FALLOW FARMING:
EXPLORING SUBSISTENCE IN KRISA, FAR NORTHWEST PAPUA NEW GUINEA, AND BEYOND

—PART II—

Thesis submitted in partial fulfilment of the requirements for the degree of
Doctor of Philosophy in Environmental Anthropology

by

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CHAPTER 5

THE KRISA EXAMPLE

5.1. People and Place: A Journey Through Time

Krisa: A People, Place and Language both Eternal and Ephemeral

Krisa community today[207] comprises about 1,200 individuals who affiliate with six major patriclans integrating a larger number of patrilineal groups. They claim a territory of roughly 120 square kilometres, rendering population density 10 persons per square kilometre. The territory stretches between the coast and the Pual river (see Map 7), the rugged terrain ascending from sea level in limestone folds which parallel the coastline; forming occasional peaks; then rising to the three mountains Sawa (835 m), Dale (550 m), and Sau (580 m); and finally levelling out at some 300 m ASL in a wide plateau which fans out in spurs and descends into the Pual basin (see Plate 1).[208] The breezy plateau affords panoramic views southward over the forested plain and onto the blue silhouette of the Bewani mountains beyond (see Plate 2). It supports Krisa main village, the focal residential cluster of the community and often equated with it (see Plate 3). This residential centre is located roughly 20 kilometres south of the Sandaun provincial capital Vanimo. Between 5-10 kilometres further south are the villages of Krisa's Mbo-speaking neighbours, traditional allies. Towards the east and northeast live Ningera-speakers, towards the northwest coastal people, both largely Krisa's traditional enemies and present-day rivals. Krisa people themselves are the sole speakers of Krisa (or I'saka)[209], an untypical Papuan language which has been classified as an isolate in the Macro-Skou family and recognised as concurrent with Krisa community (Donohue & San Roque 2004:1-2,6).[210]

Myth at once affirms and qualifies the present political and linguistic situation. According to a widely endorsed version of the story of Creation, the first humans—ancestors of the Krisa clans and by extension of all humankind—emerged on Dale, the mountain therefore most sacred and revered on Krisa territory. Upon some cataclysmic event, most of them were scattered over the world. They retained, however, vague memories of their ancestral tongue, and thus aware that an important part of themselves had been lost set out "to search for their language" (PAINIM TOK PLES). This led them back from the various directions to their original homeland, where they became reunited as the community of today.

If the assertions of primordial unity and eternal homeland sanction the current condition, the reference to diversity and migration indicates its historic emergence. Indeed, linguists have ascertained extensive population movements in the far northwest of PNG and in north-central New Guinea at large, presumably triggered by the 'Bewani expansion': some destabilising event south of the western Bewani mountains approximately 200-250 years ago, which by domino effect set numerous groups on the move (Donohue & Crowther n.d.:3,4f.; cf. also section 2.1.).[211] Consequently, north-central New Guinea became "an area with the highest concentration of different language families in a small area anywhere in the world" (op.cit.:2). Krisa oral histories reinforce the image of generalised and turbulent

Table 11: Krisa Group Migrations (Synthesis)

group	origin/ migration route	gbp	years AD	group fusions & fissions	presence in current territory
A	Mt. Dale	>15	pre-1580	sister to **B**	pre-1580
	→ Krisa plateau	15	~1580		
		6	~1850	takes in **D1** (adoption)	
B	Mt. Dale	>15	pre-1580		pre-1580
	→ Krisa plateau	15	~1580		
		5	~1880	takes in **J'** (?adoption)	
C	Mt. Sawa	>10	pre-1700	composite	pre-1700
		8	~1790	associates with **G**	
		6	~1850	splinter leaves name to **F1**	
		4	~1910	takes in **J** (?adoption)	
D	Mt. Sau	>10	pre-1700	link with Ningera (sister)	pre-1700/ †
		9	~1760	marriage link with **G**	
		6	~1850	massacre and dispersal → **D1**	
D1	→ Krisa plateau	6	~1850	taken in by **A** (adoption)	~1850
		4	~1880	marriage link with **H**	
D'	{Mt. Sau}/ from Pual foothills	6	~1850	taken in by **E** (?adoption)	~1850
E	from Pual foothills	6-11	pre-1700 –1850		post-1700
	→ Krisa plateau	6	~1850	takes in **D'** (?adoption) takes in **F1** (?sister)	
F	{Mt. Dale}/ from SE	(>15)	pre-1580		—
	→ Samararu	<14	post-1610	link with Samararu (marriage)	
	→ across Pual river → across Wia creek	7-9	~1760-1820	splits into **F1** and **F2** across a brother–brother link	
F1		6	~1850	taken in by **E** (?sister) adopts name of previously resident **C** splinter	~1850
F2		4	~1880	absorbs **H**	pre-1880
G	{Mt. Sawa}/ from NW	>10	pre-1700	link with Jayapura, W Papua (sister)	
	→ Pual basin	n.d.	not dated	link with Pual basin (sister)	
		9	~1760	marriage link with **D1**	~1760
	→ base of Mt. Sawa	8	~1790	associates with **C**	
H	(Ningera?)	4	~1880	absorbed by **F2** marriage link with **D1**	†
J'	from Pual basin (Auali)	5	~1880	marriage link with **G** taken in by **B** (?adoption)	~1880
J	from Pual basin (Auali)	4	~1910	marriage links with **A** and **D1** taken in by **C** (?adoption)	~1910
W	from West Papua	½	mid-1980s	taken in by **G** and **F1**	mid-1980s

(For details regarding group names and chronological dating refer to notes 212 and 213; dates and locations in curly brackets indicate a presumably mythical rather than historical residence.)

migration and ensuing relations between disparate groups; corroborate reconstructed migration routes; and push the hypothesised event back in time. They provide accounts—synthesised in Table 11 on p.200—for at least 12 different groups which have come together in the current location and community over the course of the last three centuries, memories of their migrations dating back up to 400 years.[212, 213, 214]

Only two groups (A, B), who claim the name ISAKA (cf. n.210) as identifier for group and language as their own, assert continuous occupation of the area since the 16th century, rendering their mythical residence at Mt.Dale at once historical. Table-top mountains like Dale do indicate potential settlement sites (Kuaso et al. 1998:35). Also, the large cave at its summit, commonly taboo for visitors, revealed pot shards when exceptionally inspected in September 1997. If such signs neither prove past settlement nor its connection with present populations, occupation of mountain sites is a frequent theme in oral accounts from the region (Simet & Ketan 1992).[215] In Krisa itself, two further groups (C, D1) claim convincingly historical residence at Mts.Sawa and Sau respectively. The latter report a cave still containing human remains, and dispersal upon a massacre—maybe the template for the mythical dispersal from Mt.Dale, which though may itself rely on an actual event and thus describe a common process of community disintegration in the past.

Any groups other than A and B remember only subsequent presence in the current territory and/ or immigration from the interior.[216] Oral accounts trace both their individual fates and their successive integration and increasingly collective migration towards the present village site, their progress marked out by a string of toponyms (see Table 12 below; also Map 7). The respective locations confirm the tendency of traditional settlements to occur along ridge systems for reasons of defendability (Kuaso et al. 1998:3,11); several of them yielded archaeological remains during a reconnaissance survey (op.cit.:8-13).

Table 12: Successive Settlement Sites of Contemporary Krisa Groups

site	resident clans	other clans	time span
Api	A, B	C, G, D at Mts. Sawa and Sau; E approaching	~1580 – 1790
Wolu–Paltari–Duwi (+ outliers)	A, B, E (C, G)	D1, D', F1, F2 join	~1790 – 1880
Yeble	A – H	J and J' join	~1880 – 1940
Desawa & coast	A – J	(W join)	~1940 –

The earliest remembered site is Api, "strategically situated" (op.cit.:11) on a ridge jutting out from the east of the plateau. A and B maintain they settled there following their descent from Mt.Dale in the late 16th century. They kept separate men's ceremonial houses, indicating separate residential clusters, though in vicinity of each other. They assert that during their residence there they dealt out land according to its current distribution (cf. also Kara 1996:36), and were joined by all other groups about 12 generations bp (~1670) (Kocher Schmid 1996). This suggests that they came under increasing immigration pressure from the late 17th century onwards, which coincides with the earliest remembered presence of C, G, D, and E, who may but embody the surviving portion of a larger onslaught.

By the late 18th century, Api was given up due to war pressure (Kocher Schmid 1996). A and B relocated respectively to Wolu and Paltari, situated adjacently on a ridge to the west; E moved subsequently into the neighbouring Duwi; little later, most of the remaining groups arrived (cf. Kara 1996:36). Still, settlement remained dispersed and men's ceremonial houses separate, while C and G stayed largely apart from the rest altogether, in sites towards their mountain of origin, Sawa.

The next relocation was collective and occurred shortly after the last major influx of immigrants. By the end of the 19th century, and under the guidance of a legendary warrior (cf. also Kara 1996:37, Kocher Schmid 1996)[217], all groups which had so far assembled moved yet one ridge spur further, to Yeble, where they united in what is remembered today as I-TÖNI (dwelling place/ old)—the "old village". Its formation may have been accompanied by adoption of a single language, as suggested by the idiomatic expression "I KAIPA, WEI KAIPA" ("one village, one language") (San Roque 2001:31), which captures at once the unity and uniqueness of Krisa speakers. Previously, the various immigrant groups had likely spoken vernaculars different from one another and from that of the earliest occupants. Indeed, memories survive in Krisa today of an ancestral tongue (cf. Kara 1996:20), whether in historical or mythical terms. More recently, Mbo, spoken by Krisa's southern neighbours, with whom there has been extensive intermarriage for generations and who have continued the trend of immigration, assumed the status of a second language in Krisa until about two generations ago (cf. PR 49-50/13). On the other hand, some immigrant groups may have shared one vernacular, arriving but in successive waves.[218] Their historical reunion may therefore at once have provided the template for its mythical equivalent.

