing rates to achieve the ideal fallow pattern, at which point clearing rates stabilized right through the major incorporation period.

This suggests to me a keen appreciation of people-land relationships but it does not suggest complete dominance or control over events. No one in 1895 who sponsored a migrant at Yumbisa could nave foreseen the resultant outcome. The advantages of incorporation led to emergent circumstances in clan dynamics which were dealt with in rational ways. The control over immigrant numbers is clearly a density related function though not simply a density dependent mechanism. It was self regulating in terms of clan dynamics since offspring of earlier migrants, as clan members, had first choice on land thus reducing land availability and making incorporation less likely.

Anthropologists in general probably have little quarrel with the notion that human behavior is self-regulating in the sense that individuals make decisions and attempt to behave on that basis. The question of what conditions such decisions and the resultant behavior is a more complicated matter. But it is certainly the case that culture is a grand regulatory mechanism in that it confines, by and large, the responses of individuals within certain ill-defined bounds. How a particular cultural unit (a population/social group) operates/behaves is an intermediate level question. The relationship of organism to population so familiar in biological ecology is for human systems greatly complicated by the high degree of social organization and cultural capacity. One would then expect that relationships between individual human organisms and their environment are considerably less deterministic in detail. If one is to generate statements about systemic regularities from the aggregate behavior of individuals (population level), the potential for tight hypotheses is greatly reduced in most cases precisely because, while "culture" confines behavior, it also provides a means of overcoming at least many constrictions. It is a fundamental question as to whether or not or to what degree the resultant behaviors provide for the population through regulatory phenomena. That is to allege, the adaptive significance of any given behavioral pattern must be empirically substantiated if regulatory mechanisms are to have any analytic usefulness. Moreover, a major arena of regulation for any behavioral trait must be seen in its interaction with other cultural elements <u>within the system</u>. This view is isomorphic with the notion of coadaptation of enzymes and structural proteins in physical evolution in which "natural selection is able to apply <u>adaptive pressure</u> upon the result of the interaction of all of these coadapted systems of coadapted systems; <u>stabilizing selection</u> can act <u>directly</u> upon every allele at every locus" (Byles 1976:88). To pursue the analogy, homeostatic mechanisms operate on the individual level, are instrumentally effective on human behavior, while it is the system which "experiences" adaptive pressure.

I would not care to push the analogy too far. Rather let me illustrate the implications. Both Meggitt's hypothesis which introduced this dissertation and Waddell's intensity version near the end, bridge large portions of the theoretical matrix of relationships that I suggested as a heuristic framework in Chapter I. Each is slightly different but both are statements at the population level. To be sure, they have implications for the individuals in such systems but they do not specify the intervening network of relationships among contributing factors. I doubt they were intended to do so.

Meggitt's sociocultural side of the equation suggests a central role for agnatic ideology which "structures" groups. In his conclusion, he is forced to infer the degree of agnation from reported observations in the absence of quantitative data for his numerical operationalization. To this extent he offers a cluster of related factors if not a network of relationships. Waddell accepts Meggitt's ranking of societies but focuses on a behavioral attribute, namely systematic assimilation of migrants, and adds the welcome conclusion that migration itself is a function of <u>local</u> density. Both are then related directly to pressure on land or intensity and fixity of resources. The terms on either side of the equations are open to variable interpretation and the temptation is great when one considers any extant system since potential conditioning relationships are legion. These two hypotheses represent population level statements which suggest the adaptive significance of certain characteristics of the sociocultural "phenotype." It is not my intention in this instance to be critical. Hypotheses must be abstractions and the agnation-density relationship has certainly generated a search for limits of applicability. But we will make considerable progress if we can ever specify the circumstances under which such relationships are expected to hold. To do so requires the articulation of fairly complex portions of a hypothetical network, with the focus on articulation, or, in other words, the relationships between lower level phenomena that link diverse inputs and outputs of the system. In short, the compilation of chains of relationships which inform us of the selection circumstances on the individual level and their continuation beyond the system boundary would allow the possibility of rather more complex hypotheses that would reduce residual variance to manageable proportion--no easy task.

This is unabashedly a reductionist argument especially directed at unrestrained systematics and, I hope, the dead horse or straw man of early overzealous ecologically oriented excess--a caution not a condemnation. It is, however, manifestly not a plea for reduction to what is in the informant's head nor what is outside of his house.

The study related in this dissertation has by no means satisfied the programmatics implied above. My focus has been intentionally on the environmental-social relationships--the boundary links. Ideology had of necessity to be considered in the present and was unavailable for the past, but the analysis began with environmental features and proceeds into the sociocultural realm. I do not thereby imply ecological primacy but I do naturally claim that without a knowledge of ecology, system structure cannot be adequately generated. Still without a detailed focus on ideology the residual variance appropriate to my observation of "regularities" is high. In addition, it is one thing to convincingly demonstrate structural relationships for one delimited population but quite another to generalize to other sociocultural systems. However, it should be apparent that the dynamics of incorporation at Yumbisa reflect very strongly the general thrust of Meggitt's hypothesis, although there are important differences. Waddell's version seems not to fit quite as well but this may simply be because the appropriate circumstances have not yet occurred in the developmental trajectory of the Kapii system, and they may not. I am suggesting that these two versions of a hypothetical relationship, like many others, are likely to be correct somewhere but are also bound to be wrong somewhere else, and it is the extension of their applicability that is desired.

What is unique about the Kapii case is the time depth that can be tapped. The major constraint in the analysis, the lack of information on past ideology, derives from that very advantage, a fair exchange nonetheless. In the analysis I have tried to capture the developmental trajectory of the agricultural subsystem through repeated consideration of classes and stratifications of individual actors which reveals patterns of continuing and emergent circumstances and patterns of response. This is the methodological message. The philosophical message is that people are neither pawns of their environment nor masters of their destinies.

C. Land, Women, Pigs and Men

In light of several of the above considerations it is possible to suggest a thread of hypothetical relationships which exemplifies earlier allegations in a more substantive way and to thus speculate on some of the possible connections between a variety of "variable sets" commonly considered in HNG ethnography.

I begin by broadening the consideration of incorporation to include inmarrying women as well as single male migrants and migrating families (cf. Watson 1970). Then, returning to Wynne Edwards, the question is posed: Are there "conventional" goals for competition which serve as density dependent "indicators" of resource depletion? In addition, I would ask: What mechanisms restrict overexploitation,[3] and what circumstances result in positive

---

[3]Cf. Siskind 1973. In this excellent article, Siskind begins with Wynne-Edwards and proceeds to trace a thread of relationships among sex roles, sexual behavior and ecological relationships for South American tropical forest hunters. The mode of analysis is very similar to that used here even though the material is different.

feedback that supercedes or counteracts regulatory mechanisms? Wynne-Edwards sees competition as a central attribute and, for this case, several "commodities" can be readily supplied. I will focus on land, women, pigs and men, an order which possibly reflects their relative importance. Land is not a "conventional" goal of competition but more nearly the critical resource, at least as density increases. The other three correspond to Wynne-Edwards' conventional goals--especially pigs, the overt, quintessential goal of competition.

Although land is not scarce for most HNG people for short-term production, it is certainly _viewed_ as scarce by some people when fallow areas are considered. This is evident at Sari and Yumbisa, to judge from the clearance history. In the case of Mondopa, and to a lesser extent Yumbisa, although land _per se_ may be readily available, the practice of concentrating production on one land type puts that type in a potential position for greater scarcity. Land is publicly proclaimed to be scarce among some central Enga clans and,even at Yumbisa, bush plots containing pandanus groves are scarce resources. Differential shortage of land was at the root of the agricultural dynamics described earlier.

To men, women may be considered "scarce" in the following ways. In terms of sexual relationships, rules of morality and fear of contamination by and large restrict access to marital relationships, albeit with some variation and postcontact change. The major constraint on marriage, in turn, resides in the brideprice. At Yumbisa, such may be small on occasion and women have almost complete latitude in choice of suitors. Elsewhere in HNG, marriage is arranged with a variable degree of choice by the brides. At Yumbisa permanent bachelors are rare but elsewhere the proportion can be high (e.g. Kakoli, Bowers 1965). Waddell reports 15 percent of men over 25 as unwed at Sambakamanda whereas Mae bachelors are extremely rare. Polygamy is the major drain on available brides but the practice is offset by different ages of marriage. Where first marriages are made at age 25 for men and age 18 for women, the available pool of spouses is more nearly balanced. However, since brideprice is a condition of marriage, men who are older and thus better articulated with their social network than most young men, have the advantage in mustering an acceptable brideprice. This is especially true where marriages are to a degree arranged. Even at Yumbisa where almost all men marry, there is still direct competition for the women seen as most desirable brides. Men are "scarce" to women as well, in this latter sense, as will be considered.

The case of brideprice also illustrates the way in which pigs are scarce. Given the requirements of the exchange system, its crucial role in interpersonal and intergroup relationships and the social status deriving from pig manipulation, the demand for pigs would seem to be boundless. The production of pigs and their redistribution is, however, circumscribed. This category of scarce commodity fits best Wynne-Edwards' notion of a conventional goal for competition. Scarcity occurs at two levels. Production of pigs would appear to be maximized in some sense at Sari since Meggitt reports that people wish to breed their pigs as often as possible. Presumably then, pigs are scarce in relation to demands for them. But pigs are "supplied" by receiving exchanges as well as breeding. Thus, individuals within a social group who have similar networks of helpers but different affinal receivers (for example), compete over the pigs that might be acquired through the network. To the degree that the exchange in question is seen as a corporate responsibility, this competition is mitigated but it cannot be thus removed.

Intragroup politics and manipulations become paramount and the niche for bigmen is accentuated. By contrast, Kapii exchanges are less corporate in character, but in any case of exchange two individuals may desire the assistance of a common helper. Competition then focuses on the maintenance and strengthening of interpersonal bonds, which presumably also requires more pigs. Within this context, the two strategies of raising pigs and receiving them in exchange must in part relate to added labor of caring for a herd. At Yumbisa, pig raising appears to be far below maximization even though the net outflow of pigs is strong. Nonetheless, people are unyielding, even violent, in their demands to receive pigs both within and between groups. It is the relationship between individuals that counts in the long run rather than the pig itself, and demand must be carefully balanced by appropriate acquiescence or concession.

Finally, men may be scarce to any social group when it is felt that an insufficient fighting force exists to deter actual or potential enemies. This could occur either through previous deaths in battle, outmigration, a random fluctuation in male-female birth ratio with group exogamy, or simply a small population in comparison to enemies. As I have suggested from the Kapii case, men may also be scarce in comparison to intended, desired, or required labor in subsistence related activities. A host's following of migrants additionally provides him with "scarce" social ties.

In none of the four cases is the notion of scarcity pure and simple nor does it occur in the classic market circumstances of traditional economics. "Commodities" are restricted or lacking in quantities which satisfy the desire of individuals who want them. In fact, social control is exerted through control of pigs, land, women and young men. Land can be given to migrants or coresidents, support in exchange can be withheld to some degree and also used as a reward, and women are restricted in their choice of spouses. Young men, if they are to marry, require the support of older men to amass brideprice. If Wynne-Edwards' idea is applicable, pigs would appear to be a prime candidate for a conventional goal of competition. Land should be least so, being closest to a critical resource, and women and men may fall between. The question is whether there are density dependent mechanisms which adjust people-land ratios so that overexploitation does not occur. Clearly where density is high there are likely to be individuals who are short of land. Migration to more favorable areas is a common response and forced migration during warfare also occurs--both before over-exploitation in a subsistence sense. The problem is that we neither understand what density means in different circumstances nor the level of exploitation. A slightly different tack may be more enlightening.

Returning to Table 39, we note that female labor input per woman varies from 775 to 1,300 hours per year. For Yumbisa, the figure reaches a minimum of 713 hrs./yr. in 1900. In every case male labor input per man is less, ranging from 6 percent of a woman's time in Yumbisa of 1975 to 74 percent in Yumbisa of 1935. (Mondopa 57%, Sari 36%). Elsewhere there may be nearer equivalence, e.g., Kapauku (Pospisil 1963). Nonetheless, this small sample bears out the observations that women commonly provide the major subsistence efforts. This contribution is everywhere recognized by informant and anthropologist alike as the essential basis of production. However, what is not commonly addressed is the question of the impact of women's choice in where she will carry out the labor which will occupy a good portion of her life.[4] Beginning with

---

[4]See Faithorn (1976) for a consideration of reasons

this question, which I too did not investigate directly in my fieldwork, I would like to suggest a pattern of hypothetical relationships that link subsistence behavior with land, women, pigs and men (as considered above) as well as migration and incorporation; that provides some insight into the implications of the Wynne-Edwards analogy and perhaps clarifies the methodological or theoretical question of how to articulate individual and systemic characteristics.

Consider then a recent time or place in HNG where populations have expanded to include areas beyond those ideally suited for the subsistence base. It may first be asked: What considerations might be important to a woman contemplating marriage to one of several suitors from different places, in the case where she has complete choice. Clearly there would be a host of ideosyncratic preferences on the part of the woman, as well as the men who court her, which must remain unpredictable. There are almost certainly, however, recurrent factors which influence her choice. I will suggest a few. If one of her suitors comes from a place similar to Yumbisa of 1935 in

---

for this lacuna.

which the group is actively expanding into virgin bush, she can well expect her labor to be small in comparison to yields. Without postulating some model of "economic woman" one can expect labor information to be of considerable interest to the bride to be. It is also likely to be readily available since most marriages occur within reasonably close proximity, and further, probably she has female relatives of some sort in or near the suitor's community. At Yumbisa and in surrounding areas, she actually works a prospective husband's garden before the brideprice exchange is arranged. The groom, moreover, would have cleared a "demonstration plot" which his "sisters" planted. Thus, the potential bride will have considerable opportunity to become familiar with the characteristics of her suitor's landholdings and his own particular degree of expertise in subsistence endeavors. To be sure, either or both may become disenchanted with the premarital image created during courting once the "honeymoon is over."

A second suitor may, however, come from a clan parish where forest clearing is no longer possible. In such a case, if he nevertheless spends considerable time in direct subsistence activities (say preparing fallow land for her gardening work, fencing, ditching or whatever) so that relative labor inputs are similar, such a circumstance may appear more attractive than one in which the husband contributes little direct subsistence effort.

In addition, some social groups may appear more attractive if their reputation for successful pig prestations is great, especially if such exchanges result in the frequent consumption of pork. Other reputations, such as staunchness or success in defense of place and person, may enhance the chances of a woman's choice of suitors from such a group as she considers the health and well-being of her family to be.

There are probably other group or individual characteristics of this sort and their existence and nature is an empirical question, of course. It should be possible to determine the recurrent patterns of choice if failed marriage negotiations and divorces are carefully investigated. The patterns would likely be complicated by the differences of the recipient group relative to the woman's natal place. It is not necessary to exhaustively account for the factors that would influence her choice but sufficient to demonstrate a tendency for marriages to be contracted in social units under particular circumstances. The strength of such a tendency is subject to research and there are surely the usual myriad intervening or conditioning variables.

If, however, it can be shown that certain social groups (or individuals in certain circumstances) have an advantage in acquiring women as wives, the implication to group dynamics is potentially far-reaching. There are several possible extrapolations but one especially cogent to this thesis concerns the relationship of the foregoing to agricultural intensity and land shortage. The changes that occurred in the subsistence base at Yumbisa over a long time could offer direct information on this situation. Unfortunately the crucial data are not retrievable from the information acquired. However, if the above process of concentrating women operates and if female labor intensity estimates in Appendix 7 are representative, one would expect the attractiveness of Kapii men to be largely unchanged from 1880 to the present. During this period female labor inputs varied by only plus or minus 10 percent from a slightly increasing rate. Prior to 1880, female input declined from a level nearly double that value. From this, some characteristic such as the mean numbers of wives per man might be seen to reflect the relationship. Indeed, it is steady at Yumbisa (about 1.7

marriages per man) during this period. Although the marriage rate drops off before 1880, as the relationship would imply, the change is more likely to be an artifact of poor genealogical memory than anything else. The hypothesis is not contradicted but neither is it strongly supported.

Another comparison may be more directly relevant. Yumbisa men currently married have had 1.8 marriages each on the average. This compares to 1.5 at Mondopa (Waddell 1972:from Tables 3 and 4) and also Sari (Meggitt 1965). Without consideration of further complications, that would fit well with Table 39, i.e., lower female labor inputs imply more women married in.

Be that as it may, the implication of female choice in marriage can be pursued somewhat farther by proceeding deductively from the hypothetical case. To return to the situation where local groups are in different subsistence circumstances, one can see that if marriages tend to be concentrated to any degree in groups where female labor input is low (low female intensity groups), the population of such will increase more rapidly in the absence of counteracting factors. Then low female intensity/"low density" social units begin a process which tends to increase population pressure and thus equalize local variation over a greater region.

Sooner or later a core area will develop in which women no longer have the opportunity to choose a husband from a place where labor is light. At this point, the relative inputs of men and women may loom larger than a woman's expectations in terms of absolute effort. If there are places in which men contribute substantially and directly to gardening, such places will be more attractive. This can occur in areas in which there is little rich land but relative abundance of cleared slope such that there is a long grass fallow which requires considerable effort to recultivate. Under extant practices, men traditionally do this work. Shorter fallow, such as that at Sari, may result in proportionately less male labor while concentration on fertile soil, such as that at Mondopa, may result in high female labor demands. Once again populations grow in the "low density" groups.

Up to this point I have assumed that women have free choice in husbands and I have largely ignored existing social factors. It is at this point, too, that competition among social groups for women begins to take on new dimensions. The hypothetical core area requires relatively large labor inputs and female labor is much in demand, especially by men involved in exchange activities regardless of whether their group has the most attractive subsistence circumstances. Thus, unattractively situated groups must find ways to compete for women. Indeed, this will have been the case all along.

One way to acquire young brides is to enlist the support of their parents and near kin. Brideprice then takes on the dimension of an arrangement among men across social boundaries aimed at the disposition of (sometimes reluctant) women. I would not suggest that this is the irreducible basis of brideprice. Rather it should be considered as one aspect in a multifunctional relationship especially relevant in particular subsistence circumstances. At Yumbisa where there is presumably little need for coercing women, it is nevertheless customary at the completion of brideprice distribution for the bride's spokesman to lecture her at length on her new role saying that she must not run back to her parents. This serves to cement the network relationship, which is of course important, but the network is one in which men are nodes and women are sources of important links.