The uniform name 'Krisa' for community and village—vs. ISAKA, which has become inclusive rather by extension and requires suffixing with I ("dwelling place") to denote the village—seems likewise to date from the time of community formation.[219] Also, it appears that then the groups abandoned their individual men's ceremonial houses in favour of a communal one in which boys were initiated together. Likewise, the position apparently emerged then of a paramount leader, who tends to be referred to as "village chief" (CHIEF BILONG PLES; in the vernacular "he who is in charge of the village"), the first possibly the warrior who founded the village at Yeble. Collective settling therefore highlights how the various groups assimilated at once physically, linguistically, ideologically, ritually and politically to form the present-day community.

War pressure probably constituted the principal force in this process.[220] The migrations from Api to Wolu, and from there to Yeble clearly marked a successive retreat from superior enemy forces, with relocations to increasingly inaccessible sites (Kocher Schmid 1996). At the same time, population swelled through the absorption of increasing numbers of migrants, themselves converted enemies or war refugees, carried on the ripples of the Bewani expansion. If their assimilation occurred under duress, rising group sizes at once enhanced security for the individual and provided a larger force against enemy attacks. This benefit of residential concentration, realised already in group-specific clusters vis-à-vis simultaneously practised dispersal in the forest, was eventually carried to its extreme in the formation of the 'old village'.[221]

Ironically, this ultimate consolidation coincided with events which soon rendered defendability as a criterion for settlement patterns obsolete. With the advent of the colonial period, warfare subsided (cf. Kocher Schmid 1996) and had terminated by the 1940s.[222] At the same time, the rising influence of outsiders defined new criteria. Just before 1940, Australian patrol officers instructed people to shift their village to the exposed present site Desawa on the plateau, following construction of a

government rest-house nearby (cf. Cheesman 1941:182). Around the same time, emerging opportunities encouraged the first hamlets on the coast (see pp.216ff. below). With this move northwards, Krisa people completed a trend set in motion by the Bewani expansion and common to non-Austronesian speakers in north-central New Guinea (Donohue & Crowther n.d.:6).

If the motivation for relocations therefore changed, the thrust northwards and the pattern of transitory settlement remained. The drive towards the coast has overall continued, while individual hamlets there appeared and vanished, and talks are currently underway to shift the main village yet again. Similarly, pacification has not arrested immigration. Individuals representing groups J and J' joined in peaceful circumstances during the occupation of Yeble, and since the mid-1980s there has been an influx of West Papua nationals.[223] Neither has language remained immutable, as the vernacular has increasingly been replaced with Tok Pisin since the mid-1970s (see p.228 below).

Myth may therefore portray place, people and language as eternal, by projecting a temporary condition onto a timeless plane. Its historical allusions, though, reveal them as ephemeral. If unification generated a collective polity and ideology, it did not fundamentally alter the dynamics that brought it about: Krisa society remains forever in flux.

Landholdership and Kinship as Agents of Continuity and Change

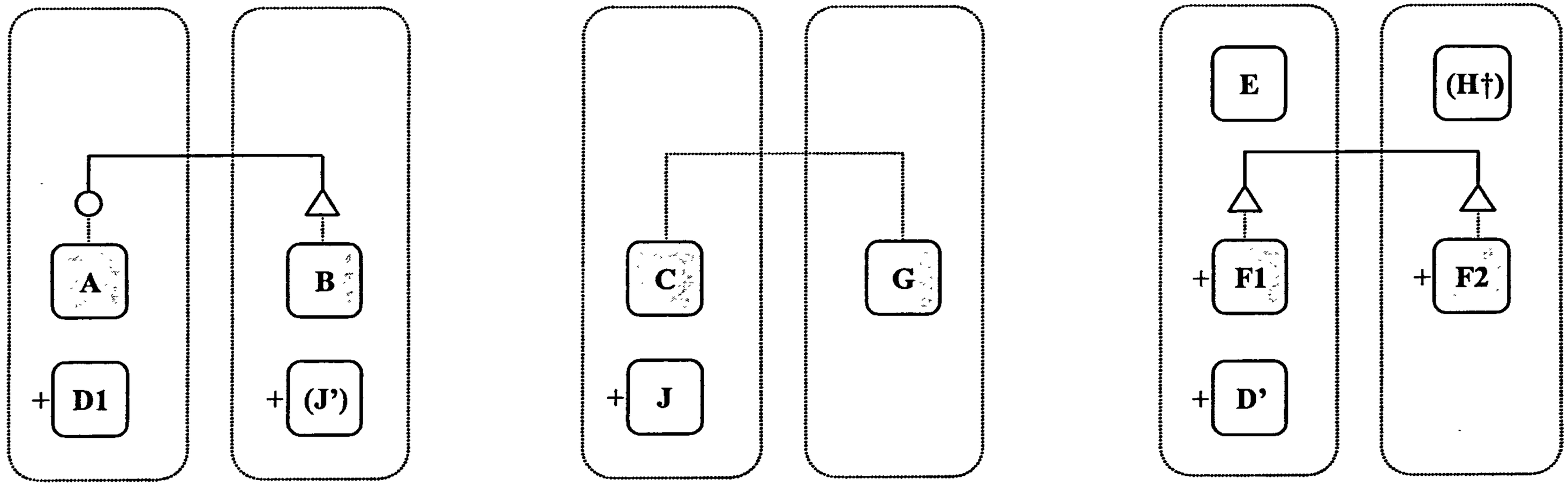
The myth of dispersal and return not only turns history into destiny; through the conjoining opposites of divergence and convergence it also captures in a historical idiom the complementarity of competition and coherence between the Krisa clans.[224] On the one hand, the clans are bound together by a strong ethic of unity, as they share a common name, language and identity distinct from any of their neighbours. On the other hand, they retain their political independence and hence potential rivalry, as they entertain individual relations with these neighbours and claim distinct territories which but combine virtually into a larger, collective Krisa territory.

Their specific histories illustrate the mechanism of territorial maintenance and shift in the continuing process of settling and migration. This relies on the dual function of clans as landholding corporations and exogamous groups, and on landholdership and kinship in turn as the key agents of continuity and change.[225] A Krisa elder captured their mediation through males and females, and thereby at once the essence of Krisa (and regional) politics, by stating:

> "This is our story: the men fight and acquire land; but the women don't—the women exchange against one another in marriage."[226]

The mechanism relies in principle on the correspondence of territorial sovereignty and exogamy, but in practice correlations are fuzzy (cf. n.224). Thus, the historical assimilation of groups in Krisa has resulted in a constellation of six major patriclans, which are paired on account of ancestral siblingship or political association, and which subsume the remaining patrilineal groups, whose degree of recognition depends on context and has varied over time (see Figure 10 on p.204). They continue to claim distinct territories, which though may be shared by agreement; in terms of marriage, however, only the six amalgams count. Rather than obliterating political principles, this situation adds a further dimension of potential rivalry, which may thus emerge as much within as across the major clans.

Figure 10: Pairing and Integration of Krisa Groups



The model provided here best represents my records. Other researchers have identified the 6 major clans (Donohue & San Roque 2004:4); 7 clans without further specification (San Roque 2001:30); and 7 or 8 clans, with nos. 7 and 8 tending to be E and D' (Kara 1996: 25,35; Ketan 1992:24). These representations correspond to information typically provided ad hoc by locals.

The volatility of constellations is evident in the contrast between the situation described here and that at the time of the Timber Rights Purchase, only a generation ago. Then, A, B, C, G, F1, F2, J and J' were represented as signatories. (The purchase agreement [reproduced in Simet 1992:Annex 5] lists the names of the respective agents, whose affiliation I have traced through genealogies.) It is notable that neither D1 nor D' were separately listed, while today certainly J' and possibly J would no longer receive separate recognition.

Each clan traces its origin to one or several spirit ancestors (TETE or DIRI) in the mythical past.[227] In the present, it is represented and guided by a leader, who rises to his position through a combination of birth and achievement,[228] and whose name may substitute for his clan or indeed ancestor.[229] Between both stretches the succession of past leaders as a string of names which mark the consecutive generations and connect them to past events and settlement sites, thus lending historical legitimacy to territorial claims. Down to 10-6 generations bp, they belong to ALIWE or HISTORI ("history"), an era shrouded in mystery, during which ancestors emerged through divine act. Below this threshold, ancestors assume successively more human qualities, including procreation. If this entails the generic recognition of women as mothers, their identities remain obscure, for, as leaders explained repeatedly, "women do not acquire land". Ancestral sisters, however, may occasionally be remembered, even by name, as foundresses of clans or connecting links between them (cf. Table 11). More commonly, the names of females begin to emerge and marriage connections remain documented from about 5 generations bp. Typically, this is also the threshold at which the string of single ancestors breaks up into several lineages within a clan.[230]

The concepts of both leader and clan remain unlabelled in the vernacular; in Tok Pisin, they are respectively referred to as LIDA ("leader") or BIKMAN ("bigman"), and GRUP ("group") or KLEN ("clan").[231] The respective groupings are, however, identified by individual names (cf. n.212), and Krisa vernacular may couple these with the term for blood (SI) to emphasise their essence. Indeed, one clan's myth of Creation tells how the first human formed out of a lake of blood under the gaze of the creator being. More generally, blood is the substance considered to uniformly suffuse a clan and pass unchanged through the generations in the male line, resulting in the clan's synchronic and diachronic homogeneity. The former is reflected in a merging terminology for agnates[232], which classes FB with F and FBC with G, thereby collapsing the clan terminologically into a single patriline. The latter results in a tendency to identify present members with their ancestors (cf. n.229). Together, they render clan members primary kin and accordingly ban unions between them.

With the attendant mandatory clan exogamy, any acceptable[233] union involves the mixing of blood, although the balance is determined by the circumstances. In the context of secure marriage, father's blood predominates. It alienates his children from their mother's clan; integrates them into his own; and connects them to its land. As one man declared emphatically:

> "I can't return to my mother's land, I must return to my father's land: this is my true blood!"[234]

Still, mother's blood continues to run in the background, producing a strong affinity with her clan as embodied by her brother, and consanguinity with its members. In fact, mother's blood can be transmitted further to successive generations, infusing its recipients with consanguinity. Transmission through males acts towards maintaining the status quo, in keeping with the principle of diachronic homogeneity, whereas each transmission through females dilutes the original blood, until it vanishes after a maximum of two successive and/ or alternating transmissions (see Figure 11a and b on p.206).

People therefore commonly recognise ancestry from four clans—F's, M's, FM's and MM's—with decreasing strength (Figure 11c). All of them provide potential avenues for affiliation, though with steeply declining relevance. The

Figure 11: Transmission of Clan Blood Through Females

Diagram a) shows constellations which Krisa people regularly recognise as consanguineous; they represent abstractions from a statistical survey of over 50 pedigrees describing defined kin relationships.

Diagram b) shows constellations which were exceptionally recognised as consanguineous; they represent specific cases, the gender-neutral diamonds being used for consistency.

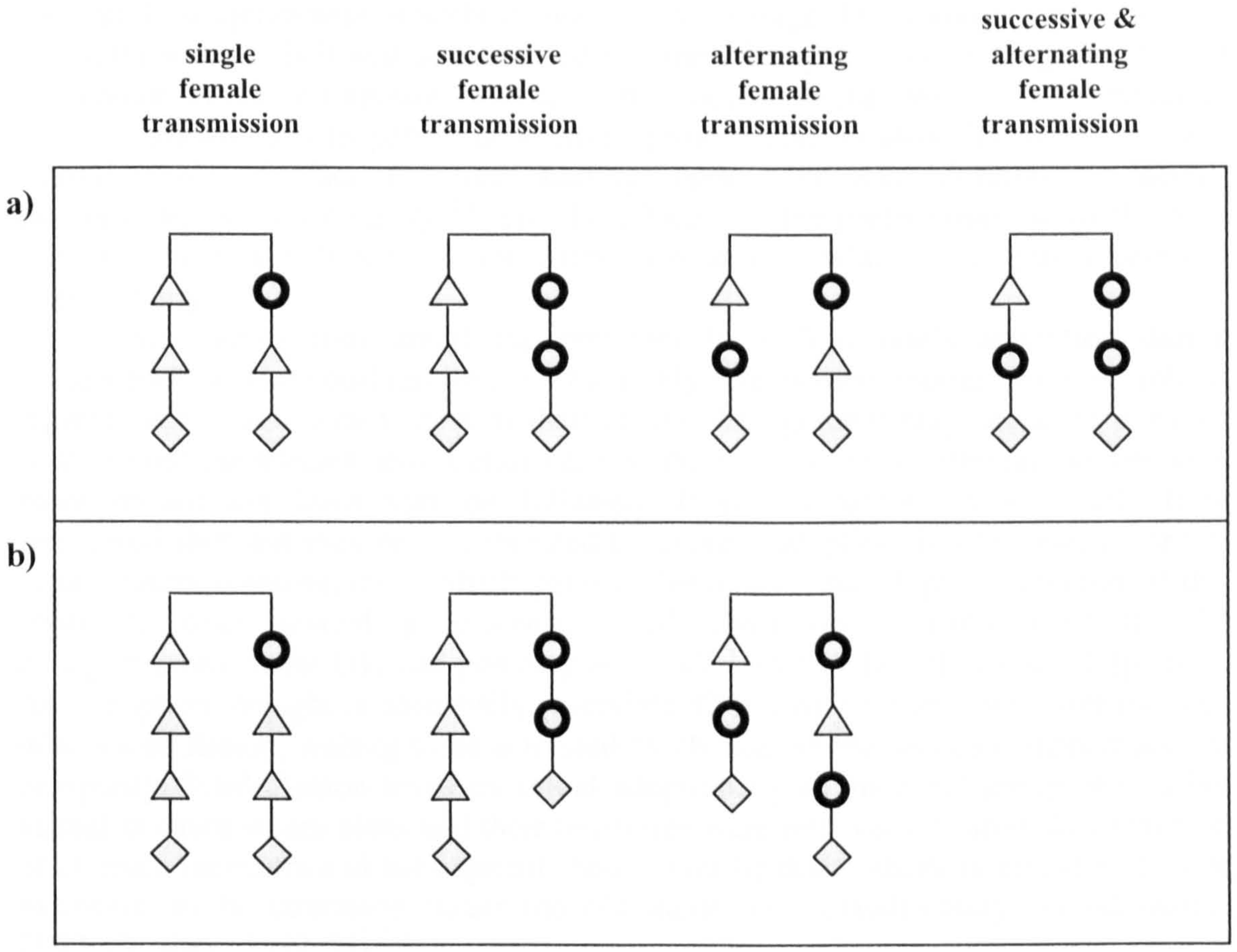
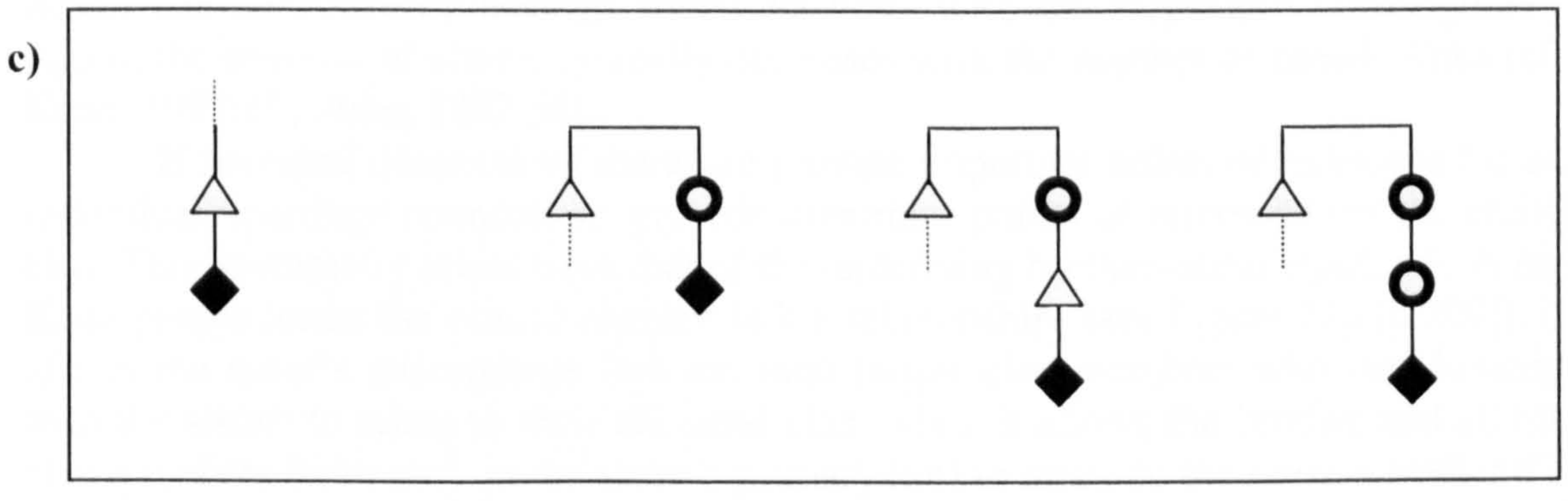


Diagram c) shows commonly recognised ancestral clans, the blackened diamonds representing ego.



classical case of secure parental marriage produces patrilateral filiation. This, though, is less a product of the father's corporate membership than of his child's straightforward socialisation into it, following its mother's typically *virilocal* residence. Deviations from this ideal arise with diminished social and/ or legal presence of the father, which may result in the mother's *patri-* or *fratrilocal* residence and consequent socialisation of her children into her own clan, although other scenarios are also possible. The most extreme case is illegitimacy, whereby the absence of a recognised parental union leaves the genitor socio-legally nonexistent and therefore his children totally in the sphere of their mother's clan.[235] More ambiguous situations arise in cases of marital separation, potentially aggravated by poor compensation of the dissolved union (see p.225 below); death of the father; and conversely adoption with or without mother's remarriage. The younger the child at the event, the more fully it will be socialised into the subsequently caretaking clan: that of the mother; of her new spouse; or of any other adopter. In the case of inter-community unions—traditionally in particular to Mbo-speakers and occasionally to Ningera and coastal people—the fact of a mixed marriage alone, without any destabilising factors, entails a degree of ambiguity.[236] This is reflected in the preferential use of the term HAPKAS ("half-caste") for children from such unions, which highlights a person's maternal origin.[237]

Any ambiguities entail the potential to realign one's affiliation during adolescence or adulthood (an option which only affects men, though, for their role as representatives and perpetuators of their clans). Realignment may occur for personal and/ or political reasons, and is classically to the maternal clan, although occasionally more distant kin links may be followed. It ensues almost automatically from residential shift but may be corroborated by express adoption. In any case, it confers classificatory consanguinity, which persists throughout the adoptive situation. If this continues over several generations, fused clans result, exemplified by the amalgamations of A/ D1, and possibly B/ J', C/ J and E/ D' (cf. Table 11 [p.200]). Any adoption, though, is potentially reversible. Clan fusions, therefore, carry the seed of renewed fission, waiting to be activated by changes in the sections' rapport and/ or prosperity. While fusion involves actual adoption by an ancestral group, this is but virtual in cases where clans and their territories were left 'vacant' after the extinction of all male members and subsequently taken over by descendants of erstwhile female members, to be continued under the old name and (classificatory) blood (Ketan 1992:43; Simet 1992:53).[238]

Ancestral connections not only allow (infrequent) realignment of one's affiliation, but are common avenues for political association and consequent access to land and resources. Hence, individuals have at once manifest claims to resources on their own territory, and dormant claims to the resources on ancestral clans' territories, which can be activated through social relations with the respective consanguines. Again, the strength of claims typically decreases with the number of female links (cf. Ketan 1992:15; Simet 1992:56).