In the Enga area, and elsewhere, this arrangement persists in various affinal exchanges associated with life crisis occasions for the children of the union. Such exchanges have sometimes been interpreted as securing the transfer of children to their father's clan. They might also be seen to have a component in a continuation of the male alliance which keeps a woman with her husband once she is there. The expectable extensions of this trend are: variable attempts by a woman's family to influence her choice, arranged marriage such as occurs around Hagen (M. Strathern 1972), and early betrothal as in some eastern highlands societies. The degree of such influence (and perhaps the frequency of affinal exchange) should exhibit an association with female labor intensity if the hypothesis is correct. The eastern highland area suggests just such a circumstance by gross subsistence characteristics, to judge from the extensive grasslands, rare forest, accentuated dry season, increased areas in cultivation per person and, possibly, longer occupation time. Early betrothal occurs but an analysis of affinal exchange frequency would require detailed consideration. Regional patterns may be superimposed on the fluctuating situation with local groups.

Further implications can be drawn. To the degree that brideprice and affinal exchanges influence the flow of women, the nexus for a positive feedback loop is set up. Thus poorly located groups (i.e., those requiring high labor inputs) must accentuate their exchange activities which requires pigs. The added pressures on land resources and increased labor attendant on pig raising acerbates agricultural intensity which requires still more labor (mainly female in many extant cases but including the utilization of young men or bachelors). Pigs may be acquired through network relationships but this only serves to spread the effect through the region (Watson's Jones Effect /1977/, though it might also concentrate pigs in the core). The favorably located groups, if successful in attracting women, undermine their subsistence position eventually and, even if they do not, may be involved in the vicious circle of exchange inflation through network relationships.

This may be one factor which contributes to (undemonstrated) increased exchange activities in "high density" areas. However, the role of female choice in marriage arrangements is not at any point one of complete capitulation to male alliance relations. As M. Strathern exemplifies, a woman who is totally unwilling to consent to an arranged marriage is a poor candidate since there is no ultimate way to control her and expect fulfillment of productive and reproductive functions. Variously in the highlands unwilling brides reportedly commit suicide rather than enter into an arranged marriage. Most do not, of course, and the result may well be a degree of sexual antagonism. It is not simply that reluctant wives band together against their husbands who respond in kind. It is rather more far-reaching in that manipulations to acquire and keep women are only useful to men if those women adequately carry out crucial labors and reproductive functions. Yet as Langness (1974) and Lindenbaum (1976) suggest, four female resources remain beyond full control of men: fertility, child care, labor and periodicity. Langness interprets the nama male initiation cult of the eastern highlands as a "magical system designed to insure male power in these areas." The nama cult in its various versions associated with female pollution expressed as a concern for blood, provide another component to affinal exchange especially where the ideology recognizes a differential acquisition of spirit, body or whatever by sex of parent.

However satisfying this arrangement may be to men, one wonders how it fits with other components of the system (coadaptation) and what women think. Langness (1974) provides part of the answer to the first question. Among other things, Langness suggests that women "really" are dangerous and polluting since a boy overly attached to his mother or a man overly influenced by his wife threatens male solidarity. That in turn is (minimally) a threat in the face of endemic warfare. Warfare, in turn, I would add, can be ascerbated by pressure on land but will also be most severe in the core areas where corporate social groups are in close proximity and peaceful mechanisms for solving disputes are poorly developed (e.g. no "leopard skinned chiefs" or higher authority). Moreover one of the circumstances in which women are most likely to attempt to influence their husbands toward assisting them is precisely where their labor is hard (by comparison to better situated groups) and doubly so if husbands customarily contribute significantly less direct subsistence input than in better situated groups. These are likely to be just the areas in which strong localized, unilineal descent groups occur with sexual hostility and distance, an hypothesis advanced by Allen (1967).

The degree of sexual antagonism and the level of participation of women in the male political arena are moot questions (cf. Faithhorn 1976). However, since these societies are visibly surviving, even thriving, women must be doing what men expect of them. This leads to the second question. Although there is little direct information on female ideology (in fact insufficient to judge whether it is critically different), I must assume that provisions exist for appropriate motivation, gratification, etc., so that most women raise children and make garden. In Yumbisa, and by most reports elsewhere, a "good wife" (male view) is generally recognized, appreciated and acknowledged as a critical asset to her husband's activities. Yet there is, to my knowledge, no panhighland category such as "bigwoman" comparable to bigman for their respective domains. Direct research is sorely needed here. There is apparently a common male notion of what an ideal wife is like in terms of production and reproduction but what do women see as a model wife and, to return to the beginning of this discussion, what do women see as a model husband? Such questions must be answered in order to understand the role of female behavior in relation to the more readily available, public domain of men's interaction. The female labor intensity hypothesis described here suggests the possible importance of such information.

Male-female views associated closely with pollution fears can be seen to be positively adaptive in system context. A case in point is that of the post partum intercourse taboo. Such a taboo runs contrary to male desires for children and, perhaps, group concern with fertility and thus group strength. It has been suggested that the latent function of keeping a woman free from pregnancy for several years has economic benefits because if she were too encumbered with children, less garden work would be expected. In addition, reproductive economy is enhanced both in terms of post partum recovery and extended lactation in a situation where weaning must occur to a low protein, high carbohydrate diet. The well-being of the child is overtly a concern to men, women, and groups, at least to judge from Yumbisa where taboo violations are blamed on the husband who has to compensate his wife's clan. Such taboos were apparently well respected prior to contact changes. At the system level the economy of reproduction looms large as an adaptive attribute as does the unity of males for defense and offense. Sexual antagonism and dogmas of pollution contribute to both.

Men and women are culturally pitted against one another to a degree since they are seen as mutually inimicable--women's blood to men and men's power to women and their children. Hence birth is a solitary or all female affair, birthing women are very polluting, and babies are separated from all men for some time because men's residual magical powers might harm the child. During the nama ceremony, women have their allotted, culturally specified time when they express (perhaps) resentment as they attack the men and boys returning from seclusion. At Yumbisa, betrothed women damage the house and trample the gardens of their chosen young men who are in the initiation seclusion.

Also at Yumbisa, the post-pandanus feast turns into an overt sexual "war" as indicated in Chapter III. A strict interpretation of the female labor intensity hypothesis must find this last case peculiar since women do not work long hours at Yumbisa. Although the female labor input is greatly in excess of the male input, this has not been the case in the past (by my calculations), yet informants say the pandanus feast fight is old. Either they and/or I could be mistaken or we could both be right. I would guess the latter since Yumbisa was settled not in some cultural isolation or from different societies but from a recent traditional highland stock. They share the basic Enga (at least) ideology which includes idioms and symbols that assume sexual antagonism. This might seem to be a crude "mentalist" argument that flies in the face of what I have suggested about ecological/subsistence relationships. I think not, of course, and would instead suggest that idioms and symbols related to pollution and potential antagonism are at their root conservative elements of the ideology which allow various interpretation and are associated with different behavior depending on circumstances. One set of circumstances has to do with female labor and choice of husband. At Yumbisa sexual antagonism occurs, at least on certain formal occasions, since it is a necessary consequence of the structure of such sociocultural systems. There are indeed reasons aside from female labor intensity why sexual antagonism occurs. There must be since the ideology both generates and regulates them. This is the nexus of coadaptation from the biological analog and the individual level of analysis. Coadaptation is simply a term for inferred dynamics of the relationship between cultural beliefs and practices which have been studied by anthropologists under the rubric of functional analysis. It is at this point too that structural/symbolic analysis articulates with ecological analysis. On one side lies meaning, on the other environment. At their conjunction human activities are generated in relation to both (cf. Kelley 1968).

To speak thus might seem to fatally dilute the hypothesis under consideration. I would hold, on the contrary, that it serves simply to recognize the limits to its applicability. This female labor intensity hypothesis is really not a hypothesis at all in any strict sense of the term. Rather it suggests a series of relationships that are part of a larger (unspecified) model of sociocultural relationships. Affinal exchange clearly involves more than an arrangement by which women are retained; it is multifunctional. Surely this is true of any significant, delimitable, recurrent human activity we observe. The problem then becomes an appallingly large one of concatenating the multiplex threads which make up sociocultural relationships. To achieve sufficient coverage, unrecognized or uncontrolled variables must be reduced to a degree such that we can reasonably expect relationships to be in some sense testable. To this end the female labor intensity hypothesis is offered.

An interesting mechanism for distributing people over space is suggested. To the degree that women are concentrated in low intensity areas, populations grow more rapidly there. The effect is one of equalizing densities in the early part of the developmental sequence, sneaking Wynne-Edwards in by the back door. Where core areas form and coersion becomes a factor, success in attracting females alters the intensity gradient and makes competition even more imperative. What I have been describing in this emergent hypothesis is female incorporation. But this dissertation has been directed primarily at male incorporation, suggesting a similar chain of relationships which articulate with the former. I conclude then with a briefer exposition of male incorporation and its variation which completes the examination of land, women, pigs and men.

I return to the initial conditions of the previous developmental sequence. Social groups are distributed over space with variations in size, density and resources. Individuals who are short of land in relation to their perception of adequate holdings have several possible recourses: clearance of forest, usufruct grants within or between social groups, migration-incorporation, forcible or covert seizure of some variety including minor boundary alteration, or agricultural intensification. Each has its outcome and implication to group dynamics when significant numbers of people find themselves in similar straits.

The forest clearing option has been considered in detail for the Yumbisa case but it must be noted in passing that groups whose land includes little or no rich valley must more rapidly proceed to the other options if population grows. The Yumbisa material strongly suggests that incorporation will be restricted until a large portion of the population achieves adequate resources of cleared land. After that point, natal members short of land still clear but it becomes desirable for those with relatively more land to sponsor migrants resulting in population increase beyond ordinary rates, and this may be further ascerbated by attracting extra wives. As the forest disappears, other options become more prominent.

The Kapii dynamics also suggest the pervasiveness of two alternative social organizational principles based upon agnatic or in-group ties as opposed to affinal and cognatic links. This was exemplified in the agnatic clearance groups which gave way to groups composed of agnates and natal nonagnates as opposed to the strategy of hosting nonagnates. Kelly deftly demonstrates the importance of these two structural arrangements in showing that the Enga and Siane "societies rely on principles of descent and a segmentary system of land tenure which parallels and is linked to the descent group structure, while the (Chimbu and Kuma) societies employ, on an individual basis, relationships with affines and matrilateral kin as well as with agnates" (Kelly 1968:62). The latter more closely resemble the Huli (Glasse 1968) who, like Kapii clan, employ relationships with a wide variety of cognates. Kapii, a fringe Enga clan, occupies one side of a valley the other side of which is fringe Huli.

Given these two structural possibilities, various strategies of land acquisition can occur in different circumstances with variable outcomes. An individual may seek usufruct grants within the agnatic clan. Presumably this is a primary gambit since the idiom of "brotherhood" usually applies, but it might be expected to be least effective just where clan land as a whole is scarce. In "low density" circumstances internal grants can be common tending toward social if not physical concentration especially if the Enga-Siane type of structure occurs. Where density and concern with group identity are high, internal usufruct grants serve to maintain control over productive gardens particularly where fighting is intense. As this ascerbates overall land shortage by reducing ideal fallow time, it also concentrates critical resources which both makes the group more vulnerable to disruption and, perhaps, more prone to forcibly seize land.

The option of seeking usufruct grants outside of the agnatic group will be most affected by alternative structural principles, but even in the Enga type case such grants persist and can do so since in warfare close affinal and matrilateral relationships are somewhat independent of corporate interaction. The "one clan, one land" idiom tends to create an all or nothing case; either one migrates to the land grant host or one stays home. Where optation is the norm there appears to be no problem since low density differential land shortage is met with affinal and cognatic grants and the high density case simply accelerates the process which yields a central Chimbu distribution and ultimately an upper Chimbu variant. Lineality would seem to be the principle that requires explanation.

The migration-incorporation case is to a large extent an extension of that pertaining to underlying land grants. However, the factor of competition for men enters. Descent constructs serve to keep men in the clan which may be useful for warfare but undercuts the safety valve of migration. As a result, migration may occur forcibly through warfare. Presumably, then, groups within a core area who through demographic fluctuation represent a local "low density" adaptation, must quickly increase their numbers for defensive purposes. I have suggested that they may under some conditions attract women, but what they need, and quickly, is men. Male migrants under these circumstances become critical. Members of neighboring parallel clans in both the agnatic and optative types of system represent a threat. In the former the languishing clan stands to be reduced ultimately to a subclan (or lineage) by infiltration and in the latter case their land may be transferred to members of other clans over time if land holdings are commonly interdigitated. Thus affines and cognates at some distance are more likely to be fully incorporated and develop a vested interest in the group. Further ramifications are possible in this scenario. A "low density" group within an "agnatic" core may increase its population more rapidly than surrounding groups resulting in restricted incorporation and a return in practice to a closer correspondence with the ideal. Neighboring clans may then be in the (relative) "low density" circumstance.

Whenever other options are less promising boundary alteration tactics are a possibility. In particular, where land is seen as scarce, groups are compact and close packed, encroachment on rich land is possible and "agnatic" structuring restricts migration over a region, then warfare for land is most likely. It is likely elsewhere, too, for other reasons.

A common pattern from the female labor hypothesis was a concentration of potential population in the "low density" pockets. Similarly for male incorporation. The net result is an adjustment of people to space. However, in the latter stages of both developmental patterns (i.e., in "core" areas), competition for land, women, pigs and men tends to concentrate population and pressure on land in larger regions, regardless of structure. At this point agricultural intensification becomes almost a necessity, but it will have been a necessity before that point in certain ecological circumstances and desirable in others. At Yumbisa, for example, utilization of the valley gardens could be only minimal without ditching and construction of fairly large mounds. At Mondopa, concentrated land utilization may not be absolutely necessary but it is clearly efficient.

The picture then is one of complex variation between individual social groups in culturally similar concentrations with regional gradients and a fluctuating, quasi-static balance--a long-term expansion of population over space (cf. Brookfield with Hart 1971). The underlying characteristics and processes would appear to be widespread and recognized by researchers. The Kapii case has illustrated much of this. Still, a synthesis which encompasses even a small portion of the cross-cultural variation eludes us. I offer none. Yet I would conclude with a few final comments on the possible nature of such a theoretical framework.

D. Conclusion

Meggitt's hypothesis, which was instrumental in prompting the research reported here and which introduced this dissertation, suffers from a serious theoretical difficulty which also characterizes Waddell's version, my own and any other such relationship at the population level. Meggitt's will serve to exemplify. It suggests that the degree of correspondence between recruitment practices and the implication of descent ideals varies with pressure on land. The Kapii case fits this expectation very closely. But at a more fundamental level, the hypothesis implies that the success of descent ideology in conditioning individual behavior varies with demographic-ecological relationships such that the ecology overrides or alters the ideology. This is not to reduce the above-mentioned studies to "vulgar materialism." On the contrary, Kelly's excellent analysis (1968) quoted above, which accords well with the major thrust of this conclusion, serves to spotlight the inherent dichotomy between ideology and environment.

Such considerations are beyond those that can or should be usefully considered here. The point remains, that relationships like Meggitt's fail to specify the conditions of their applicability. They not only leave a huge "residual variance," that is, they do not consider the hidden or conditioning variables, they also rarely contain a consideration of the conditions under which they are not applicable (their limits). They have, of course, been profoundly stimulating as the research and reflection on Meggitt's hypothesis over the past twenty years amply illustrates. I would not speak then to be critical but to echo A. Strathern's (1968) call just ten years ago for models to deal with the complexity.

I fear, however, that the models will be extraordinarily complex. The Kapii analysis suggests that various individual strategies in response to demographic-ecological factors can be discerned which were utilized by individuals to meet differing needs. To expand this analogously to wider cultural and ecological areas, suggests a rather large repertoire of individual responses to many particular circumstances some of which may be "functional equivalents."

If one imagines two different cultural units each occupying opposite sides of a valley using very similar crop inventories on similar soils (as likely occurs in HNG), their organizational and ideological characteristics must be, crudely speaking, functionally equivalent with regard to the ecology. If such exist, do the sorts of chains of relationships that I have described become trivial under the dominance of cultural inertia? Suppose one group has an agnatic structure like the Enga and the other an optative structure, say, like the Huli. Does it matter? To begin with, no two groups will have the same exact resource base in terms of land type distribution nor will population follow the same pattern of growth or decline. Direct competition (warfare), variability in leadership and exchange process are unlikely to be balanced. It seems not unreasonable to suggest that the optative group may more successfully (and sooner) redistribute an expanding population (if such occurs) over its side of the valley (suggesting, even, that optative systems are more responsive to their physical environment?). The agnatic group may tend to concentrate loyalties and thus better provide an adaptation for predatory expansion (Sahlins 1961) On the other hand, activated optative ties and/or landholding interdigitation may result in a better defensive pose for the "loose" group which mobilizes many individuals. Other scenarios are possible. The Yumbisa/fringe Huli case seems to have resulted in convergence rather than competitive exclusion but the time span has not been long and both fringe groups seem to have come from similarly organized parent groups also on the fringes.

Even where social units have the same overall structural resources, "microenvironmental" (physical, social and demographic) differences obtain. In such cases, and in the preceding, success of certain individual strategies may become dominant i.e., they have a selective advantage in terms of more and more people pursuing them. The ideological structure can be reinterpreted, altered by elision or addition. The point is simple but not inconsequential. The aggregate actions of individuals operating on the resources of and within the bounds of ideology, environment and the behavior of other individuals has consequences. Such a situation may be static in one place for a time but, at some level of analysis, fluctuation or directional change must be included. Time depth in data is thus essential even though rare. Cultural dynamics result in recurrent patterns of behavior which in each case are attuned to greater or lesser extent to many other features of the system. This, I take to be another essential focus which I exemplify by the biological analog of coadaptation. If coadaptation within the system is a reasonable expectation, redundancy is a corollary (also to be seen in the biological analog) since any element of the system that fails to be maintained results in a change toward those that are maintained. In other words, systems "fail to survive" (read "change") unless there are sufficient alternative pathways to achieve the same ends (or outputs). Existence will imply multiplex buttressing of patterns. Change is not thereby ruled out, of course, but under those conditions one might well expect that some changes (if they occur at all) will initiate "quantum jumps" as a whole set of relationships alter towards a new coadaptation. The introduction of steel tools[5] or the sweet potato into the highlands would be a good example.