If ancestral connections therefore provide important points of reference for an individual, marriage connections provide important points of reference for the entire clan. This asymmetry arises from that of the underlying brother–sister dyad, which for Krisa people forms the central element in kin relationships (see Figure 12a [p.209]): it allows the sister's descendants (but not their fellow clan members who lack kinship with the sister) to relate to their ancestral clan, while it allows the brother and all his clan members (who rank as the sister's primary kin) to relate to the sister's husband's clan. Kin terminology reflects the central role of this dyad; implies the principle of

marriage transactions; designates the relevant parties; and indicates the political consequences. (For an overview of the terms introduced in the following, see Table 13 on p.210).

To begin with, it labels opposite-sex siblings by means of generic gender terms as MINI[-PU] ("man[-sibling]") and BU-PU ("woman-sibling"), rendering them symbolic of the elemental human pair and its procreative potential, whose realisation though the incest taboo prevents (Figure 12b).[239] The traditional sister-exchange marriage (AMU, SENIS) resolves this impasse by swapping siblings between two brother–sister pairs,[240] which at once compensates the involved clans mutually for their loss of females and hence future members. This operation momentarily balances the asymmetry of the brother–sister dyad, which though returns in the subsequent generation, as the persistence of mother's blood retains consanguinity and hence the incest taboo for both unions' offspring (Figure 12c).[241]

The continuing asymmetry is again terminologically highlighted, as cross-cousins recognise each other generically as PE ("penis gourd"—the traditional male attire) and SAI ("fibre skirt"—the traditional female attire), indicating their descent from the respective pole in the parental brother–sister relationship (Figure 12d). This concept of classification is retained in the Tok Pisin glosses BRADA MAN KARIM EM ("sibling/ brother begotten by the man") and BRADA MERI KARIM EM ("sibling/ brother begotten by the woman"). They at once indicate that practical use of the terms is preferentially for two males, who on the basis of their special kin relationship tend to maintain close personal ties, while fulfilling complementary roles in the political relationships between clans (see p.212 below). Opposite-sex individuals, in contrast, tend to refer to each other again as MINI and BU-PU, thus collapsing the original siblingship into a single origin, akin to the terminological merging for agnates, and highlighting the incest taboo between them. Upon a similar operation, their descendants in turn continue to recognise each other as cross-cousins or siblings, depending on their relative sex (cf. Figure 11a).

Whereas cross-cousins therefore carry complementary terms which manifest their complementary political roles or gender, MB and $ZC_{m.s.}$ carry a self-reciprocal term, ONI, which manifests the reciprocity between access to one's maternal clan through MB and the control exerted in turn by him over his ZC (Figure 12e).[242, 243] The former aspect predominates for male ZC, with principally political implications (see p.212 below); the latter for females, with implications for marriage transactions.

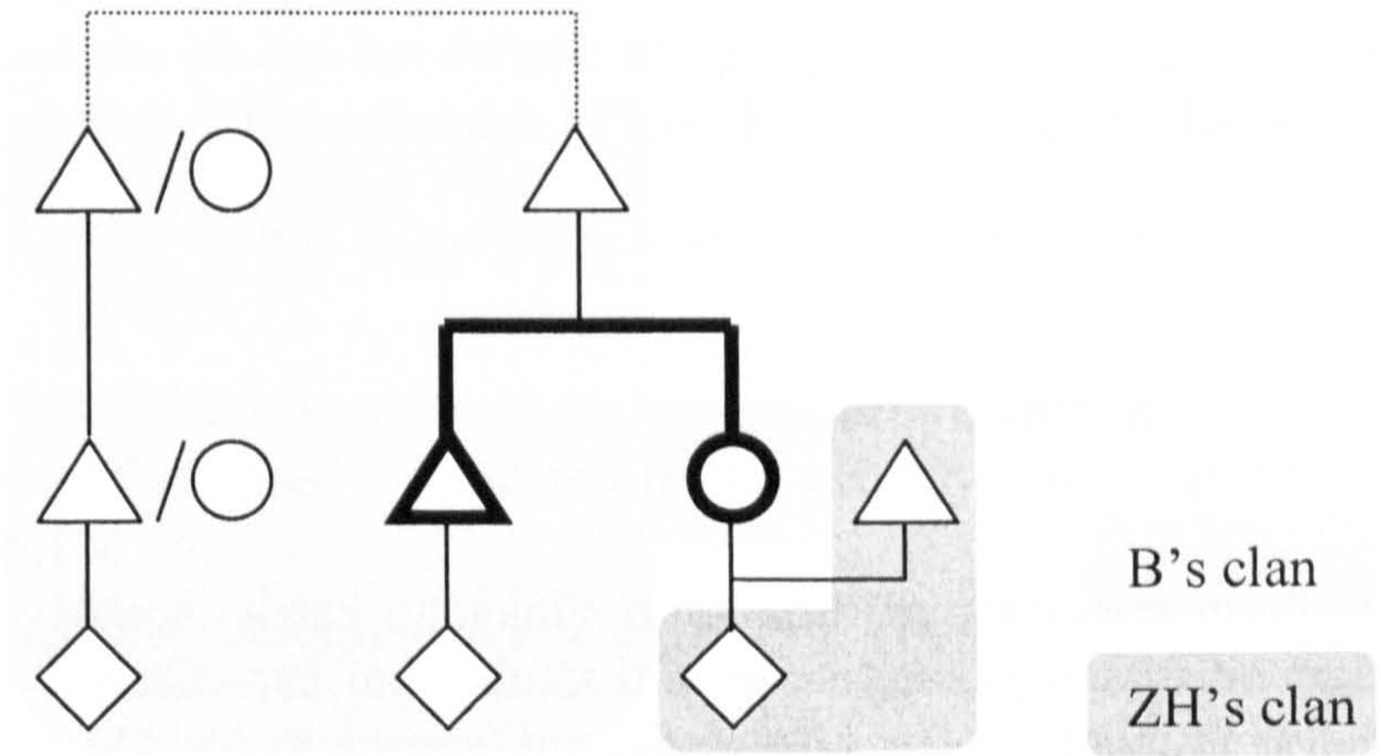
Any marriage creates claimants and debtors, as it alienates a woman's procreative potential from one clan and confers it to another. In Krisa, therefore, a marriage is to be balanced against an exchange marriage, ideally through the swapping of sisters (cf. Figure 12c), a process regularly described as:

> "The [bride's] brother calls out to him [i.e. the groom] to send a sister over."[244]

Want of eligible partners, though, may delay marriage exchanges, and thus transmit claims and debts to the subsequent generation, where the incest taboo between cross-cousins interferes with a straightforward compensation. Whereas a groom may return his true sister (or clan-sister)[245] to the bride-giving clan, his daughters have become consanguines for *all* its members and must therefore not return to it as brides themselves (cf. Figure 12a). Instead, their clan may settle its debt through recourse to females who are not similarly related to the claimants. Otherwise, it may activate its own claims in turn, to bestow women from clans still indebted to them, who they can likewise not marry themselves.

Figure 12: Centrality of the B–Z Dyad

a)

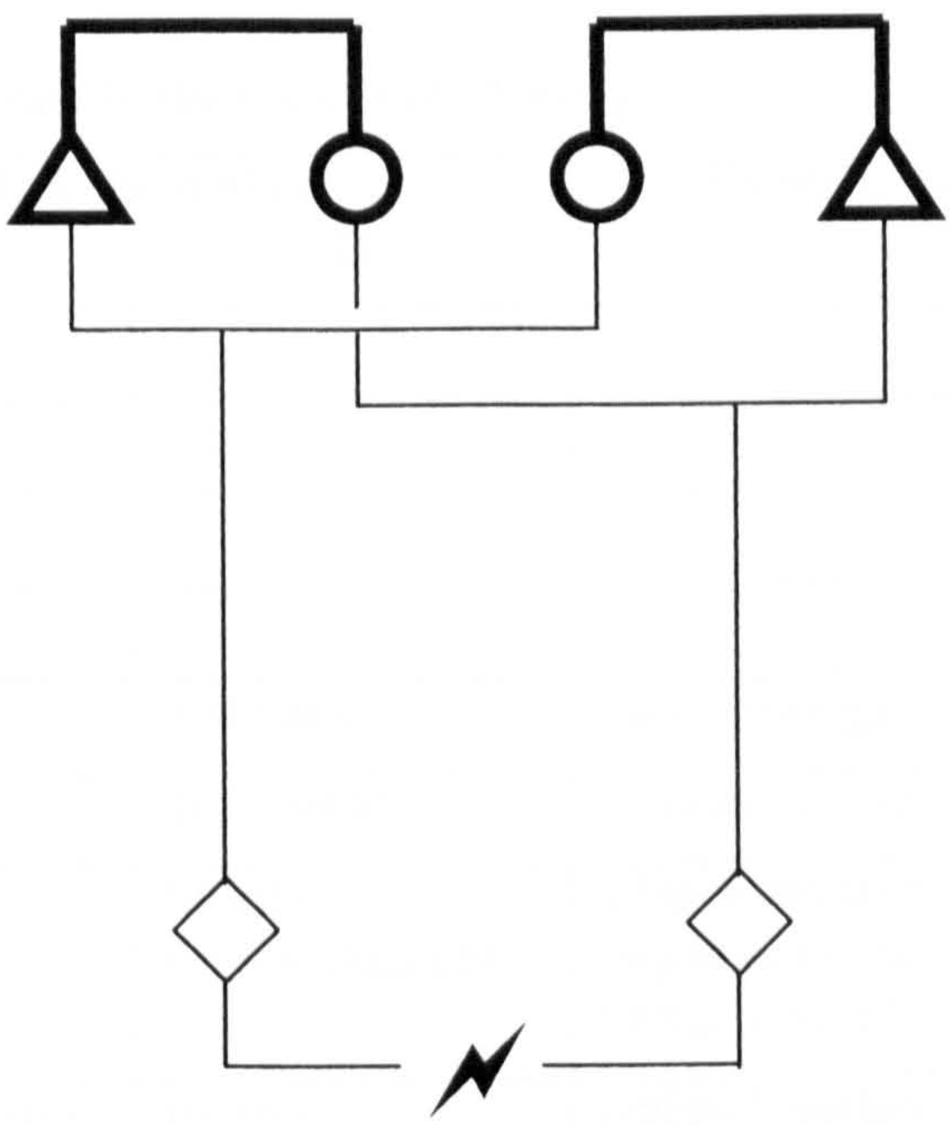


b)

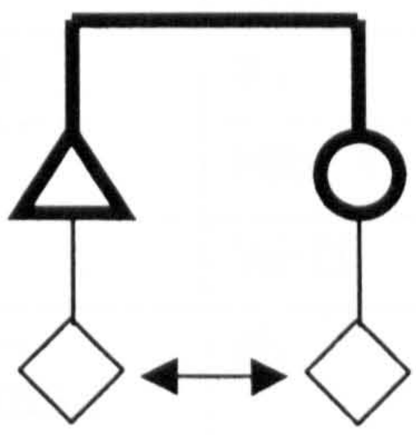
MINI "man"

BU-PU "woman-sibling"

c)



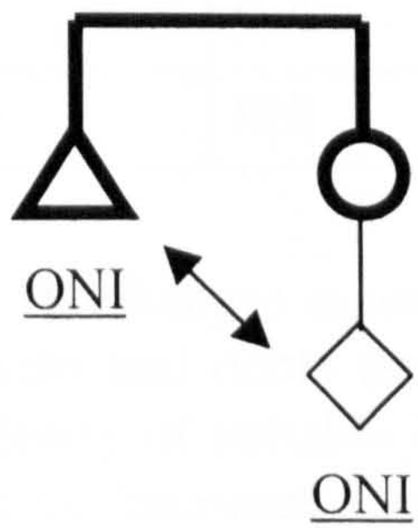
d)



PE "penis gourd"

SAI "fibre skirt"

e)



ONI

ONI

These fall principally into the kin classes of SAI or ZC-ONI. The bestowing males are for them PE and MB-ONI, including the principal kin types and their same-level agnates, who in Tok Pisin are collectively classed as KANDERE. Through mother's marriage, they are by definition in the claimants' position and hence retain the power to pledge her female offspring against their own mothers or brides. As the same applies to these women in turn, Krisa marriage exchanges follow the principle:

> "Your brother or KANDERE is in charge of you, and you go to her brother or KANDERE."[246]

With the converse perspective, the respective men may likewise be said to swap, which in Tok Pisin is reflected in the gender-neutral term SENIS ("exchange[-bride/ -groom]").

Hence, Krisa exogamy rules and the attendant creditor–debtor relationships divide opposite-sex individuals into two mutually exclusive categories: consanguines, identified by the reciprocal kin labels MINI–BU-PU/ PE–SAI/ ONI–ONI, who are potential exchange partners; and non-consanguines, identified by the absence of such labels, who are potential marriage partners. Krisa 'sister' exchange is therefore, more accurately, the exchange of non-marriageable consanguines, related through a brother–sister pair, for marriageable non-consanguines.[247]

Table 13: Selection of Krisa Kin Terms Relevant in the Context of Marriage

principal kin type	vernacular term	Tok Pisin gloss I	Tok Pisin gloss II	English gloss
H	INI			
W	BUA			
man	MINI			
woman	BU			
$B_{f.s.}$	MINI(-PU)		SUSA MAN	man(-sibling)
$Z_{m.s.}$	BU-PU		SUSA MERI	woman-sibling
MBC— esp. $MBS_{m.s.}$	PE	**KANDERE**	BRADA MAN KARIM EM	sibling/ brother begotten by the man, "penis gourd"
FZC— esp. $FZS_{m.s.}$	SAI	**BISNIS BRADA**	BRADA MERI KARIM EM	sibling/ brother begotten by the woman, "fibre skirt"
MB	ONI	**KANDERE**	ANKOL	uncle
$ZC_{m.s.}$	ONI		ANKOL	nephew, niece

Exchanges among the principal kin types still manage to achieve a balancing of claims and debts among up to four clans, which though relies on the concurrent availability of suitable marriage partners. With more distant consanguines, however, balancing becomes increasingly difficult. In any case, a symmetry once achieved dissolves through the incest taboo among the offspring. Hence, recognition of the brother–sister dyad as fundamental for consanguinity at once carries its imbalance into the next generations, which combines with the absence of positive marriage rules

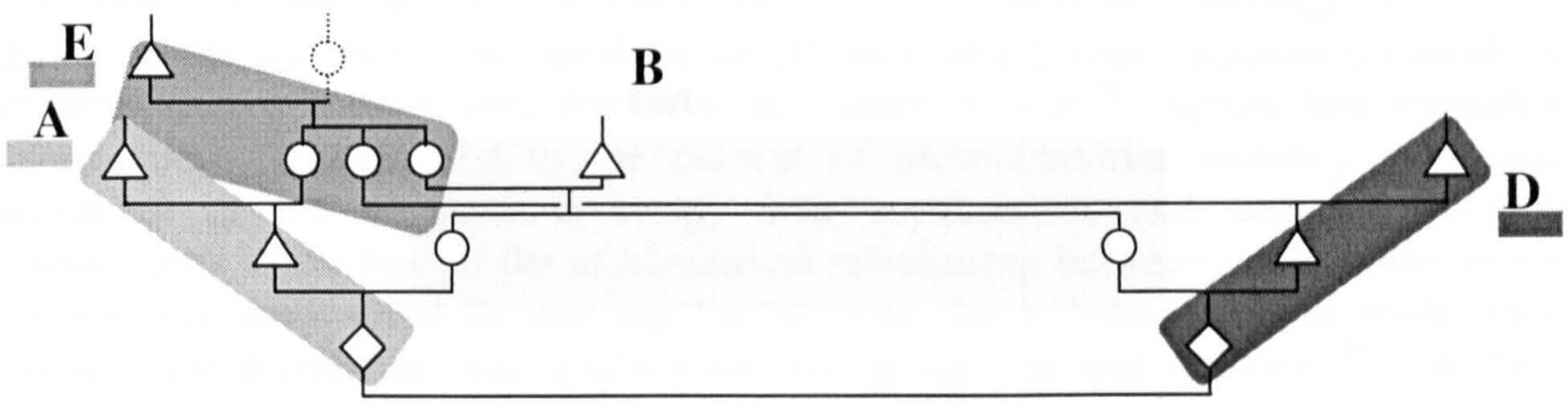
to promote unions between politically dispersed spouses. The simultaneous demand for compensation binds the clans together in an open-ended, reticulate pattern.

The number of clans thus connected relates to the extent of recognised consanguinity. Thus, appropriate unions involve minimally a system of four different clans, as the incest taboo excludes clan members and cross-cousins for both the spouses and their parents, but does not extend to matriparallel cousins or their agnatic analogues (see Figure 13a below).[248] The more (clan-)sisters therefore marry into different clans, the higher the relative numbers of matriparallel but variously affiliated offspring and hence of eligible partners in the next generation. Conversely, the marriage of (clan-)sisters into the same clan will subsequently reduce choice. Absence of matriparallel relatedness for the spouses and/ or their parents then raises the number of involved clans to at least five or six, which exhausts the present complement of exogamous units in the community (Figure 13b).