The net result of multiple individual strategies in different circumstances, coadaptation, redundancy and selection on the system level is that recurrent patterns do not readily "fall out" of the data. The various hypothetical relationships referred to frequently in the New Guinea literature are probably all correct in the sense that they apply somewhere under some conditions. The problem is one of knowing their applicability and this cannot be known until their interaction is understood which in turn cannot be known unless the individual relationships are understood. Not quite, but nearly so.

---

[5]For example, the rapid abandonment of men's houses as an institution and the attendant flutes and rituals in the eastern highlands may be seen in relationship to the introduction of steel tools and consequent alteration in female labor (as per the hypothesis offered here) in addition to Langness (1967) and Watson and Watson (1973).

Proceeding from the individual to a theoretical entity (system) on the population level can only be justified in the end by its utility in informing us of the underlying human condition. Thus, this link must be preserved though I think not to the degree of complete reduction to individual characteristics. In another direction there is yet a more difficult step. This is the determination of processual regularities rather than simple observed covariance among elements. Regulatory mechanisms fall into this category. Earlier in this chapter, the idea of density dependent regulation was introduced via Wynne-Edwards. No simple mechanisms were apparent. Direct competition for land results in migration, but land is often the critical resource rather than the conventional one that Wynne-Edwards suggests. Competition for women or men which tends to boost population in "low density" pockets must therefore release the pressure in "higher density" areas and thus fulfills his expectation. However, the process can in itself lead to pressure on the resources in the pocket and thus fluctuations continue. The whole region undergoes readjustment by expansion. It may be that certain areas of the highlands really are tightly regulated below some density level and have been for a long time. Certainly the archaeological evidence from near Mt. Hagen (Golson 1977) suggests that agricultural people have lived in the highlands for 9,000 years. Population growth was sharply regulated by some means. Modern contact changes may have been more disruptive than we imagined and readjustments to sweet potato introduction may still be in progress.

There remains the obvious role of pigs and their conversion to shell valuables as the most likely source of conventional competition. Careful research on this topic would be required to properly judge the operation of any such regulatory mechanisms. In the context of the foregoing discussion, however, one possibility stands out. Where a man's social position is related to the acquisition of sufficient resources and his success in the exchange system, those individuals who are less successful are probably most likely to be the migrants who leave a "high density" group. This would apply primarily to older migrants since young men are almost automatically in a low social position. Position in the new community will depend on the new context.

Regulatory mechanisms must specify circumstances of applicability as with the earlier hypothetical statements.

In a sense such processual hypotheses are more difficult to determine than the earlier associations. On the other hand, they may be more powerful and are methodologically more available than inductive relationships when derived from "without" as with the Wynne-Edwards observations. In such a deductive approach there is some promise of partially alleviating the circular difficulty of determining the matrix of relationships noted above.

In the end, our theoretical framework still wants for rigor and scope. On the other hand, the ethnographic work done to date in the Highlands of New Guinea probably contains sufficient information to evaluate rather complex theoretical statements--if only we knew what they should be.

APPENDICES

APPENDIX 1

PRINCIPAL CULTIGENS AT YUMBISA

Botanical Name	Common Name	Local Name	Notes
Allium cepa	onion	aniane	Introduced
Brassica ?ainensis	Chinese cabbage	kumbala	Introduced
Brassica oleracea	cabbage	kapusa	Introduced
Colocasia esculenta	taro	maa	
Cordyline sp.	tanket	akaipu	Clothing, boundary Marker
Elaeocharis sphacelata	'put put'	kuta	Clothing
Ipomoea batatas	sweet potato	aina	"Traditional"
Nicotiana tabacum	tobacco	muti	"Traditional"
Pandanus sp.	nut pandanus	anga	Rarely planted, multiple uses
Phaseolus vulgaris	bean	tupaita	Rare, introduced
Pisum sativum	pea	piundii	Introduced
Pyrethrum cinerarifolium	pyrethrum	palawaa	Remnant of de-funct cash crop
Rorippa sp.	'kumu'	auwa	
Rungia klossii	'kumu'	?	Semicultigen

Botanical Name	Common Name	Local Name	Notes
Saccharum officinarum	sugar cane	*lyaa*	
Setaria palmifolia	highland pit-pit	*mina*	
Solanum nigrum	'kumu'	*takani*	
Solanum tuberosum	Irish potato	*samu, pasalee*	Introduced
Zea mays	maize	*kanapa*	Introduced

APPENDIX 2

GARDEN SURVEY

A "transect" was chosen which followed major paths and seemed to represent slope and valley in reasonable proportion to cultivation. All plots on both sides were monitored, whether in fallow or cultivation, although some large plots were recorded only for the portion readily visible from the road, and some adjacent valley plots were added to adjust the valley-slope proportion (see Map 2, Appendix 5 for "transect"). By chance there were 100 plots which represent about a one-sixth sample of total local clan plots.

The first survey was made on 24 April 1973 and plots were added until 8 July. The last survey was run on 17 April 1975. Between these dates bimonthly recordings were attempted until the last six months which were recorded monthly. Actual periods varied somewhat due to other commitments and three periods of two to four months occurred due to absence from the site. In these latter cases mounds were age estimated to one month in the next survey.

During each of the 30 surveys, which took a full day, the following data were recorded: number of mounds constructed, number of mounds harvested, weeding, crops visible, stages of growth, approximate amounts of crops, harvest of crops, damage by pigs, workers present, miscellaneous notes (fallow status, pigs grazing, change of ownership, etc.). As a result the following information became available: number of mounds constructed per cultivated garden per day, maturation/harvest times, weeding intervals, crop composition and distribution, gardening techniques, degree of pig damage, work patterns, short and brief fallow information and miscellaneous data. All information can be stratified for slope vs. valley and the social categories of gardener.

The difficulties with this survey can be succinctly summarized. Although the sample size was fairly large in comparison to the total population of plots, the nature of gardening practices suggests that sampling is itself inappropriate in determining rates of gardening. A random sample of 100 plots or a compass transcet might have improved the data but would not alleviate the underlying problem. Basically, if gardening were done in small, continuous increments over many cultivated plots, the sample would be more representative. As it was, however, gardening was done rapidly in a few places for any time period. The resultant bias yields a variable prediction for total number of mounds in the clan area when compared to the total mound count described in Appendix 3. The latter provides a good figure for total number of mounds. A consideration of the time involved in the two methods suggests that an increase in sample size would be so time consuming that one would be better off to do a total count, say, every six months. However, the two-week interval would still be appropriate for determining information other than mounding rates.

APPENDIX 3

GARDEN MOUND COUNT AND CROP COMPOSITION SURVEY

A. Mound Count

During a two-week period centered on 1 April 1975, all garden plots on Kapii local clan territory were visited. All mounds in each plot were counted and recorded by estimation of their age in unitary months--(one through nine), less than two weeks, greater than nine months (unharvested) or harvesting (with age estimate). The work was done by myself and Imambu, my local research assistant. We ran independent counts and age estimates on several plots and compared notes which showed close correspondence. The major deviations occurred in the five- to seven-month cohorts which are difficult to separate. Ageing was done by visual examination of vine length, weed growth, development of subsidiary crops and occasional inspection of tuber development. It should be noted that this survey was conducted at the end of the fieldwork when maximum recovery from the 1972 frost had occurred and I was most familiar with garden characteristics having kept the garden record described in

Appendix 2 for nearly two years. However, a comparison to that record of 100 plots showed that the maximum expectable accuracy in age estimation should be ± one month rather than the ± two weeks we used. This is especially true for the five- to seven-month period.

B. Crop Composition

During the same two-week survey the occurrence of subsidiary crops was noted for each garden for each cohort of mound ages.

In May of 1974, all the local gardens in current cultivation belonging to three families who were known to have been present during most of the preceding ten months were surveyed. This turned out to amount to 20 plots, 18 of which were valley gardens. Two additional plots from two other families were added to represent slope gardens more fully. The total number of mounds was 2,780 (with 21% on the slope vs. 23% by the mound count of 1 April 1975).

The sample is more appropriately conceived of as 2,780 mounds which represent the planting characteristics of the ten women who worked them. For each mound, the number of plants per species was recorded and their stage of development. That provided a frequency of plants per mound per species. From the 1 April survey (part I above), the number of mounds in which the species occurred was derived. Assuming the mound composition survey to be representative of all mounds in the area, an estimate of the total crop composition for all gardens in cultivation was calculated.

APPENDIX 4

HOUSEHOLD FOOD CONSUMPTION SURVEYS

Observations were recorded for two time periods: 5, 6, 8, 10, and 11 October 1973 (nia shortage) and 2 through 9 April 1975 (good times). Sample households were chosen conveniently near to our own house and were composed as follows:

	no. of house-holds	males >15	females >15	chil-dren <15	total population
nia shortage	4	8	11	17	40
good times	6	9	10[a]	15[b]	40

[a]4 lactating, 1 pregnant
[b]2 nursing frequently, 2 seldom

The good times sample added two households to the nia sample but household composition had changed somewhat.

All houses were visited during morning and evening meal times. Informants were asked to recall anything ingested between observations and anything put away for later. Rarely was the full household present; absentees were quizzed on their consumption at the next meeting, when possible. Any foodstuff discovered during these observations was weighed in whatever state of preparation. When the family was actually in the process of eating this would have been awkward, though I did do it on a few occasions. Rather than disrupt the routine, I recorded the observed size of sweet potato tubers (length and diameter) and asked informants to point out ones of a size similar to those already eaten. By the third day most households were in full cooperation with the scheme and gave willing (if not accurate) reports. Irish potatoes and taro were recorded by diameter (and length for taro), greens and pork by a visual estimate of volume and pandanus nuts by a measure of double handfuls, handfuls, small handfuls.

Charts were then constructed which converted length and diameter of tubers to weight by comparison to weighed samples. Pork and pandanus weights were established by sample measurements and greens were compared to uncooked weights. Such measures were at the best rough approximations.

The next problem revolved around the frequent absence of members of the sample. The population was stratified as: males 15-55, females 15-55, children 4-15 (actually 4-12), nursing children (<4), persons over 55.

For each stratification, consumption records were divided by morning meal, daytime consumption and evening meal (and after) for each type of food for each day. The total food of one type eaten in each such cell during the survey period was divided by the total number of recorded consumers thus yielding average figures for morning, daytime and evening consumption for each age/sex stratification and each food type. (E.g. over eight days, four nursing children ate a total of 60 grams of sweet potato in ten reports during the daytime. Therefore, a nursing child was assumed to eat--on the average--six grams of sweet potato a day.) Assembling these figures for all foods and converting to kilocalories (Waddell 1972:Appendix 5) gave a daily estimate for each age/sex stratification. Then the age/sex estimates were adjusted by the population pyramid distribution (Figure 2) and a per capita consumption figure was calculated which appears in Table 15:II.

There are two major difficulties with this survey.

1. More accurate weights must be taken of actual food consumed. This requirement acerbates the second difficulty.

2. The fundamental problem is one of monitoring eating behavior in a dispersed settlement where people do

not eat habitually at one time or one place and snack between meals. Moreover, households are composed of multiple families or multiple gardeners who bring the produce in at different times from various sources. The necessity of careful measurement requires that the observer be constantly with the consumer, even constantly interrupting his eating. The only way I can see to get around this problem would be to follow each individual in a sample all day long for several days. To achieve an adequate sample would obviously require months. Although the procedure would likely produce very interesting data of other sorts, the observer's effect on eating behavior might be large.

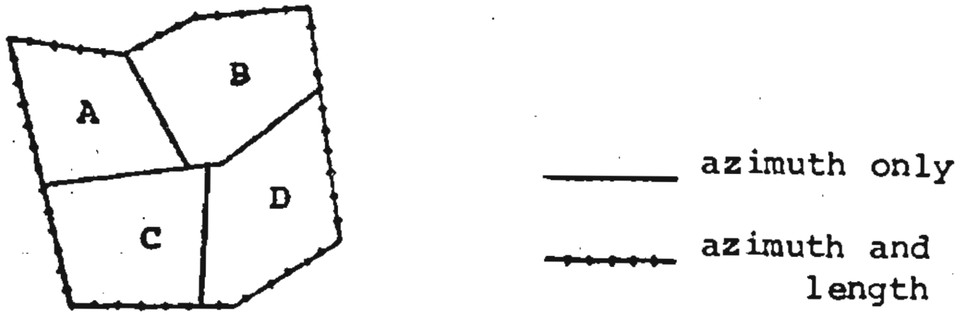
My impression of the results of this survey is that the recorded food intakes are largely underestimated.

APPENDIX 5

MAPPING

Mapping was begun early in the fieldwork and carried on sporadically throughout. All ground survey was done with a handheld K and E (after Brunton) compass and a 66 foot steel tape. I shot the azimuths and measured each segment while my assistant held the other end of the tape.

The initial work was done by establishing a "baseline" survey along the two major paths which also served as the garden "transect" noted in Appendix 2 (see Map 2). From that referent, east-west running ditches, paths and/or fences were surveyed from the slope edge as far into the swamp side as water level would allow. This was repeated until almost every side of every valley garden had at least an azimuth. Thus (approximately) for each block of four gardens I had azimuths and measured lengths for the total perimeter and azimuths only for the four internal sides.



This procedure was possible only because most valley garden boundaries were in fact fairly straight lines--minor irregularities were ignored or "averaged" by a linear sight approximation. Slope gardens in current cultivation were mapped individually and tied to the valley block if close.

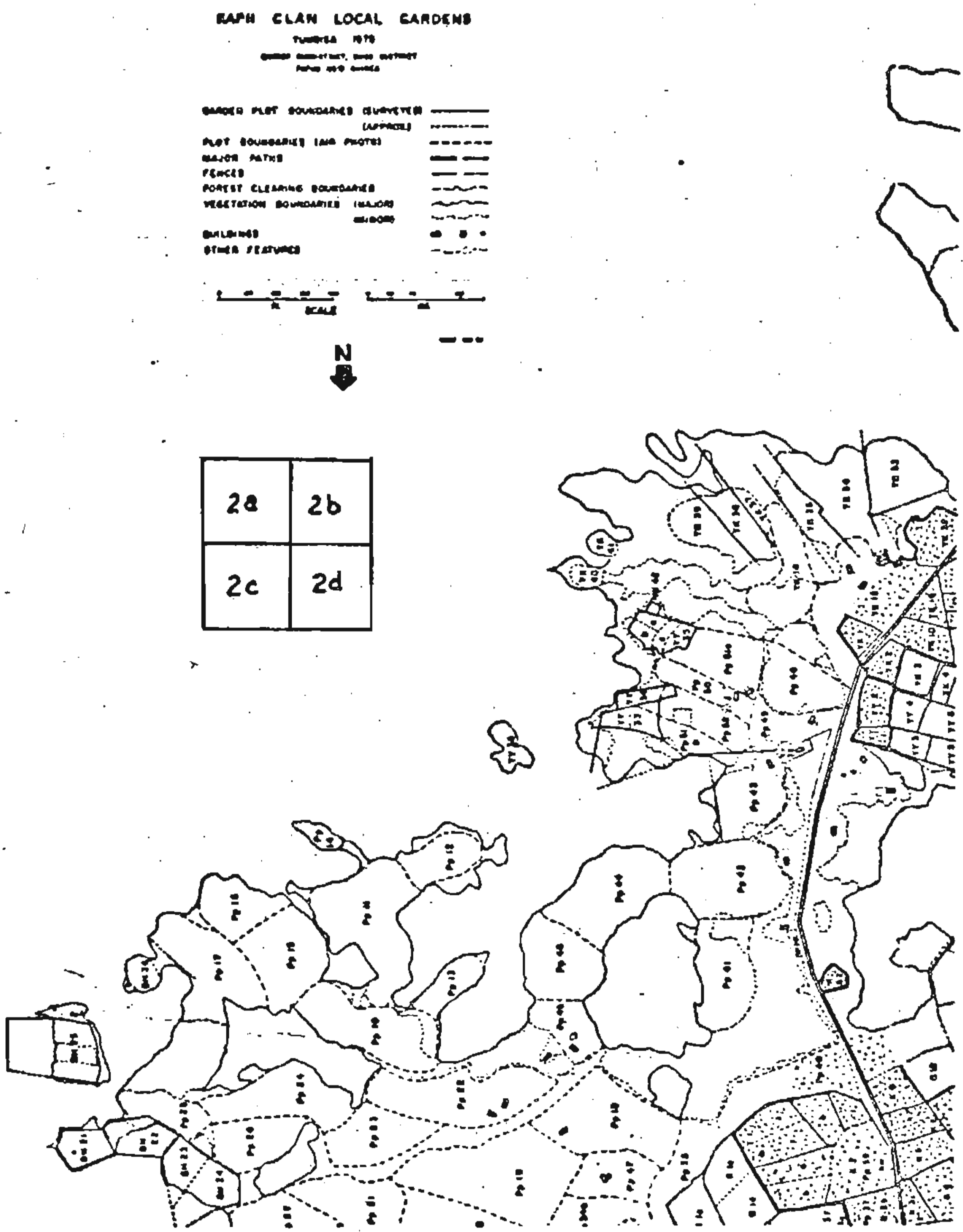
As I made the initial field map, before all east-west surveys were completed, it became apparent that some fundamental discrepancies existed. To tie the east-west lines together, seven north-south compass transects at 400 ft. intervals were made with measurements to a corner of every garden crossed. Using that basis, much better closure was achieved. The resultant blocks were then finished by east-west survey with occasional shorter compass transects to solve "local" problems.