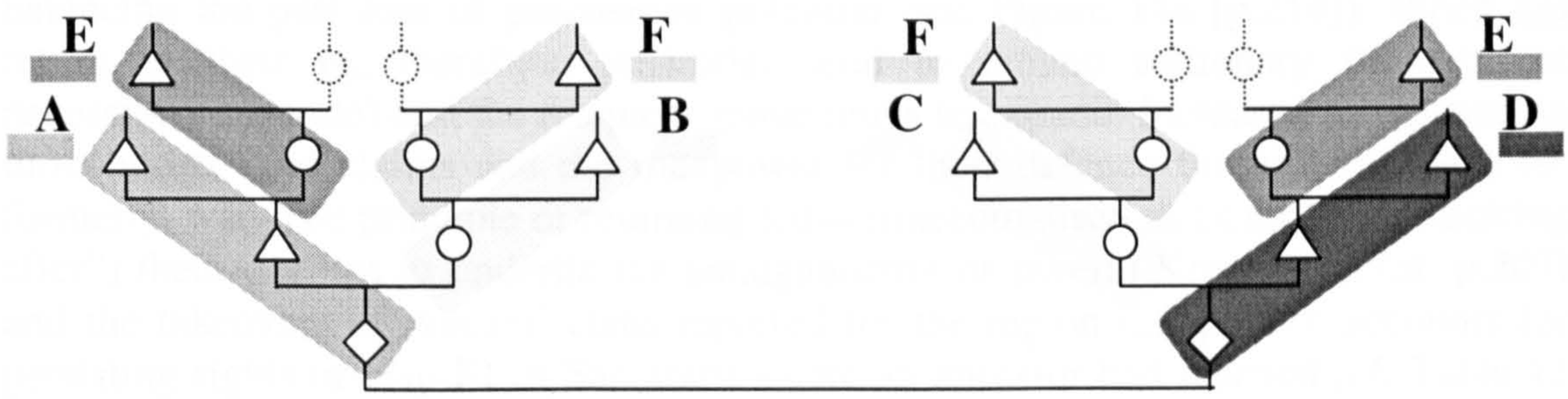
Figure 13: Suitable Marriage Partners

(various coloured shading indicates membership in clans A-F)

a) minimal number of clans required for an appropriate marriage:



b) minimal number of clans required for an appropriate marriage in the absence of matriparallel relatedness for the spouses and their parents (excluding any constellations recognised as consanguineous in Figure 11a):



Exogamy rules alone therefore considerably constrain partner choice. Marriage practices reinforce this tendency by further inflating the number of required clans. Multiple unions play a key role in this process. They are a characteristic feature of Krisa kinship, manifesting for women as successive marriages upon widowhood, for men additionally as polygyny, especially in the past.[249] Either produces offspring who as uterine or agnatic siblings are barred from marriage, hence reducing choice in the next generation.[250] The constraining effect of polygyny was multiplied in the past through its frequent occurrence with sisters, which eliminated their potential to produce eligible matriparallel partners (see above).[251] Any of these consequences became the more significant through the relative lack of females in the region, which polygyny exacerbated.[252] In addition, remarriage of women reduces partner choice in their own generation through a prohibition of the levirate[253], which requires that a woman's successive husbands affiliate with different clans, thus successively limiting alternatives for both herself and any prospective spouse. Finally, the desire to find an agreeable match in an appropriate age cohort restricts availability further.[254]

Extensive exogamy rules and constraining marriage practices consequently force people to find spouses abroad. This encourages not only expansion but supports a community on the move, by opening up the social channels along which migration can occur. Within the community, the multiplicity of reciprocal kin relationships between clans balances their individual asymmetries and strengthens community cohesion. The same applies to a lesser extent with extensive intermarriage, as between Krisa people and their Mbo-speaking neighbours, which under stationary conditions ensures mutual support and, formerly, allegiance in war.[255] Across less enmeshed communities, though, and in the context of trans-territorial mobility, the lower incidence of kin connections brings their asymmetries and attendant political implications to the fore. If the asymmetrical relationship between opposite-sex cross-cousins has implications for marriage transactions, that between same-sex male cross-cousins has thereby at once implications for group size and territory.[256] Tok Pisin vividly reflects their contrasting roles, by labelling maternal cross-cousins, PE, as KANDERE ("kindred" [Mihalic 1971:105]) and hence clearly relatives, paternal cross-cousin, SAI, though, as BISNIS BRADA ("business brother")[257] and hence potential competitors (cf. Table 13).

Thus, PE represent an ancestral clan, offering use of ancestral land and demanding compensation for the erstwhile bride. Immigration of their SAI mutually satisfies claims, as these but activate dormant usufructory rights (and may even contribute territory, depending on their political standing) while adding members, thus balancing the past loss of procreative potential (see Figure 14a [p.214]). When SAI return to their PE, therefore, territories tend to remain stationary (though not necessarily separate) and the recipient group tends to expand. Increased group size, in turn, boosts land claims and the manpower for their defence through vigilance or, formerly, war. The principle of returning SAI—conceptualised as LUKAUTIM ("looking after") them—seems to underlie the amalgamation of several Krisa clans (cf. p.207) and the takeovers of 'vacant' clans reported for the region (cf. p.207); accounts for persisting rights of clan F1 in Samararu where an ancestor had married (cf. Table 11 [p.200]); and acts nowadays to protect Krisa claims near the coast, as inmarried men are permitted uxorilocal residence (matrilocal for their children) on the respective land.

In contrast to the ancestral connection through PE, SAI represent a clan outside one's own ancestry, offering access to new land and embodying compensation for the erstwhile bride. As both aspects reinforce each other, immigration of PE threatens to

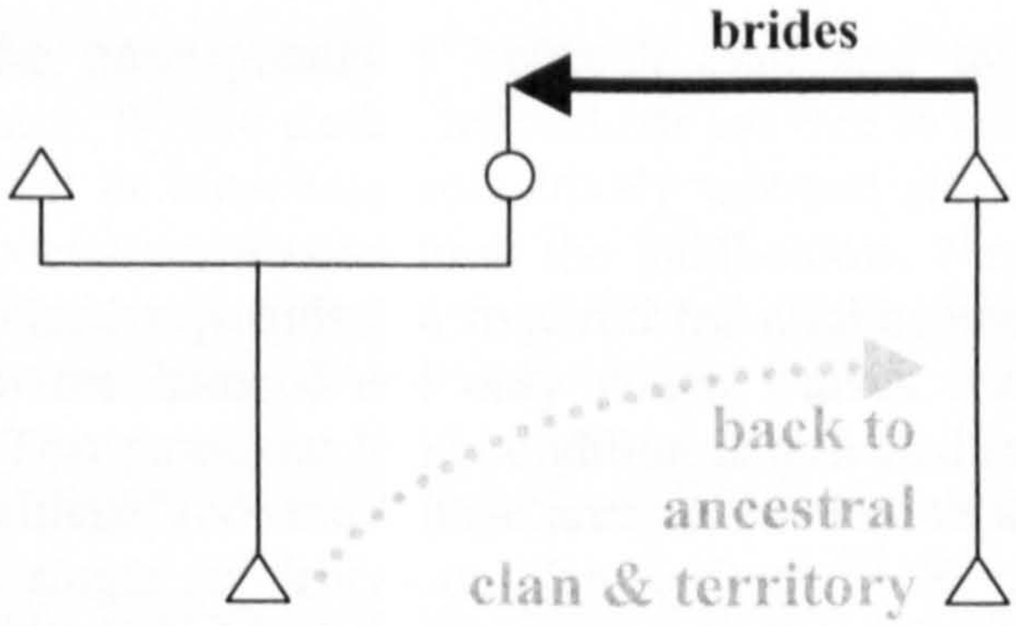
unilaterally satisfy claims, through balancing the past loss of procreative potential with territory, eventually pushing the original landholders out. This danger is heightened through the potential force of immigration; for, whereas only individuals or their lineages (as descendants of the erstwhile bride) may return to ancestral territory, an entire clan (as collective providers of the erstwhile bride) may advance onto new territory (Figure 14b). When therefore PE migrate towards their SAI, groups tend to remain distinct but territories to respectively expand and contract. This principle—conceptualised as TILIM GRAUN ("dealing out land")—likely underlay the allocation of land by long-established Krisa clans to newcomers during the 17th and 18th centuries (cf. p.201); the "land acquisitions by an ancestral sister" of clan G, first near present-day Jayapura and subsequently in the Pual basin, thus mapping the clan's migration route (cf. Table 11 [p.200]); the cession of land by E to F1 and their subsequent integration; the presumable incorporation of H, existing but virtually after extinction of its male members, into F2;[258] and, most recently, the Krisa migration to the coast (see p.216 below). The reference by B and D/ D1 to ancestral sisters as founders of, respectively, A and a Ningera clan (cf. Table 11) may represent similar land transfers, or their latent potential. Compensation of land for procreative potential may even be straightforward, as reported of a Ningera clan ceding land in exchange for a Krisa woman and, conversely, of a Krisa clan offering peace (i.e. ceding otherwise occupied territory) in exchange for two Ningera women.

The two latter cases but highlight the basic principle that providing brides stabilises and potentially expands territory, while accepting brides jeopardises territory. This suggests that territorial shift follows the marriage routes of women (Figure 14b and c), the endemic deficit of females in the region (cf. p.212, n.252) generating the slipstream in whose wake migration occurs, as each community attracts brides from their respective neighbours in a systematic fashion. An undercurrent of reciprocal marriages steadies the political effects of such flux in the short term but must yield to them in the long term. Thus, Krisa people regularly assert that traditionally there has been a net influx of women from the Mbo-speaking communities.[259] This trend is consistent with the historical advancement of immigrant groups from the Pual basin and beyond (cf. n.216). If major threats to territory have since been stemmed through sufficient reciprocal marriage connections and the increasing consolidation of the community,[260] immigration from the south continues today with the advancement of the Mbo-speaking Airu people onto Krisa territory within the last few decades.[261] On the other hand, Krisa people have themselves continued to advance northwards, following their own outmarrying women.

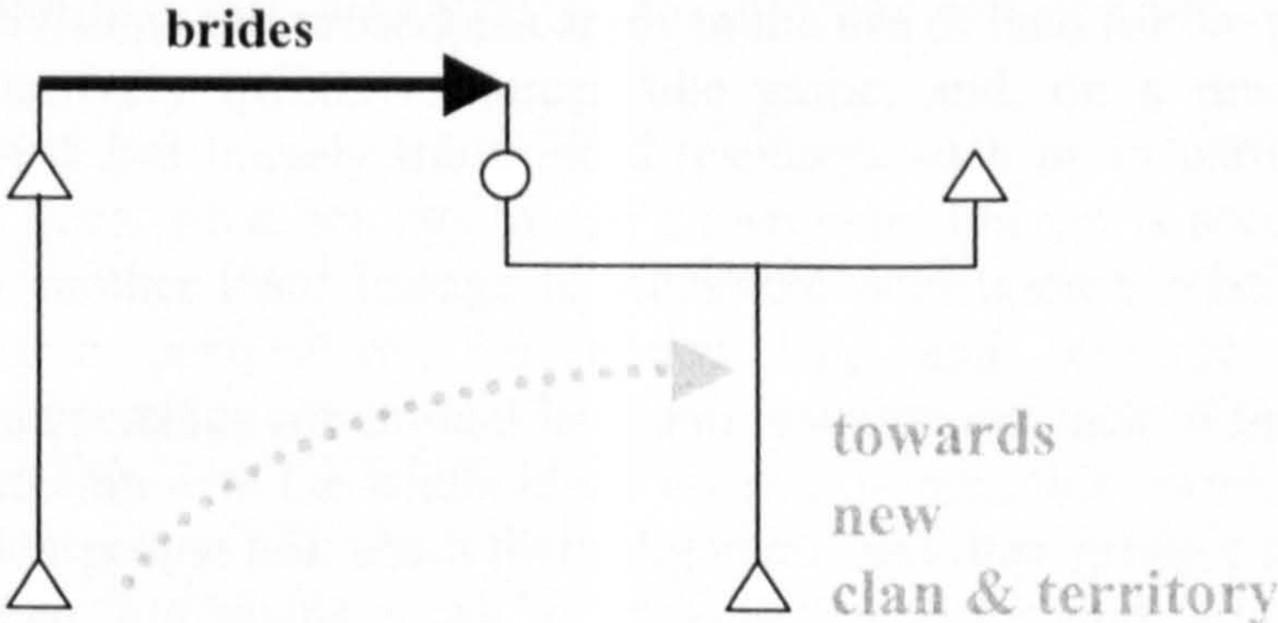
The principles and practices of sister exchange therefore support, if not encourage, the extensive migrations of groups in the region, which may in turn have served to hone kinship systems to suit the political processes entailed.[262] If acquisition of territory in war bestows the honour of historical recognition on males (cf. the quote on p.203), the exchange of women against one another in marriage not only binds groups and communities together, but in its potential failure contains also a more peaceful, and potentially more effective, means of territorial gain.

Figure 14: The Flow of Brides in the Context of Migration

a)



b)



c)

Multi-Level Mobility

The shifting of territories manifests ultimately the collective residential shift of individuals, following kin links in turn. It conforms to a common pattern of mobility in the region, which operates by diffusing the basic rules of territorial relations between groups.

These rely on the correspondence between clan and territory, and the respective rights of residence. Within a clan, individuals are free to settle anywhere on its territory, save for sacred or otherwise collectively tabooed sites; settling across clans, though, requires special permission from the landholders. Negotiation among leaders can secure the collective permission required for establishment of a village, where all clans settle on the land of one only which waives restrictions during occupation of the site.[263] This particular legal condition is reflected in use of the Tok Pisin term PLES ("place, village") for the village area, in contrast to KEM ("camp")[264] for residential clusters or single residences on clan territory.[265] Negotiations among individuals can secure the individual access to such KEM, in turn, with non-clanmembers seeking permission from landholding relatives, typically their ONI (MB), PE (MBS) or SAI (FZS). If kin relationships provide the legitimation for access, authorisation proceeds through the social relationships modelled on them. Hence, consent is typically a formal rather than selective act. Commonly, therefore, the adult male population of a residential cluster comprises also non-clanmembers to a greater or lesser extent.

Similar divisions and procedures apply to the use of land for the preparation of gardens; of collectively owned resources like game; and, on a lineage level, to individually owned and lineally transmitted resources such as in particular planted and/ or nurtured trees: what belongs to one's own clan/ lineage is accessible freely; what belongs to another clan/ lineage is accessible only upon a relative's consent. With the converse perspective, unrestricted land and resource use indicate landholdership/ ownership; conditional land and resource use lack of landholdership/ ownership, but kinship with the landholders/ owners. In fact, this correlation provides the idiom in which people talk about their alignment and their group's rights, as they distinguish between "not having to ask" or "having to ask" for land and resource use.

In principle, therefore, territorial relations between groups are clear-cut. In practice, though, they can blur, when conditional rights become unrestricted or unrestricted rights lapse. Land and resource use play key roles in these processes, as they confirm human presence on the land and thereby validate territorial claims, while their lack indicates human absence and thereby endangers claims. Thus, acquiring territory (KISIM GRAUN: "taking land"), whether in friendly (kinship) or hostile (war) circumstances, may rank as supreme expression of a landholding group's vigour and hence male prowess (cf. the quote on p.203); but only safeguarding territory (LUKAUTIM GRAUN: "looking after land") through continuing attendance can substantiate the respective achievement. Conversely, lapse of attendance equals a lapse of territorial control, rendering the land terra nullius and thus prone to foreign invasion. Claims which go rather unchallenged will stay active through occasional visits; land under threat of being wrested away, though, requires constant residence and use.

Vegetational markers serve as proxies for human presence and may double as resources which support continued residence, much as their persistence indicates ancestral occupation. In particular planted and/ or nurtured food trees fulfil these purposes, although other planted perennials, including the classical PNG boundary

marker *Cordyline fruticosa*, the cordyline shrub, may also be used.[266] Ideally, their locations correspond to the extent of the territory, and therefore their ownership to landholdership. Hence, people of Krisa descent living abroad may return as long as "they still have got food trees here". Due to territorial shift, though, ancestral resources may survive on land to which rights have been lost. Hence, clan F1 can claim continuing access to food trees in Samararu, a past settlement site (cf. Table 11 [p.200]), but no longer territory. Conversely, planting of new resources may mark emerging claims on land which has not yet been fully secured as territory; it would in the past reinforce the prior scarring of trees in the process of aggressive occupation (Simet 1992:56).[267]

The Krisa migration to the coast provides a prime example of the processes entailed in territorial shift and maintenance and the attendant vegetational changes. It commenced around 1940, when an enterprising leader first led a group of compatriots north onto alien territory, following ancient kin links through outmarrying females. Over the next half-generation, he and others founded a string of six hamlets along the coast in quick succession from west to east. Typically, forest would first be cleared for gardens and trees planted; a few years later, dwellings would be built and residents of the village and/ or the previous hamlet move in, swelling the size of each new one; then the next site would be tackled in the same way. The political implications of these activities were candidly summarised by the late leader's son when he described how his father tackled the last site by "beginning once more... to prepare gardens, plant sago, acquire land again"[268]. The same speaker justified the migration retrospectively with precisely the land use that cemented it, indeed referring not only to activities with tangible effects on the vegetation, but in particular to the hunting of game. According to him, Krisa people were the first to actually utilize what for the coastal people, whose occupation was not hunting but fishing, had been "useless forest" (BUS NATING) before, and thus terra nullius.

Initially, the old-established communities, including Ningera, seem to have welcomed the Krisa moves, being remembered as 'friends' consenting to Krisa settlement (cf. n.255); offering their land willingly for Krisa people to prepare gardens (Simet 1992:Annex Four; PR 57-58/5, DOR 57-58/2nd); and indeed helping to clear forest. At the time, Krisa presence at the coast pleased therefore all involved parties. Neighbouring groups apparently appreciated the gain in manpower; the administration anticipated removal of the population from the inaccessible plateau (PR 53-54/2) and valued Krisa involvement in the infrastructural and economic enterprises of the nascent station at Vanimo (cf. PR 48-49/6, 49-50/13, 53-54/2; DOR 57-58/2nd, 57-58/3rd, 58-59/1st). Krisa people themselves, guided by some patently visionary leaders, seized the opportunity to combine territorial gain with access to two new resource areas: the sea, and the newly established government and mission stations which beckoned with employment, services and goods (cf. PR 63-64/6).