The result was a fairly coherent map of valley gardens, except for those in wet fallow where boundaries were impossible to map on the ground. Slope gardens on the forest edge were not adequately tied to the valley block (attempted by triangulation), forest margin was largely unsurveyed and fallow slope plots were approximated by verbal description from informants while sitting on a nearby elevated vantage point. After fieldwork was completed, the map was redrawn at a scale of 1 inch = 100 feet and the above gaps in spacial relationship were filled by the use of air photographs.

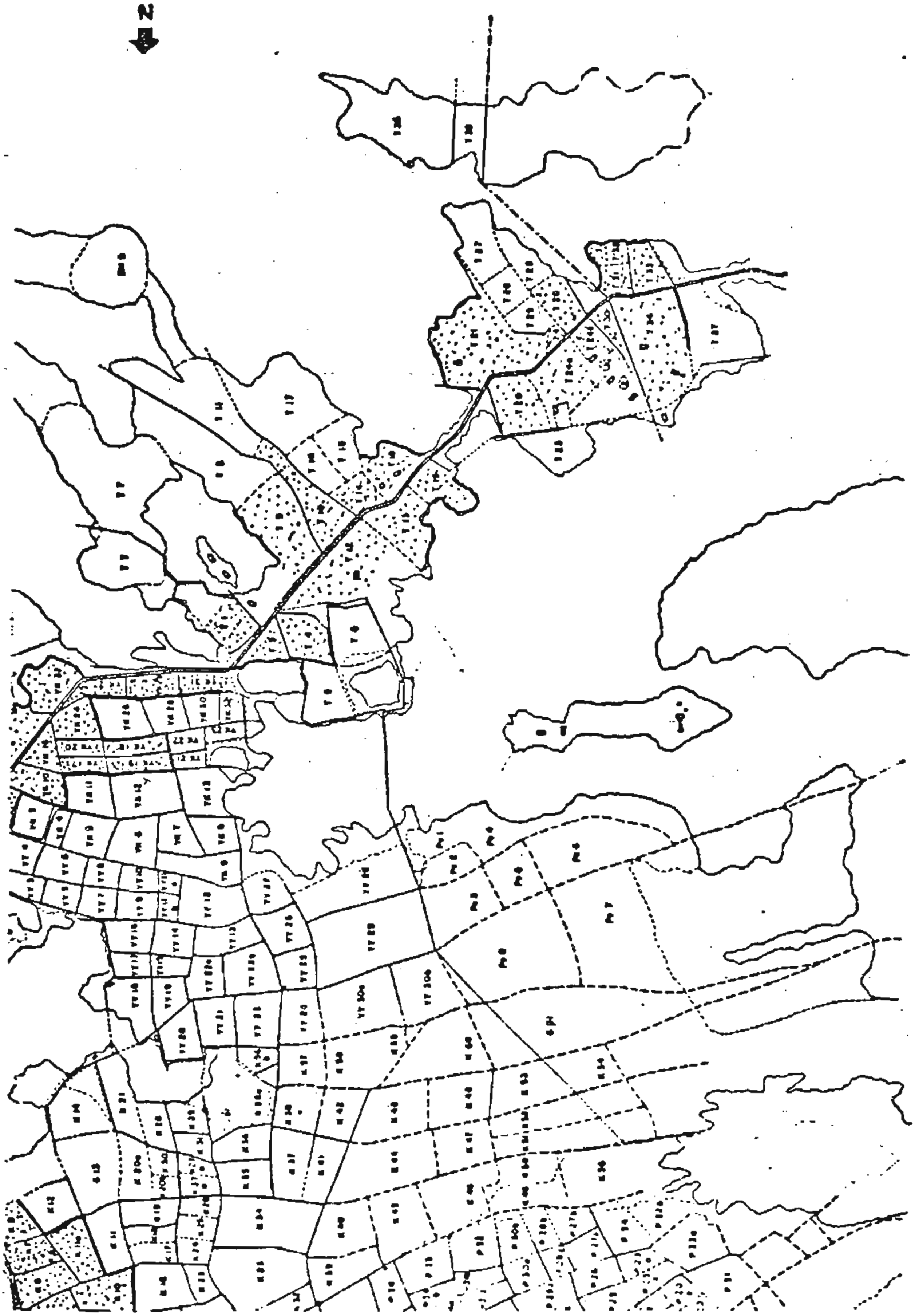
Two runs are available, made by RAAF flights in 1959 and 1974. The earlier plates are clear and (in addition to showing clearance since 1959) reveal some boundaries not apparent in the later run, especially on the slopes. Unfortunately the later photo is much less sharp. At any rate, X5 enlargements were ordered from the original nine inch negatives. These in turn were photographed on 35mm slides. The slides were then projected with a variable focus lens on to the work-up drawings. The missing boundaries noted above were thus added.

The final map was traced from that composit. Plots were cataloged by a locality abbreviation and a number (e.g. K-46 is the 46th garden in the Kinduli area--Kinduli being the local name). The area of each plot was then determined by averaging multiple measurements by plenimeter. The full map (measuring about 5x8 feet) was photo-reduced by one-third and copies made from a mylar positive for working sheets. Maps 2 and 3 are xerox reductions of that positive.

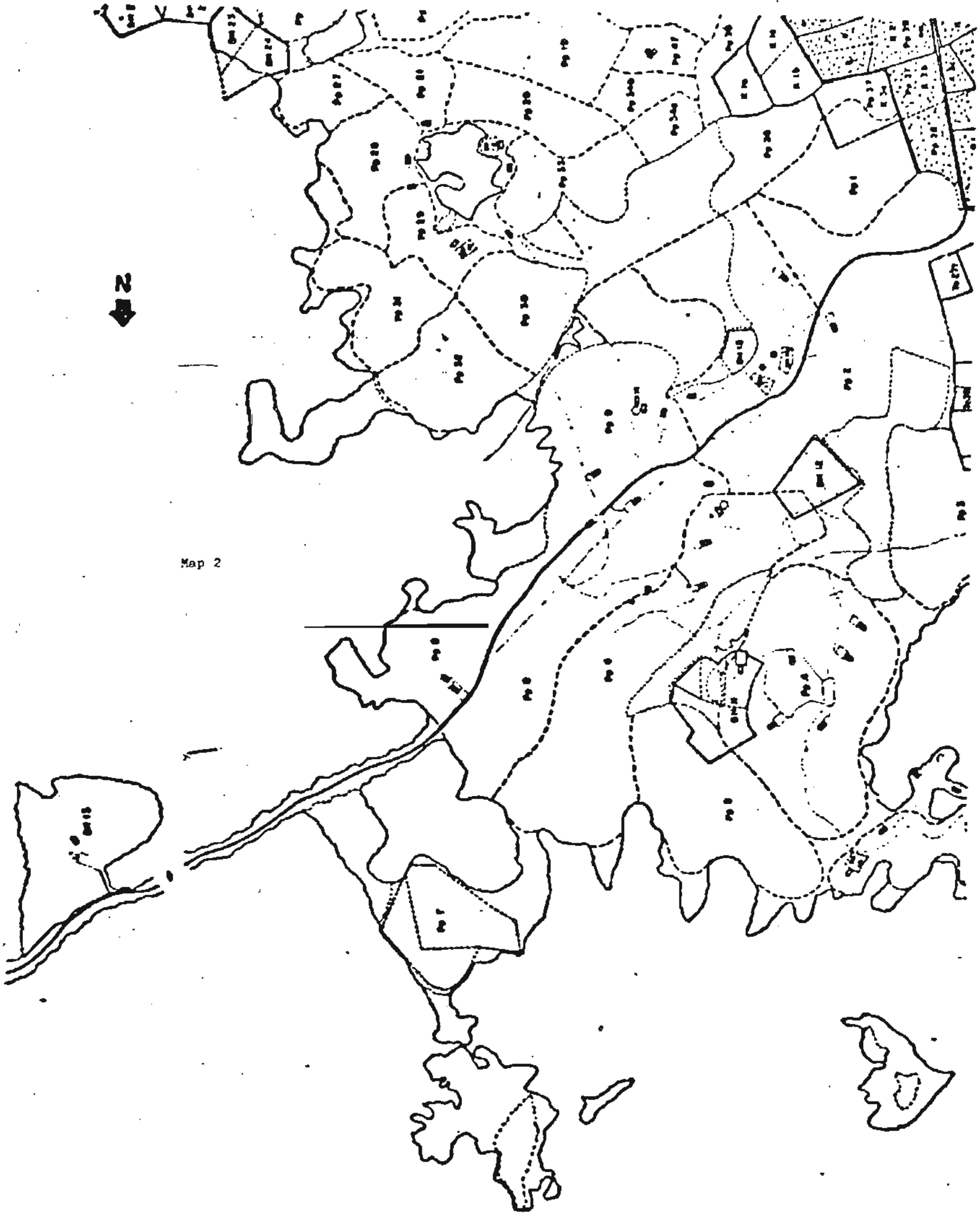
It is difficult to estimate the accuracy of the resulting product. However, some simply trigonometric considerations give the following approximation. If carefully shot azimuths were within $\pm$ 1/2° (as repetitions of the same shot suggest) and garden sides were accurate to $\pm$ 6 inch in 66 feet, the area of a fully surveyed valley garden of average size should be accurate to within $\pm$ 5 percent. Beyond that is pure guess work. My guess from comparisons of ground survey and air photos is that those plots deriving solely from air photo interpretation are accurate to $\pm$ 10 percent of area. Some fallow slope gardens may only be accurate to $\pm$ 20 percent of area.

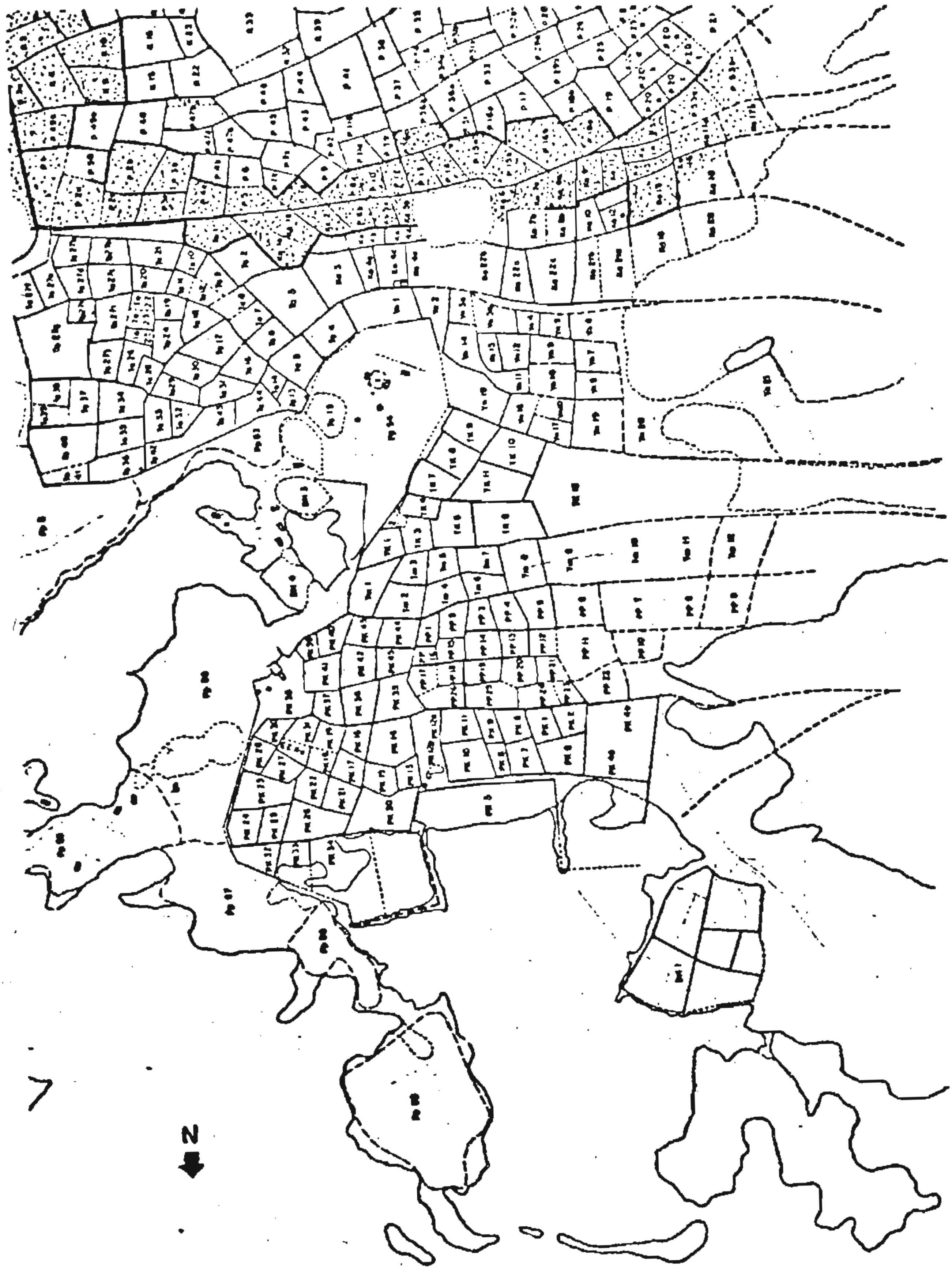

KAPH CLAN LOCAL GARDENS
GARDEN PLOT BOUNDARIES (SURVEYED)
(APPROX)
PLOT BOUNDARIES (AIR PHOTO)
MAJOR PATHS
FENCES
FOREST CLEARING BOUNDARIES
VEGETATION BOUNDARIES (MAJOR)
(MINOR)
BUILDINGS
OTHER FEATURES
SCALE
N
2a
2b
2c
2d

Map 2a

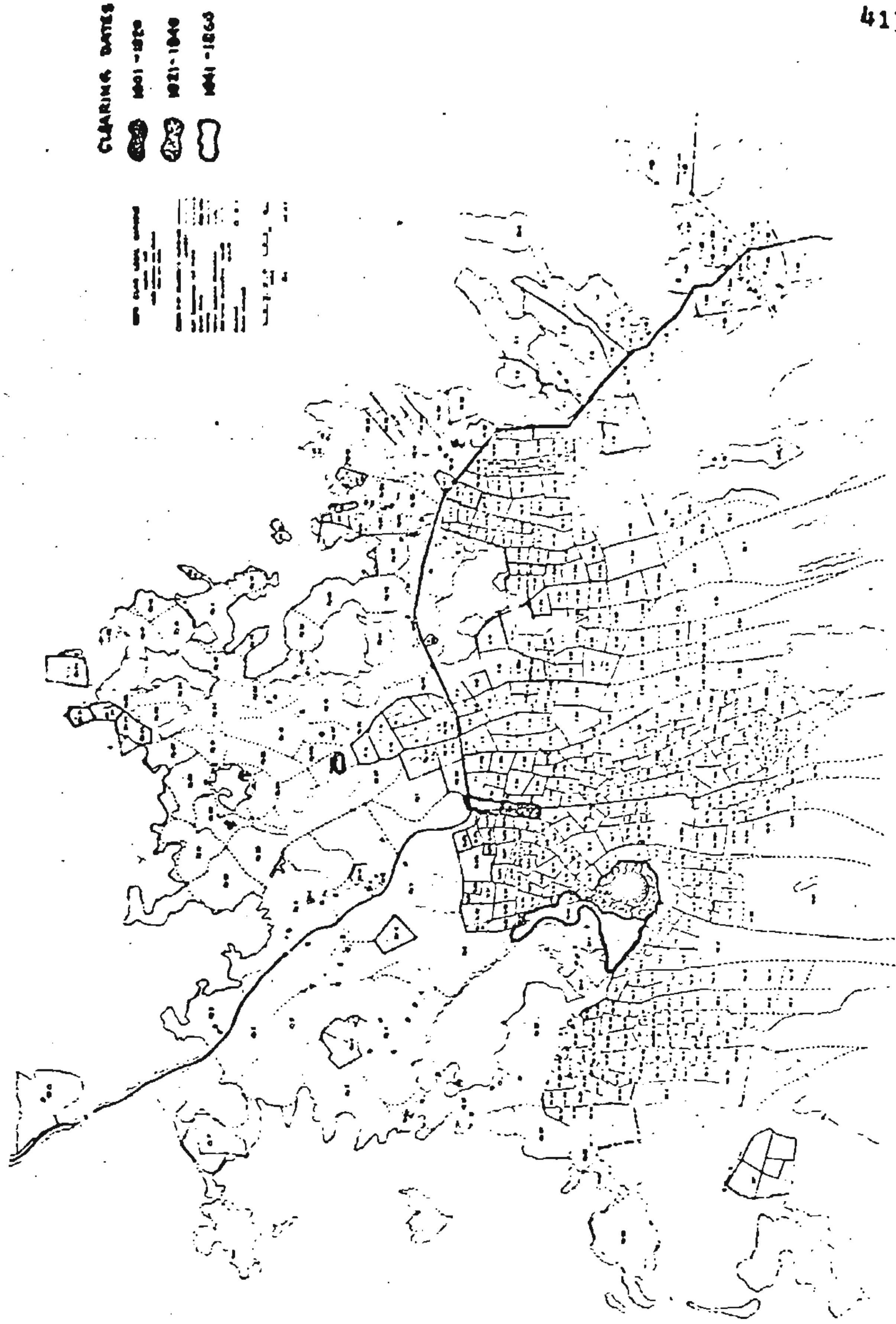


Map 2b

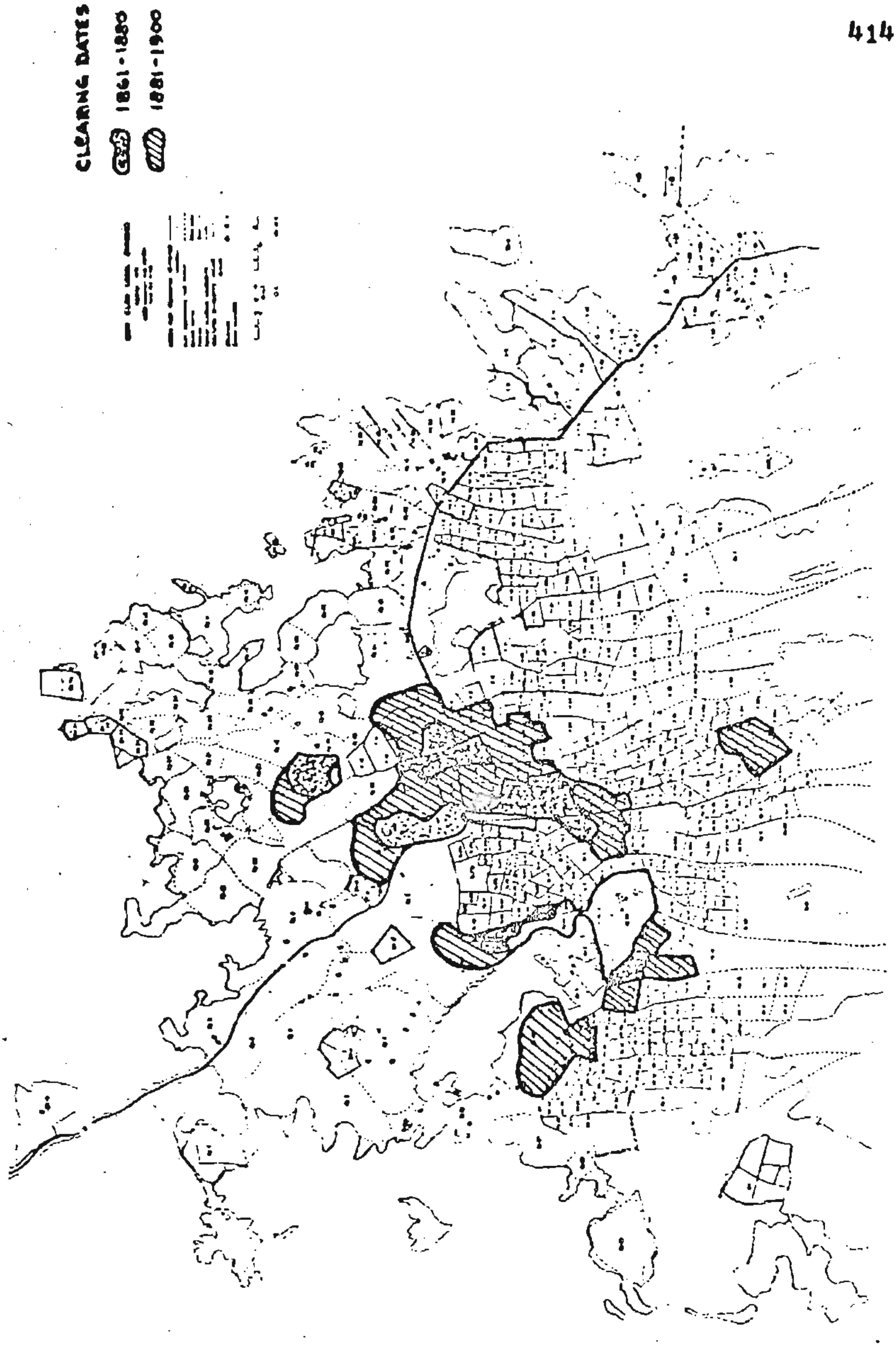

N
Map 2



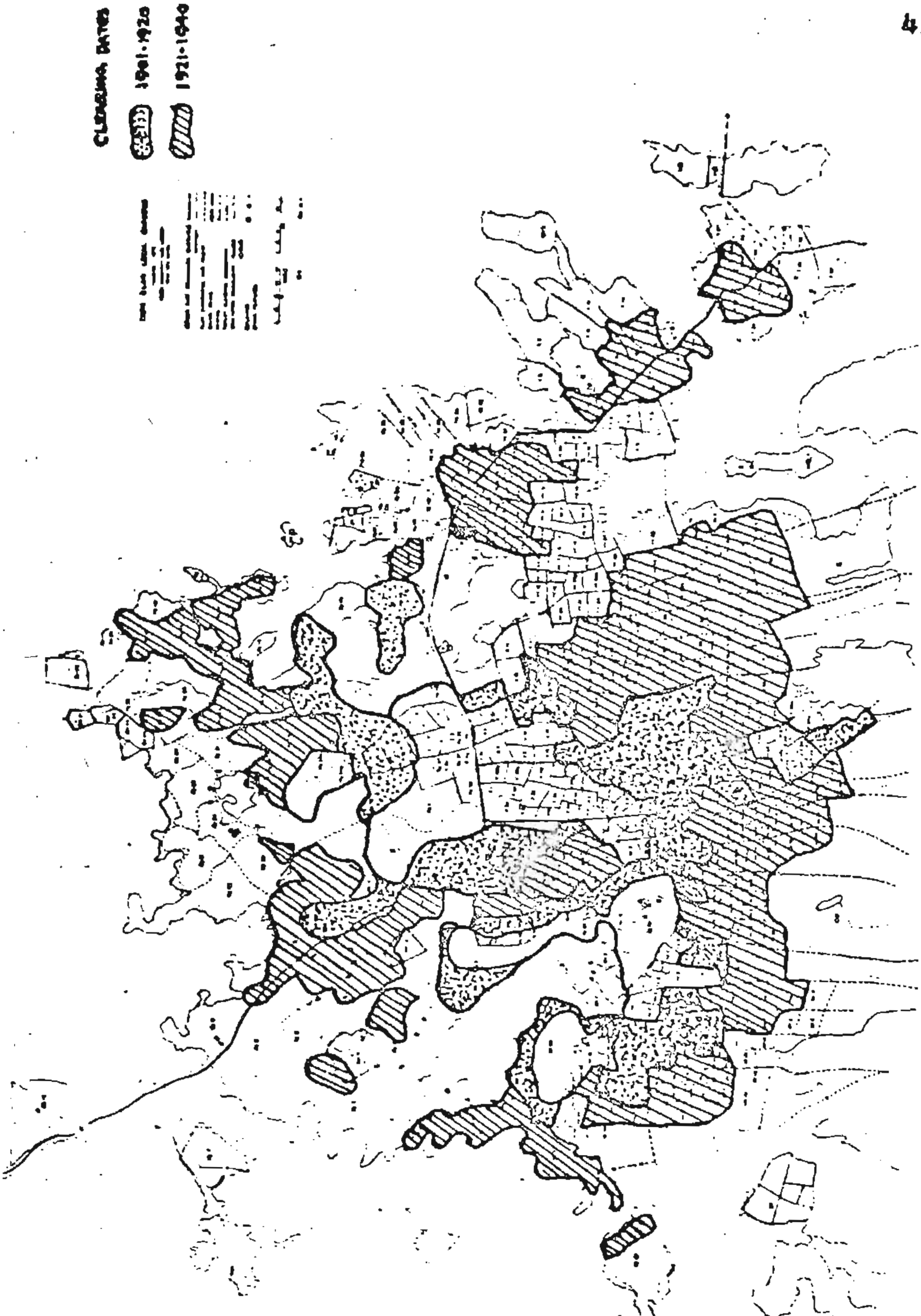
Map 2d



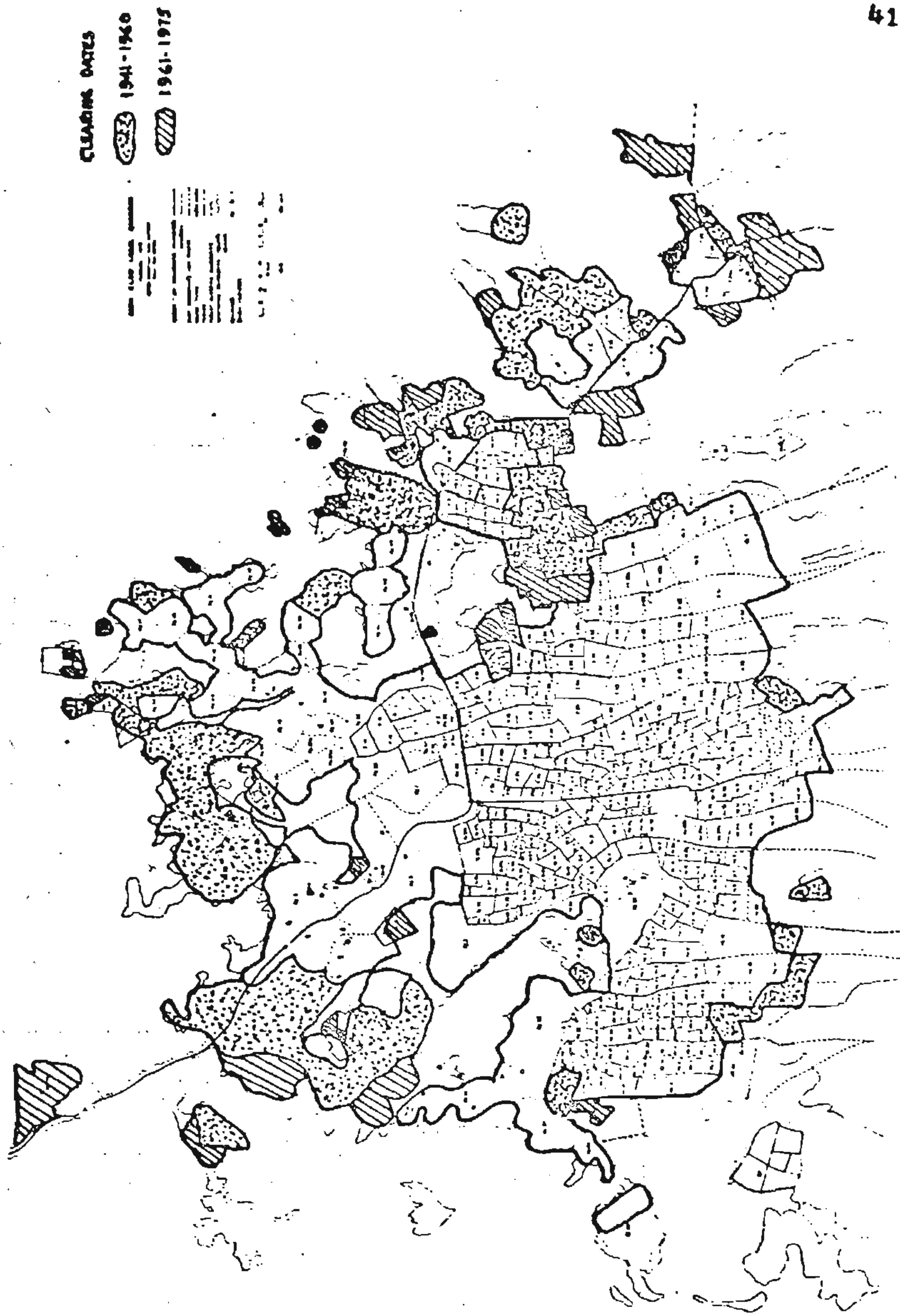
Map 3a



Map 3b



Map 3c



Map 3d

APPENDIX 6

GENEALOGIES AND GARDEN INHERITANCE

A. Data Sources

Genealogies were gathered in the following ways.

1. Several older men who were reputed to be knowledgeable about the upper levels were asked to recite the particulars. I then questioned them further on the basis of names and relationships encountered with others. This material is mainly reproduced in Figure 3. They were then asked to continue the recitations on down from the clan founder to every living married male in their lineage or subclan.

2. Twenty-one "key" genealogies were collected in full details (as far back and laterally as memory and endurance would allow). After an initial concentration on the lineage with whom we lived, these were extended, on the basis of 1 (above), to cover major "sublineages" throughout the clan.

3. "Minigenealogies" were collected for each household during the census. Residents were tied in and parents and siblings of adults were recorded. Each man's

genealogy was pushed back to the individual who first became a clan member or the clan founder. Past marriages were also recorded.

4. While gathering garden clearance and inheritance data, the names of individuals occurred which had not been previously recorded. These were then tied to the existing network.

5. Questionable relationships were reinvestigated as appropriate and the dominant view is recorded in the genealogy below. Where doubt persisted, the relationships are indicated by broken lines.

6. During the course of social activities, genealogical relationships were frequently declared publicly in support of one claim or another. These instances allowed for the addition of some relationships (and rendered a few problematical).

B. Genealogy

For each individual the following information is pertinent: clan of membership, father's clan if different, other clan ties if appropriate, place of residence/origin.

e.g., married man:	MUPALI 1930	NAME date of birth
	Bipi/Kapii	phratry/clan
	Yumbisa	place of residence

e.g., married woman:	ROMOWANA 1934	NAME	date of birth
	Yapakatutu		father's clan
	Lipitaka		place of origin

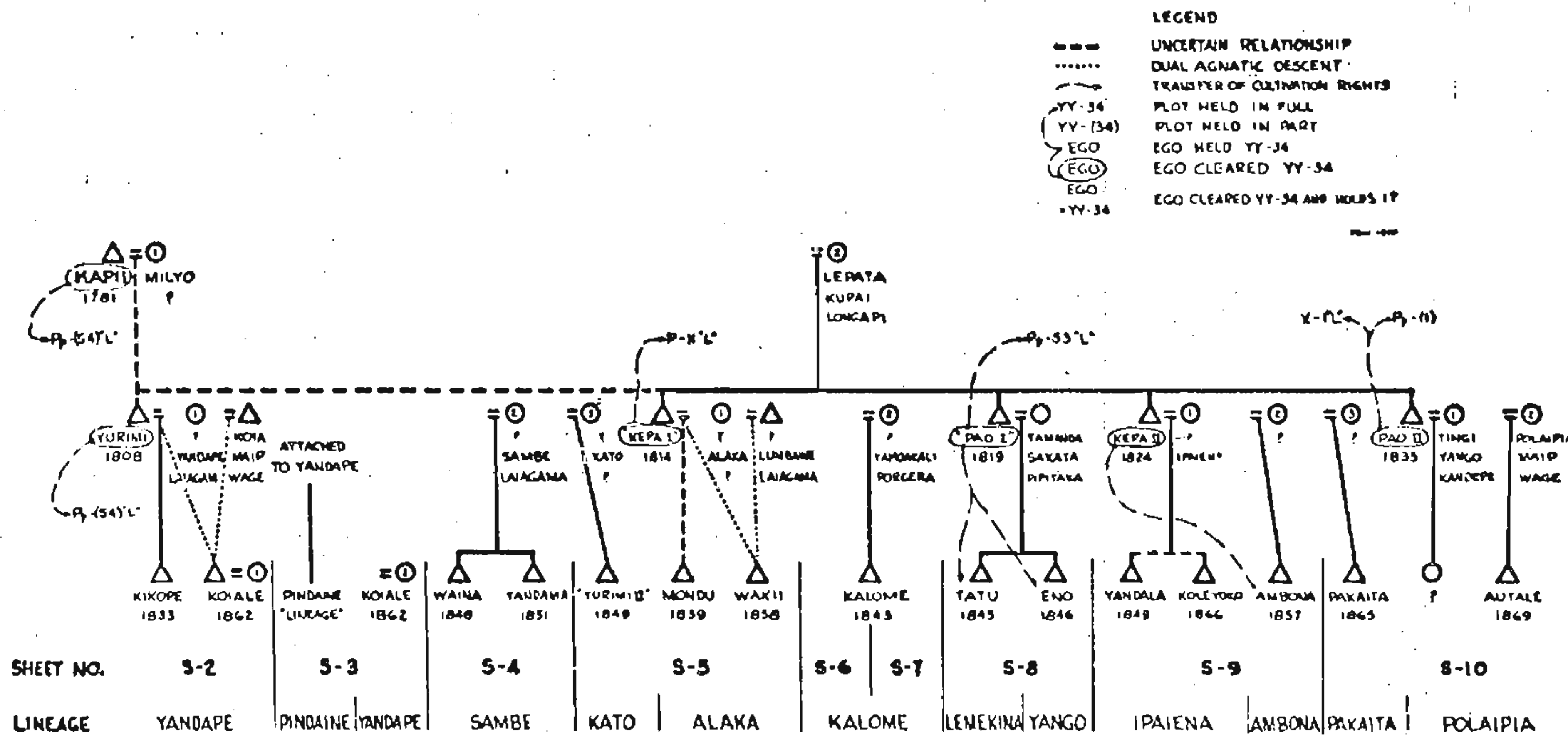
In the following genealogy of Kapii clan where no indication of clan or location is given, the individual is/was a resident and member of Kapii clan at Yumbisa.

C. Garden Inheritance

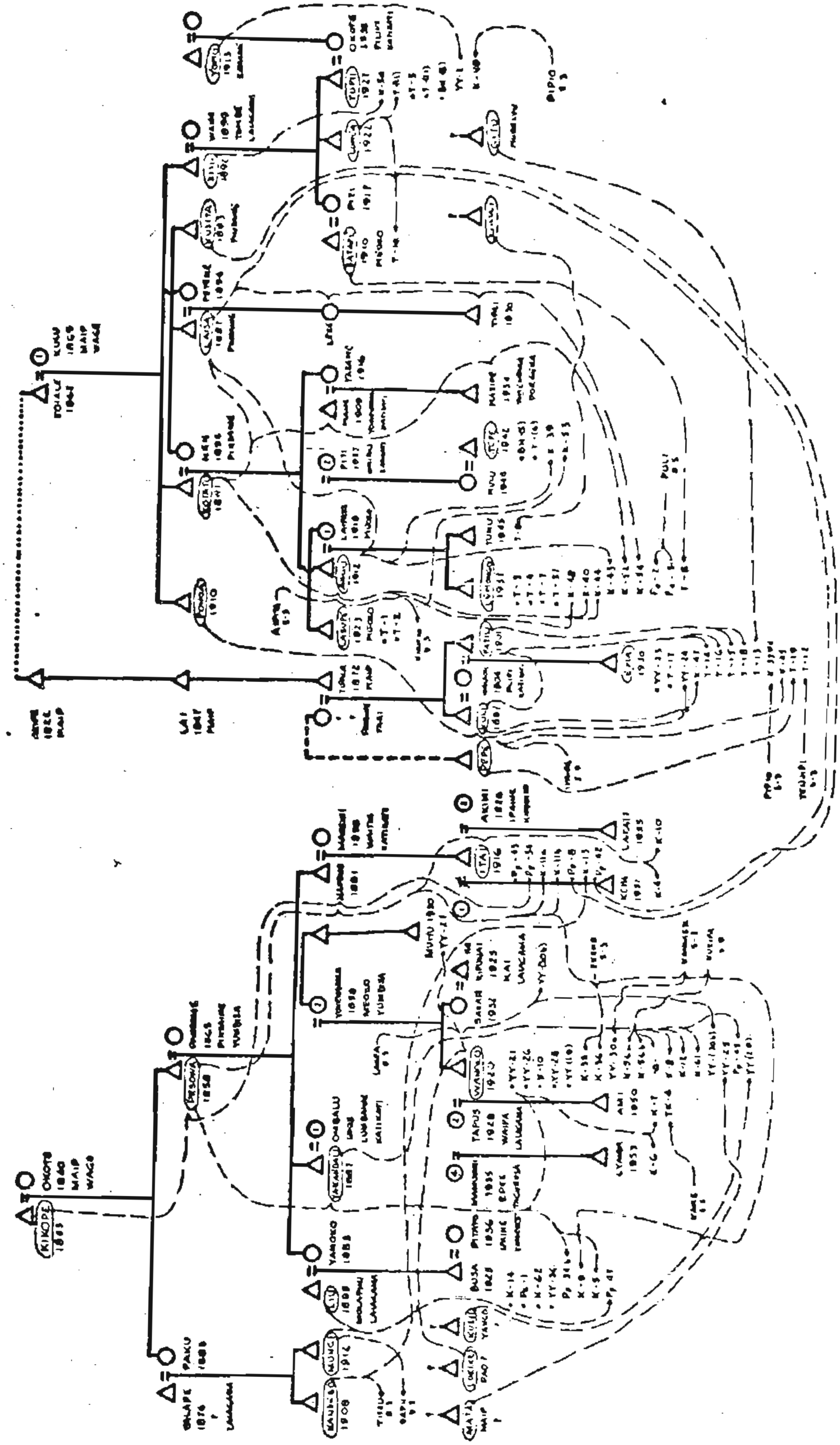
The purported clearer and each remembered cultivator was elicited down to the present for each garden plot (by existing boundaries). Key informants (bigmen) from each lineage gave the particulars. Since garden inheritance is public knowledge of some importance, the recitations are likely to be consistent (though accuracy in early clearing is another matter) Some areas were overlapped to provide a check and in several instances current owners were questioned as well. Only one garden was discovered to be unresolvable as to original clearer (P-48).

Current ownership (April 1975) is indicated by a list of gardens beneath the man's (occasionally woman's) name. This also serves to identify living cultivators. Gardens in lineage fallow are indicated as "L" and non-resident gardens as "NR" after the cultivator's name.

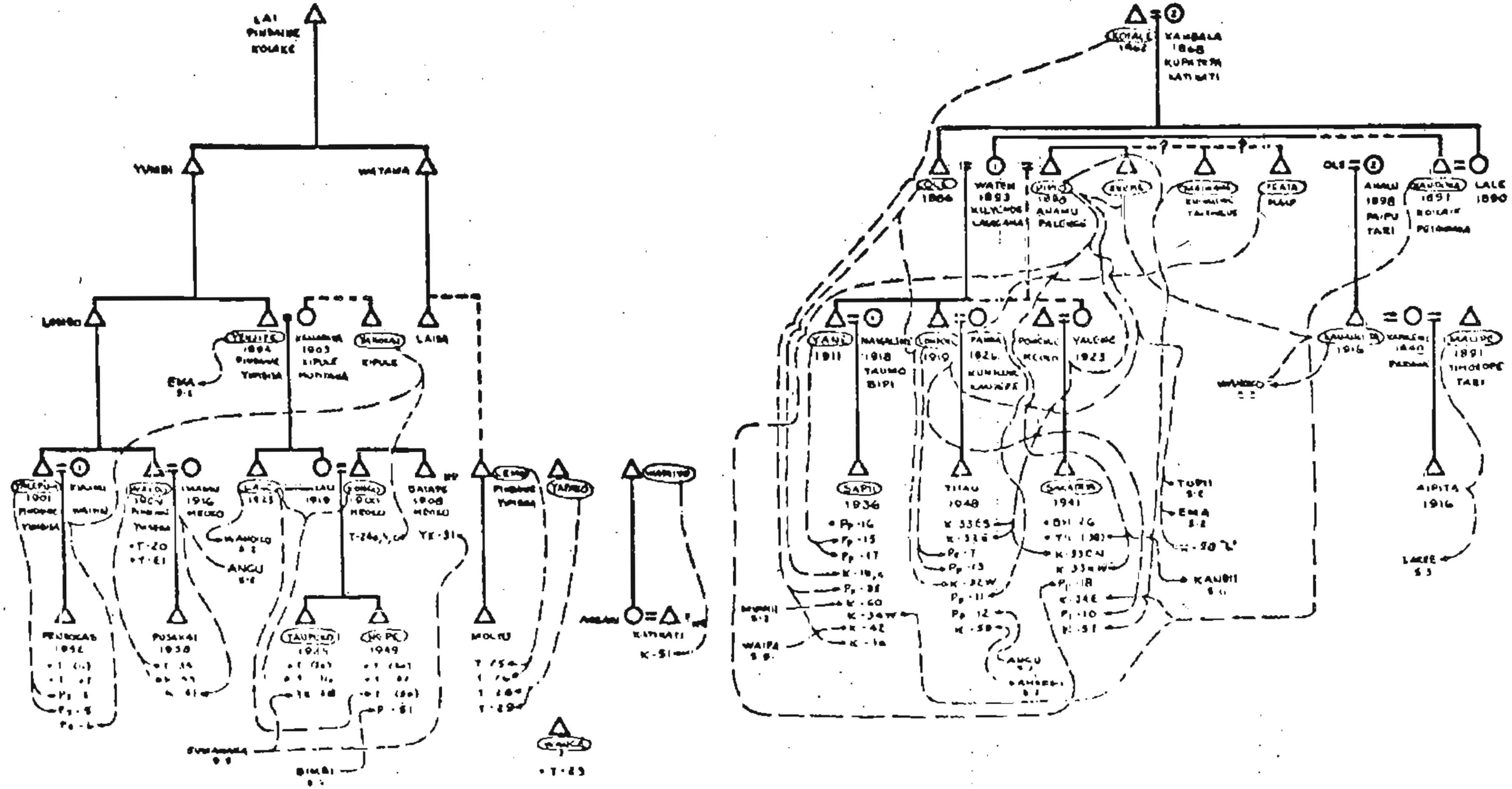
COMPOSITE GENEALOGY OF CULTIVATORS AND TRANSFERS OF CULTIVATION RIGHTS KAPII CLAN



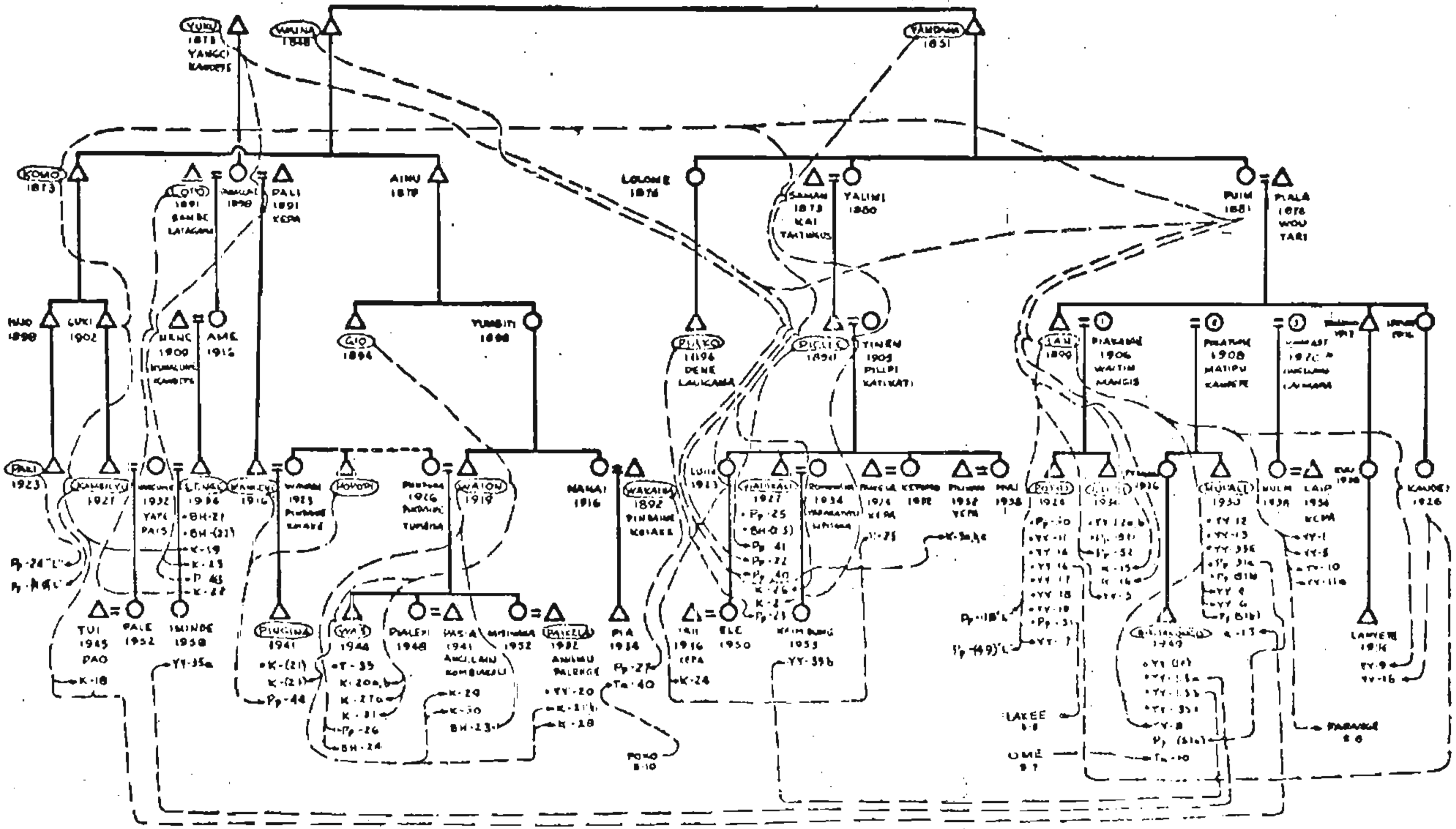
Genealogy S-1



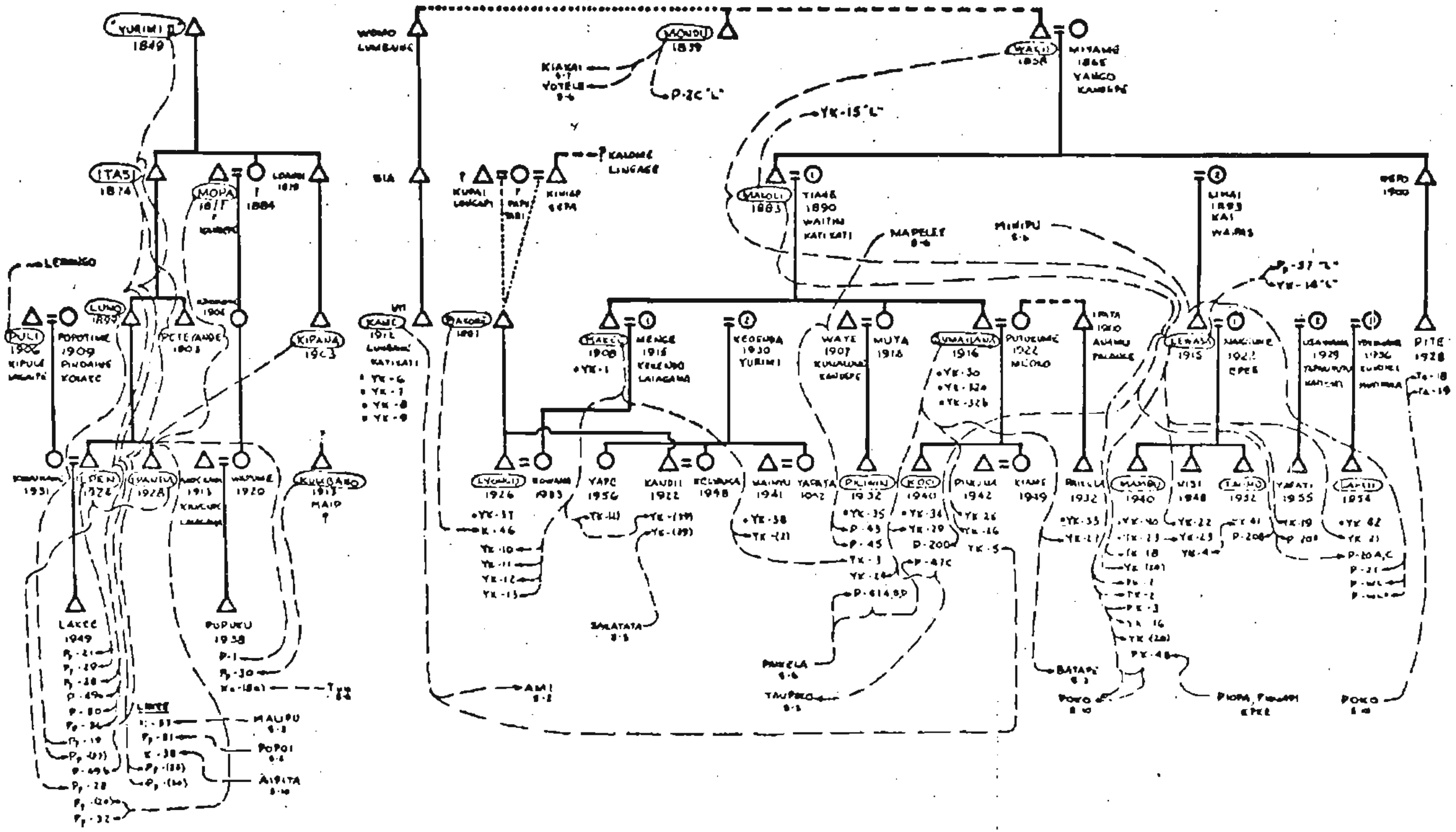
Genealogy 9-2



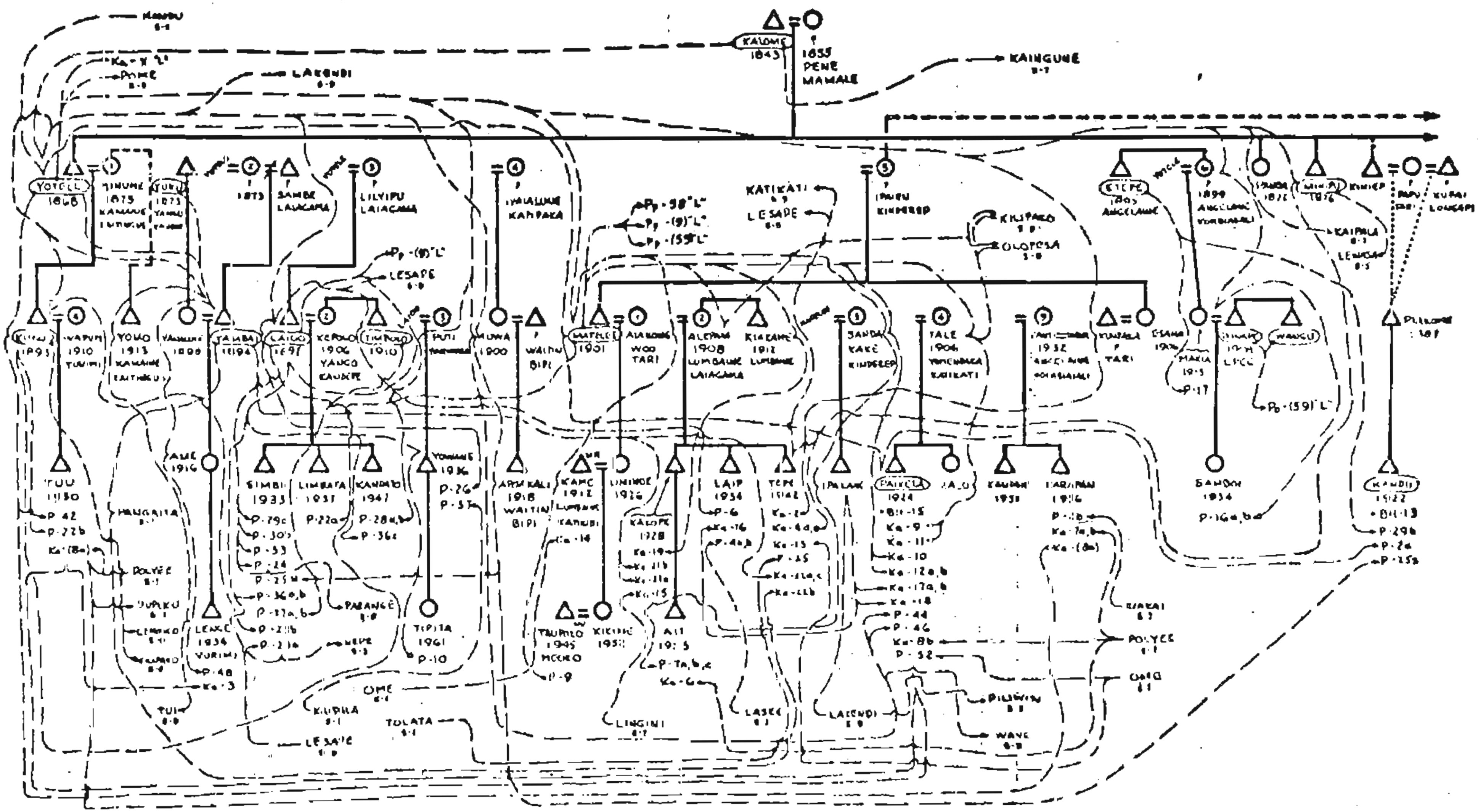
Genealogy 9-3



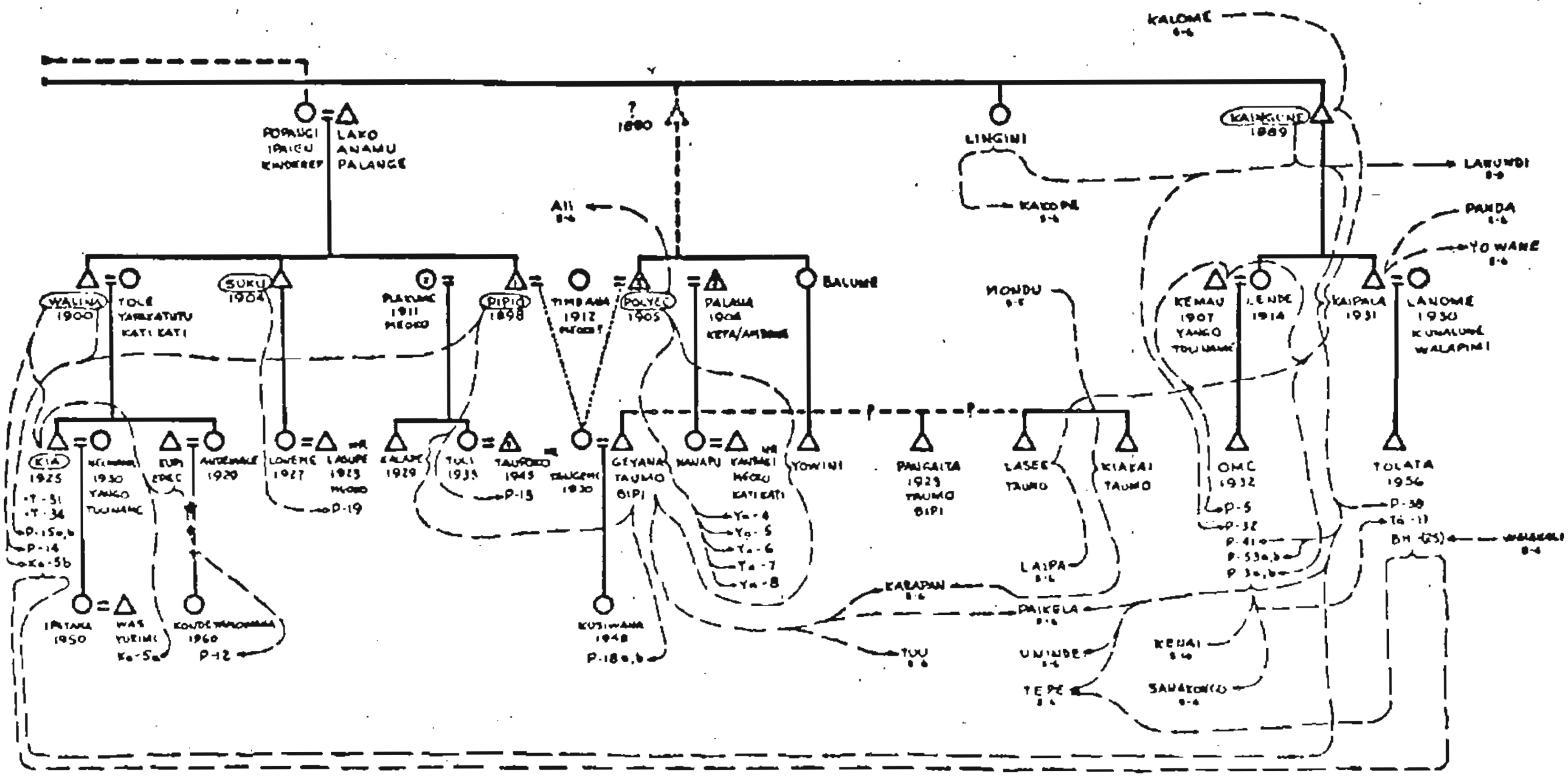
Genealogy 9-4



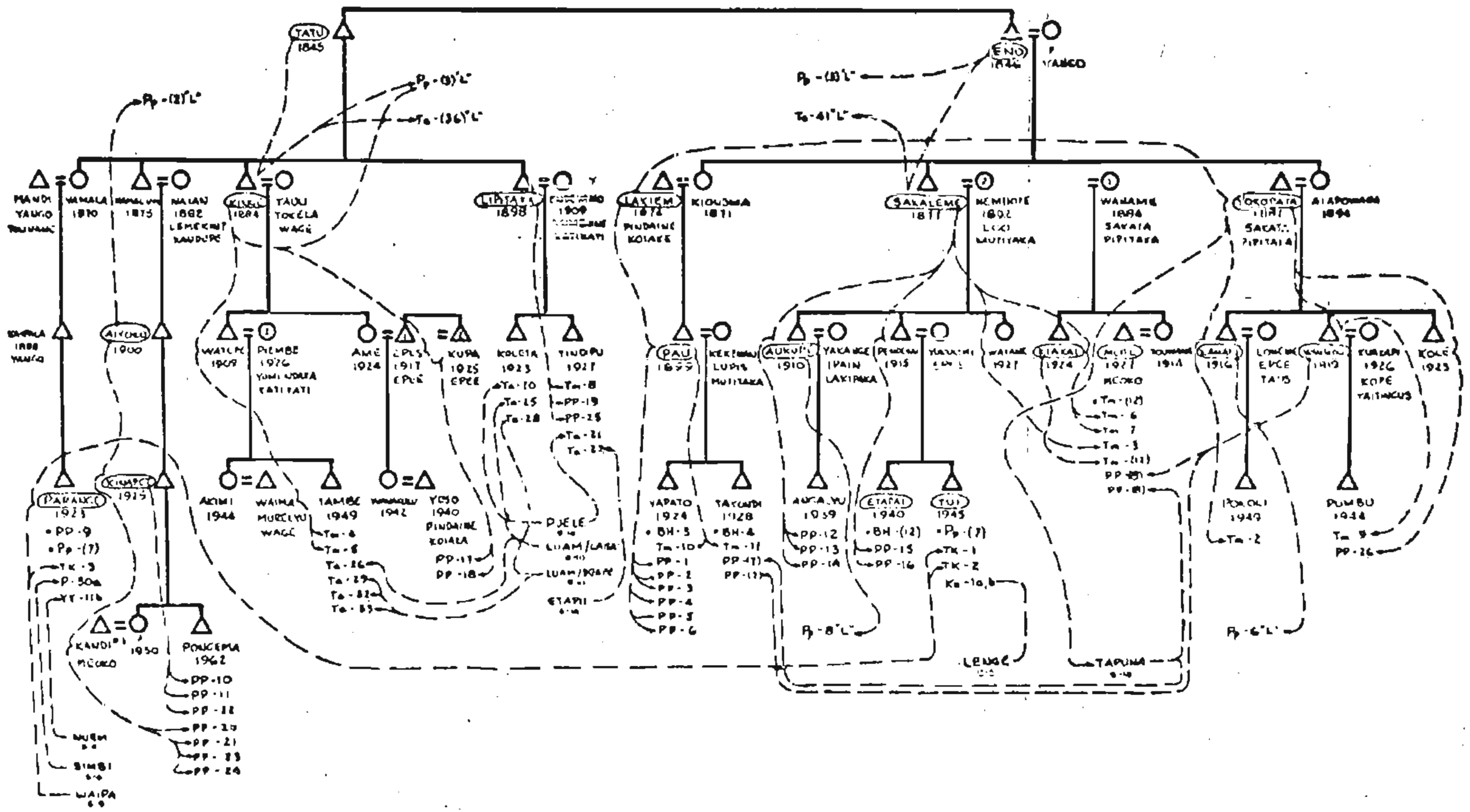
Genealogy 9-5



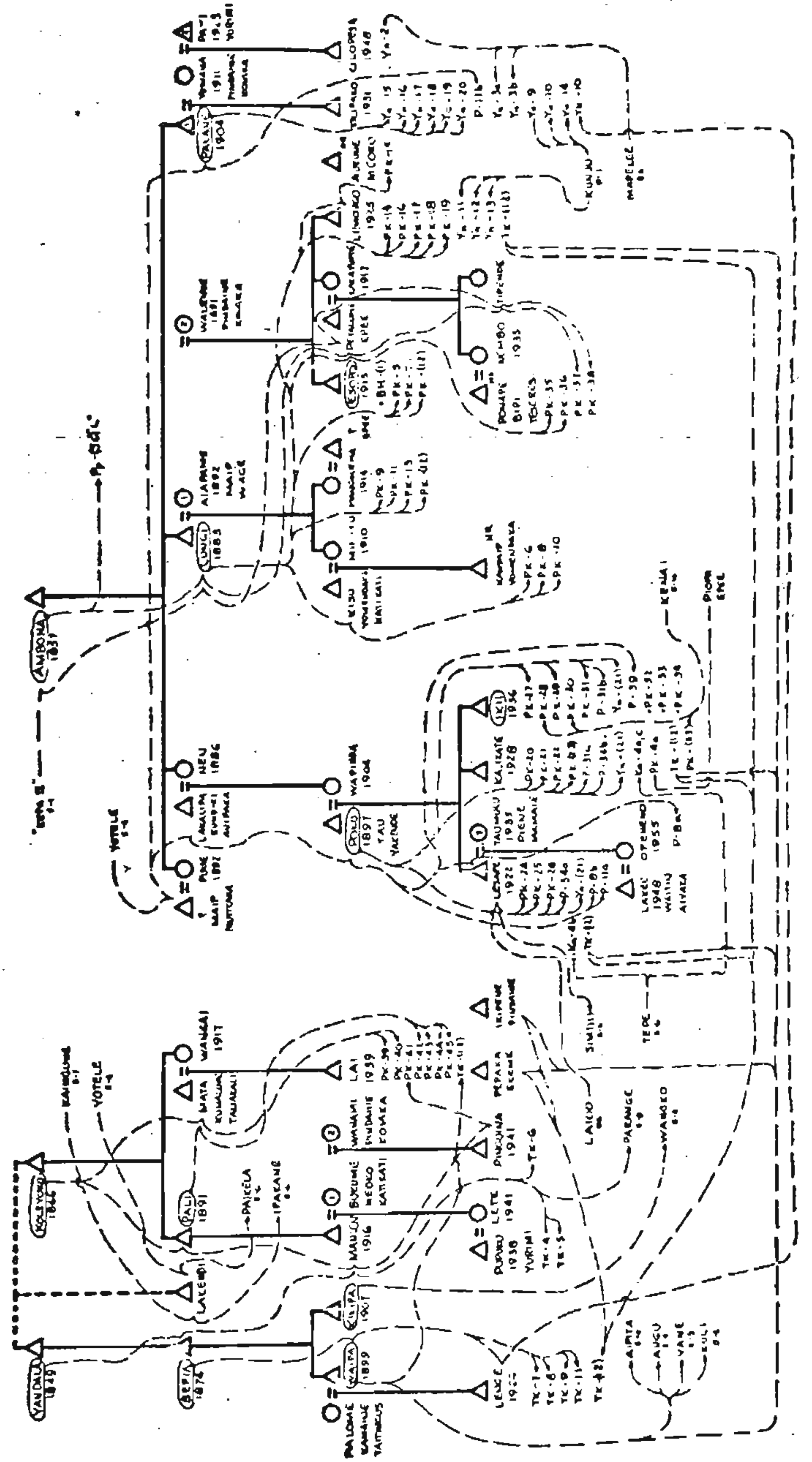
Genealogy 9-6



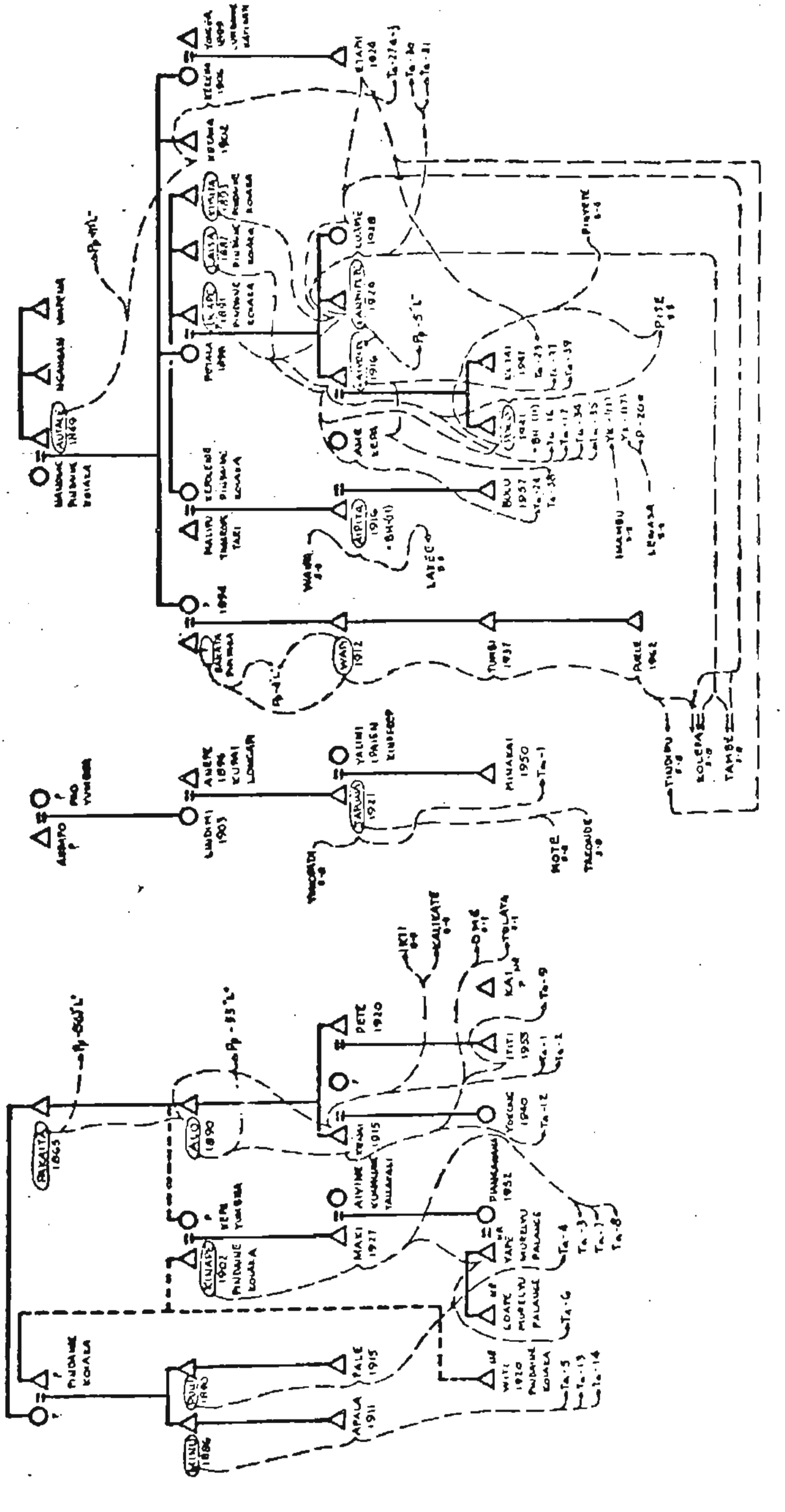
Genealogy S-7



Genealogy S-8



Genealogy S-9



Genealogy S-10

APPENDIX 7

AGRICULTURAL LABOR AND INTENSITY

The following tables were used to estimate energy inputs based upon field observations.

Table A

Activity	Female gardening per mound (steel technology)		
	Rate of Energy Expenditure (kcal./min.)[a]	Time (min.)	Calories (kcal.)
Walking	2.1	15	31
Grass cutting	3.3	15	50
Grass carrying	6.5	5	32
Breaking soil*	6.5	10	65
Mounding*	6.5	45	292
Planting	2.1	10	21
Weeding	3.3	15	50
Harvesting*	3.3	15	50
Carrying produce	3.3	15	50
Resting	1.1	20	22
Totals		165	663

[a] National Academy of Sciences 1974

*Activity alters with wood technology

Field measurements indicate that use of a wooden shovel increases the overall time and (by inference) energy expenditure by 9 percent. Slope gardens require less work due to more friable soil and smaller mounds (over the course of the garden life). Taking these factors into consideration, Table B results.

Table B

Mound Location	Technology	Calories/Mound
Valley	Steel	663
	Wood	723
Slope	Steel	574
	Wood	625

Male labor inputs were estimated as follows:

Table C

	Male Forest Clearing per 10m.^{2} (steel technology)		
Activity	Rate of Energy Expenditure (kcal./min.)[a]	Time (min.)	Calories (kcal.)
Walking	3.0	30	90
Clearing Underbrush*	4.4	60	264
Ringing and Felling Trees*	6.5	60	390
Removing Roots*	6.5	60	390
Moving Brush	4.4	30	132
Burning	3.0	30	90
Ditching and Fencing*	3.0-6.5	-[b]	-[b]
Resting	1.5	30	45
Totals		300	1,401

[a]National Academy of Sciences 1974

[b]Fencing and ditching are estimated at +10% of total

*Activity altered with wood technology

Slope and valley forest clearing are assumed to be the same, the only difference is that of ditching. Then for one square meter:

Table D

Location	Technology	Calories/m.^{2}
Valley	Steel	154
	Stone	512
Slope	Steel	140
	Stone	465

On the basis of these rough estimates and the clearance history, graphs of agricultural intensity and labor inputs were generated for the entire history of Kapii clan at Yumbisa.

The following formula was used for intensity (I_e).

$$I_e = \frac{\text{energy in}}{\text{energy out}}$$

$$= \frac{P_{f1}(r_m)e_1 + P_{m1}(r_c)e_2}{P(pcc)}$$

where:

P_{f1} = no. of female gardeners (.32P)

r_m = rate of mounding per laborer

e_1 = energy in per mound (Table B)

P_{ml} = no. of male clearers (.25P)

r_c = rate of clearing per laborer

e_2 = energy in per m.^{2} (Table D)

P = total population

pcc = per capita daily consumption (2.7kg./p x 1500C./kg.)

The variable r_c is explained in the text. However, r_m must be estimated. This was done with the following assumptions. The total cleared area for each sample time was divided as new slope, new valley or old valley. The yield of a "typical" mound was calculated assuming mounds were distributed among the three types of gardens in proportion to their total cleared area. E.g. sample time 1900:

Table E

	Percent of Total Cultivated Area	Yield/Mound (kg.)	Proportional Yield (kg.)
New Slope	17	6.8	1.2
New Valley	59	15.9	9.4
Old Valley	24	11.3	2.7
Total			13.3 kg.

Yield of a "typical" mound in 1900 = 13.3 kg.

Then the number of mounds required to provide 2.7 kg./ person was calculated for P at the sample time and divided by the number of female laborers yielding r_m.

The results of this calculation of I_e are given in Figure A.

In Figure B, the time inputs from Tables A and B are presented (adjusted for change in technology) thus showing the relative inputs of an average man and woman per day. The clearance rate (r_c) is also indicated (from Figure 16) for comparison.

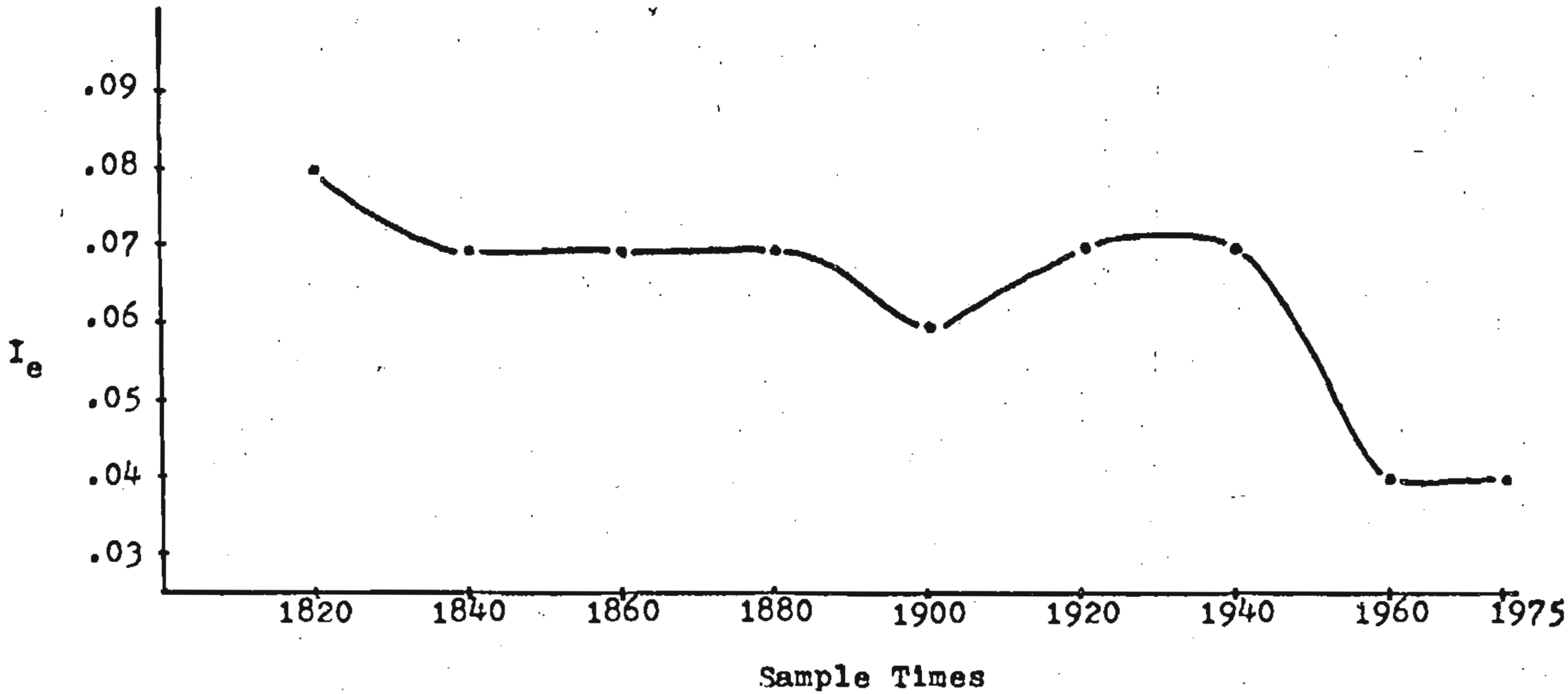


Figure A: Agricultural Intensity

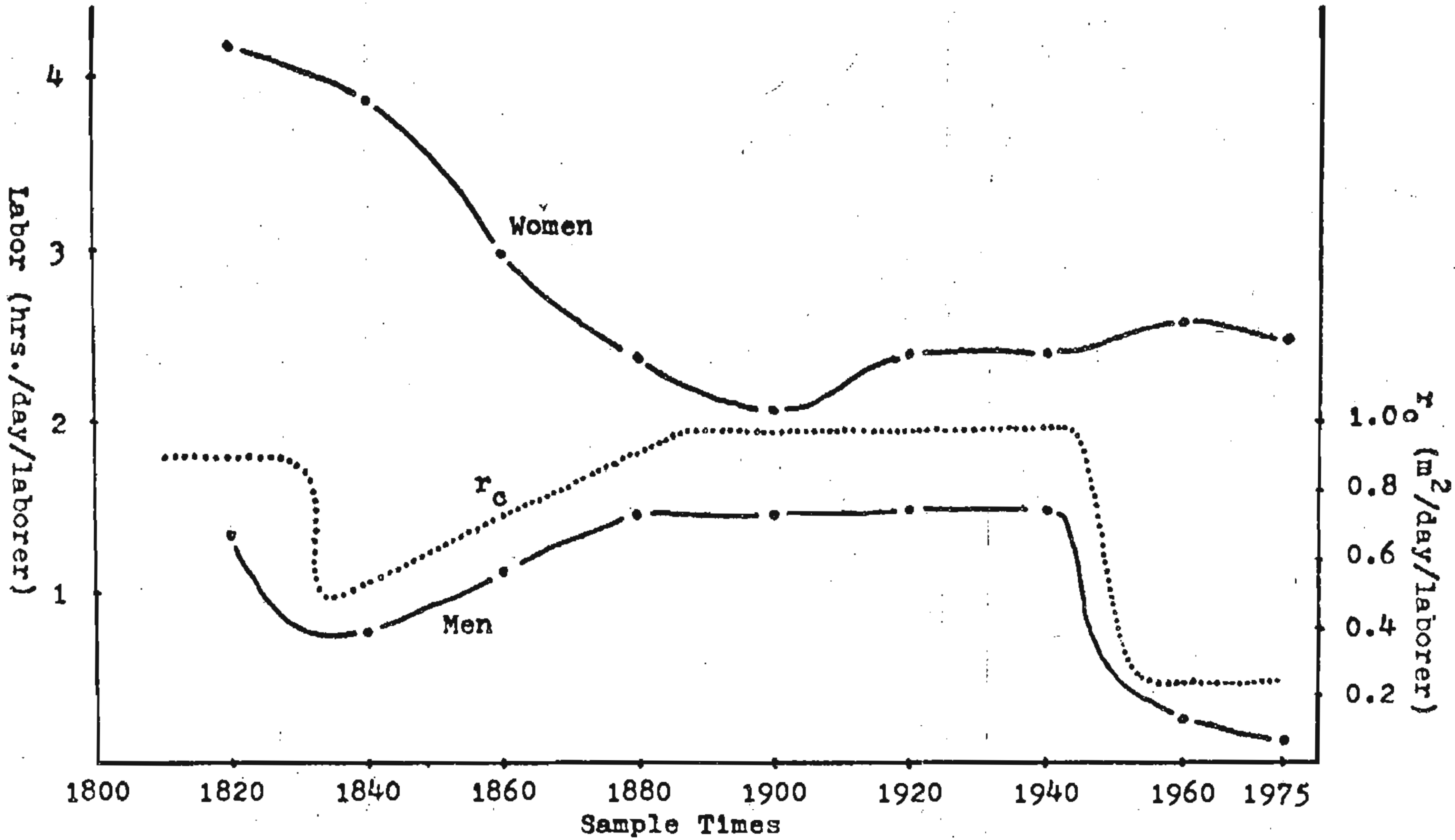


Figure B: Daily Subsistence Time Inputs for Men and Women

BIBLIOGRAPHY

Allen, M. R.
1967 *Male Cults and Secret Initiations in Melanesia*. Melbourne: Melbourne University Press.

Barnes, J. A.
1962 "African Models in the New Guinea Highlands," *Man* 62:5-9.

1967 "Agnation Among the Enga," *Oceania* 38:33-43.

Boserup, E.
1965 *The Conditions of Agricultural Growth*. Chicago: Aldine Press.

Bowers, N.
1965 "Permanent Bachelorhood in the Upper Kaugel Valley of Highland New Guinea," *Oceania* 36: 27-37.

Brookfield, H. C.
1972 "Intensification and Disintensification in Pacific Agriculture: A Theoretical Approach," *Pacific Viewpoint* 13 (1).

Brookfield, H. C. and P. Brown
1963 *Struggle for Land*. Oxford: University Press for the Australian National University.

Brookfield, H. C. with D. Hart
1971 *Melanesia: A Geographical Interpretation of an Island World*. London: Methuen and Co.

Brookfield, H. C. and J. White
1968 "Revolution or Evolution in the Prehistory of the New Guinea Highlands," *Ethnology* 7(1).

Byles, R. H.
1976 "Different Rates in the Evolution of Proteins and Phenotypes," *Annual Review of Anthropology* 5:69-91.

Carneiro, R. L.
1961 "The Evolution of Horticultural Systems in Native South America," Anthropológica, Supplement No. 2, ed. J. Wilbert, pp. 47-67.

Clarke, W. C.
1973 "Temporary Madness as Theater: A Wild-man Behaviour in New Guinea," Oceania, 43:198-214.

Collier, G. A.
1975 Fields of the Tzotzil: The Ecological Bases of Tradition in Highland Chiapas. Austin: University of Texas Press.

Cowgill, G. L.
1975 "On Causes and Consequences of Ancient and Modern Population Changes," American Anthropologist 77(3).

Criper, C.
1967 "The Politics of Exchange: A Study of Ceremonial Exchange Amongst the Chimbu." Unpublished Ph.D. dissertation, Australian National University.

Faithorn, E.
1976 "Women as Persons: Aspects of Female Life and Male-Female Relations Among the Kafe," in Man and Woman in The New Guinea Highlands, ed. P. Brown, G. Buchbinder, American Anthropological Association, No.8.

Firth, R.
1951 Elements of Social Organization. London: Watts.

Glasse, R. N.
1959 "The Huli Descent System," Oceania 29:171-84.

1968 Huli of Papua: A Cognatic Descent System. Paris: Monton and Co.

Golson, J.
1977 "No Room at the Top: Agricultural Intensification in the New Guinea Highlands," in Sunda and Sahul: Prehistoric Studies in Southeast Asia, Melanesia and Australia. ed. J. Alles, J. Golson, R. Jones. New York: Academic Press.

Goodenough, W. H.
1955 "A Problem in Malayo-Polynesian Social Organization," American Anthropologist 57:71-83.

Kelly, R. C.
1968 "Demographic Pressure and Descent Group Structure in the New Guinea Highlands," Oceania 39(1).

Kuschel, R. and T. Monberg
1977 "History and Oral Traditions: A Case Study," The Journal of the Polynesian Society 86(1).

Lang, A.
1973 Enga Dictionary with English Index. Pacific Linguistics, Series C-No. 20. Canberra: The Australian National University.

Langness, L. L.
1964 "Some Problems in the Conceptualization of Highlands Social Structure," American Anthropologist 66:162-82.

1967 "Sexual Antagonism in the New Guinea Highlands: A Bena Bena Example," Oceania 37(3).

1974 "Ritual, Power and Male Dominance," Ethos 3(4).

Lepervanche, M. de
1967 "Descent, Residence and Leadership in the New Guinea Highlands," Oceania 38:134-89.

Lindenbaum, S.
1976 "A Wife Is the Hand of Man," in Man and Woman in the New Guinea Highlands, ed. P. Brown, G. Buchbinder, American Anthropological

Association, No. 8.

McArthur, M.
1967 "Analysis of the Genealogy of a Mae-Enga Clan," Oceania 37:282-5.

Meggitt, J. J.
1956 "The Valleys of the Upper Wage and Lai Rivers, Western Highlands, New Guinea," Oceania 27(2).

1958 "The Enga of the New Guinea Highlands: Some Preliminary Observations," Oceania 28(4).

1964 "Male-Female Relationships in the New Guinea Highlands," American Anthropologist 66:604-24.

1965 The Lineage System of the Mae Enga of New Guinea. New York: Barnes and Noble.

1977 Blood Is Their Argument: Warfare Among the Mae Enga Tribesmen of the New Guinea Highlands. Palo Alto: Mayfield.

National Academy of Sciences
1974 Recommended Dietary Allowances, Eighth Edition. Washington, D. C.: National Academy of Sciences.

Peters, F. E.
1958 "The Chemical Composition of South Pacific Foods," South Pacific Commission Technical Paper No. 115, Nouméa.

Pospisil, L.
1963 Kapauku Papuan Economy. Yale University Publications in Anthropology, No.67.

Rappaport, R. A.
1968 Pigs for the Ancestors. New Haven: Yale University Press.

Ricklefs, R. E.
1973 Ecology. Portland: Chiron Press.

Robbins, R.
1963 "Correlation of Plant Patterns and Population Migration into the Australian New Guinea Highlands," in Plants and the Migration of Pacific Peoples, J. Barreau (ed.).

Salisbury, R. F.
1962 From Stone to Steel. Melbourne: Cambridge University Press.

1964 "New Guinea Highland Models and Descent Theory," Man 64:168-71.

Sahlins, M. D.
1961 "The Segmentary Lineage: An Organization of Predatory Expansion," American Anthropologist 63:322-45.

1963 Review of Social Structure in South-east Asia, ed. G. P. Murdock, Journal of the Polynesian Society 72:39-50.

1965 "On the Ideology and Composition of Descent Groups," Man 65:104-7.

Scheffler, H. W.
1965 Choiseul Island Social Structure. Berkeley: University of California Press.

1966 "Ancestor Worship in Anthropology," Current Anthropology 7:541-8.

Scoullar, B.
1971 Frost Damage--Subsistence Gardens, Lagaip Sub-District. Summary Report and Recommendations. DASF, Laiagam, 7pp. typescript.

Siskind, J.
1973 "Tropical Forest Hunters and the Economy of Sex," in Peoples and Cultures of Native South America, ed. Gross, D.R. New York: Natural History Press, pp. 226-240.

Steinhart, J. S. and C. E. Steinhart
1974 "Energy Use in the U.S. Food System," Science 184(4134):307-316.

Strathern, A.
1968 "Descent and Alliance in the New Guinea Highlands: Some Problems of Comparison," Proceedings of the Royal Anthropological Institute of Great Britain and Ireland. 1968:37-52.

1973 "Kinship, Descent and Locality: Some New Guinea Examples," in The Character of Kinship, ed. J. Goody. Cambridge University Press.

Strathern, M.
1972 Women in Between. London: Seminar Press.

Stuart, W. T.
1971 "Cultural Ecology: Prolegomena to a Natural Science of Anthropology." Unpublished Ph.D. dissertation, University of Oregon.

Vayda, A. P., A. Leeds and D. Smith
1961 "The Place of Pigs in Melanesian Subsistence," Symposium: Patterns of Land Utilization and Other Papers, ed. V. E. Garfield, pp. 69-77. Proceedings, American Ethnological Society.

Waddell, E.
1972 The Mound Builders: Agricultural Practices, Environment and Society in the Central Highlands of New Guinea. Seattle: University of Washington Press.

1973 "Raiapu Enga Adaptive Strategies: Structure and General Implications," in The Pacific in Transition, ed. H. C. Brookfield, ANU Press.

1974 "Frost Over Niugini: A Retrospect on Bungled Relief." New Guinea 8(4):39-49.

1975 "How the Enga Cope with Frost: Responses to Climatic Perturbations in the Central Highlands of New Guinea," Human Ecology 3(4).

Watson, J. B.
1965 "From Hunting to Horticulture in the New Guinea Highlands," Ethnology 4(3).

1970 "Society as Organized Flow: the Tairora Case." Southwestern Journal of Anthropology 26(2).

1977 "Pigs, Fodder and the Jones Effect in Postipomoean New Guinea," Ethnology 16(1).

Watson, V. and J. B. Watson
1973 "Mama Samting Nating." Paper read at the 72nd Annual Meeting of the American Anthropological Association, New Orleans, November 1973.

Williams, G. C.
1966 Adaptation and Natural Selection. Princeton: Princeton University Press.

Wynne-Edwards, V. C.
1962 Animal Dispersion in Relation to Social Behavior. Edinburgh: Oliver and Boyd.

GLOSSARY OF ENGA WORDS AND TECHNICAL SYMBOLS

I. Enga Words

The language spoken at Yumbisa is Karinje pii, a dialect of Enga. Major recurrent terms are glossed here and indexed to their definition in the text. Enga spelling follows Lang (1973) except where dialect differences occur.

Term	Gloss	Page
beta pingi	injury compensation	53
enda tali pingi	wedding	69
laita pingi (laita)	death compensation	81
laitasanda	initiatory gift for death compensation	83
mena yae pingi	formal pig distribution (from Mendi)	87
mondo	garden mound	323
nia	shortage in sweet potato production 14 months after frost or hail	144
sangai	male initiation ritual	53
sepya	promissory payment of pork to delay laita or tee	86

Term	Gloss	Page
tarange talipi	MoSiSn	283
tata	any portion of the segmentary descent structure deriving from a man (family to tribe)	37 48
tee pingi (tee)	death compensation for violent death	83
wanalapo	brideprice	79
wanenge talipi	WiSiHu	262
watapae	brideprice return gift	70

II. Technical Symbols

Term	Description	Page
A_c	cleared area (ha.)	240
C	cultivation factor	185
D	density on total territory (persons/km.^{2})	210
D_c	density on cleared land (persons/km.^{2})	210
I_e	agricultural intensity	223
OD_c	index of occupational density on cleared land	217
OD_{ct}	theoretical index of occupational density on cleared land	254
r_c	clearing rate (m.^{2}/male laborer/day) (r_{c25} indicates the rate applies over 25 years)	210