The stations surged in attractiveness in the early 1960s, when the impending Indonesian takeover of nearby Dutch New Guinea (cf. n.223) highlighted Vanimo's strategic position in both military and religious terms, prompting concentrated interest by administration and mission and consequently the rapid development of the outpost to a small town within a decade (Allen 1976:327f.; Willy 1996:13f.,69; DOR 61-62/1st; AA n.d.:81f.). The Krisa migration accelerated accordingly. By 1964, over 80 % of the community were living in Waraston (PR 63-64/6), one of the last and easternmost coastal hamlets, established less than a decade previously. The erstwhile hamlet had become "village" (PLES), with its own men's ceremonial house and the collective access this designation implies (cf. p.215), while the village on the plateau

was largely deserted and began to overgrow. Waraston's prominence at the time survives today in numerous life histories, as many young adults and youths report it as their place of birth, and their mothers remember "burying the baby's umbilical cord in the sand". Krisa people recall "eating fish and turtle and diving"—a total transformation of their self-confessed past lifestyle as "forest people" (cf. Cheesman 1941:182f.) and erstwhile dislike of the sea (ibid.; 1958:255). Krisa presence at the coast survives also in numerous planted trees, most salient the tall coconut palms lining the coastal road constructed with Krisa help (cf. Cheesman 1941:182; DOR 58-59/1st), and people frequently recount their planting upon recollection or passing.

Most of the land once under Krisa occupation, though, could not be kept long enough for holdership rights to accrue. Already from the early 1940s, opposition to the Krisa migration began to stir in one coastal community (cf. PR 53-54/2). Less than a generation later, the once "unused" land was becoming hotly contested as all potential parties were awaking to its value as both a residential location close to town, manoeuvring space for town planners, and indeed financial asset. Complex conflicts ensued, and continue to the present, between the coastal communities, Ningera, Krisa, and the government and provincial administration over the distribution of monies and demarcation of boundaries. They were triggered when the various communities received remuneration for the sales of logging rights (1967-68), timber (from the mid-1980s)[269], and land alienated for planned reforestation (1969-70, returned to customary tenure in 1996) and urban development (1985) (Simet 1992:esp.48,61; Sandaun Physical Planning Board 1999:3-5).[270] The transitional state of Krisa land rights became apparent with the latter purchase, as the government awarded compensation to Krisa people for "improvements to the land", i.e. dwellings and planted trees, but to their coastal neighbours for the ground itself, in recognition of their older rights (Sandaun Physical Planning Board 1999:2f.).

Upon this alienation of the coastal strip, Krisa people had to vacate Waraston. Some moved on to Pasi, the last hamlet established during the mid-century coastal migration, if slightly inland.[271] Many, though, left the coast, as an emerging road link between Pasi and Krisa village, commenced with logging operations in the mid-1980s, promised access to Vanimo without residential proximity. They settled along its course in variously sized camps, or indeed returned to the village on the plateau.

A previous, if more moderate, wave of returns from the coast had ensued when the village received a primary school in 1975. This innovation had at once encouraged other Krisa outmigrants to return from the Pual basin, where they had moved in the late 1960s to participate in the launching and operation of an agricultural programme at the mission station in Ossima, itself founded a few years before. Such involvement had allowed them to at once benefit economically; bolster friendly relations with a mission just turned Diocese (Willy 1996:277); send their children to the mission school; and, not least, ensure their presence on potentially contested land or indeed establish new claims.

Since the mid-1970s, the village on the plateau had therefore successively regained inhabitants, but this trend has reversed again in the last few years. The population keeps draining out, while the roadside camps down to Pasi are increasing in size and number. Pasi itself has become the most prominent residential cluster beside the main village and approaches the role once taken by Waraston. Its area is open for collective access; it mans a soccer team which competes with the clan-based teams of the village; and together with three other major clusters near the coast it accommodates variously up to half of the Krisa population. Outsiders tend to consider

it *the* outlier representing Krisa community (cf. e.g. Donohue & San Roque 2004:2-fig.1,6).

Leaders blame the renewed exodus on the lack of water and on road decay, which commenced once logging operations were completed on Krisa land in the mid-1990s. Their analysis captures both the essence of the situation and hints at the prime role of resources—whether traditional or modern—in the complex web of motivations that underlie residential mobility.

Water easily tops the list, being doubly vital in Krisa as in the wider region, since it functions not only as the principal nutrient but also enables processing of the principal calorie source sago (cf. section 3.6.).[272] Besides, water is central for personal hygiene which receives much attention, people usually washing from tip to toe twice daily, failure to do so indicating late return home or severe illness. Furthermore, water is essential for domestic hygiene, the dishwashing and laundry load having soared with the adoption, since the 1940s, of modern materials and fabrics in place of the disposable vegetal materials used in the past.[273] This critical importance of water contrasts with its scarcity on the porous limestone plateau: the few rivulets are insufficient; dug wells of poor quality and infested with mosquitoes, besides being typically located below the precipice and hence both difficult to access and vulnerable to destruction by landslides; attempts at piped supplies have failed; and rainwater collection equipment depends on funds and is prone to wear and damage. In the past, the dismal water situation was balanced by the safety of the remote and breezy location, which diminished the threats of both enemy attacks and malaria. With the cessation of warfare and availability of antimalarial treatment, though, the plateau's principal disadvantage has come to the fore, leading people to seek out more water-privileged locations.[274]

If this tendency remained mute while a functional road connection existed to Vanimo, this owed less to the geography of the plateau than to the functions of the village. As the embodiment of the community and location of social networks and events, from political meetings to sports matches, it constitutes the centre of Krisa social and cultural life. Besides, it has a modest complement of infrastructure: a school and an aid post manned by a paramedic, the buildings for both having been upgraded by the logging operator; a church for the Catholic congregation, which is sporadically visited by Diocesan priests who take confessions and say mass; a market, which is held between once and three times weekly; and five tradestores, which have variously operated over the last years (cf. Kara 1996:11; Leklek 1996:6f.). A functional road, which enables mass transport of passengers and goods, can not only support operation of these facilities and other commercial projects, but can also add them to those of the urban area at the coast. Road decay eliminates both functions, causing twofold frustration and persuading people to migrate closer to Vanimo (cf. Klappa 1999c).

Further incentives for this move are the thrill of staying at the cutting edge of modernity; protection of fellow community members from the (real and imagined) physical and moral dangers emanating from the neighbouring urban squatter settlements;[275] and protection of the territory (LUKAUTIM GRAUN—cf p.215) from encroachment by these same squatters (cf. McNeil 2002), the government, and neighbouring groups.

Besides the factors evident in the present outmigration from the village, there are others which motivate residential shift, acting to attract or dispel residents. In the last few decades, a prominent, if typically transitory, attractant has been commercial land use in the form of cattle farming, cocoa farming, and logging. In the 1970s,

several Krisa clans followed the example of Ossima missionaries and established cattle corrals on their respective territories (cf p.217). Clearing forest for the paddocks and keeping the animals under observation necessitated residential shift, which though reversed when cattle farming was given up about a decade later. Between the mid-1980s and mid-1990s, logging provided not only a road link to the coast, stimulating at first the establishment of roadside camps and upon its decay their expansion (cf. p.217), but also access roads radiating from the village. These prompted residential sprawl, encouraged further by environmental change, as the thinned vegetation[276] invited the preparation of gardens. The unprecedented employment opportunities reinforced the trend of outmigration from the village, leading people to keep up with the advancing logging frontier, until the change of operator and attendant decline in work satisfaction led to a reversal (Kara 1996:26).[277] Following the completion of logging, further residential contraction ensued, but the general spread of the village, and the camps lining the Krisa–Pasi road remained. In fact, the roadside camps are currently experiencing their third expansion, growing both in size and number, as the widespread adoption of cocoa farming since the late 1990s and attendant residential shift has concentrated on the lower half of the Krisa–Pasi road, to ensure future transport of the crop.

Religion has served as a similar attractant as commercial land use. In the late 1980s, several fundamentalist Protestant denominations entered the region, which had until then been under Catholic missionary influence (Willy 1996:146f.). In Krisa, converts to the Four Square and PNG Revival Churches quickly assembled substantial congregations. Their desire to break away from the Catholic village coincided with construction of a logging access road, stimulating two new camps in the north of the plateau. About a decade later, however, landslides and attendant road decay forced abandonment of the sites, their inhabitants relocating to places nearer the coast. If camps have therefore emerged and been shifted on denominational grounds, the same applies for individuals, who may change their faith repeatedly throughout their lives, with attendant residential change.

Much as attractive conditions may draw residents, unpleasant conditions may dispel residents. Besides threat of war in the past, deaths are typical reasons to abandon sites, thus avoiding memories of the loss, the spirit of the deceased, or renewed assault from the sorcery suspected.[278] The quest for solitude and independence is another prime motive. Many people start feeling claustrophobic when residential clusters threaten to grow beyond a comfort threshold of about five dwellings, and will then move out and set up residence at a new site, if sometimes only a few hundred metres away. Thereby, they gain at once privacy, autonomy, and space for house gardens, and limit the potential for tension and conflict. Likewise, people may change residence temporarily to diffuse domestic or residential strife.[279]

This tendency for diffusion has manifested palpably in the change of the village layout over the last six decades. Hamlets have budded off the original nucleus and spawned new hamlets in turn, their mushrooming boosted by the construction of access roads during logging. The once tightly packed village, nestled at the western edge of the plateau, has consequently developed into a sprawling scatter of single and clustered houses spreading north-, east- and southwards across the plateau, up to 15-20 minutes' walking distance from the village core, and thereby into various clan territories, where residence conforms once again to group-specific access. Map 8 sketches the current village layout, illustrating the sprawl.

If leaders have themselves contributed to this diffusion, as they have to the residential division into plateau-based and coastal settlement, they are now

campaigning to contain both sprawl and outmigration, with arguments ranging from the ideological to the pragmatic. They emphasize that only living in the village will preserve cultural identity, hold up morals, provide workforce for community projects, and maintain the population numbers which ensure institutional support for infrastructure, to which in turn only residential concentration will enable access, besides restoring the traditional pattern of settlement. Their purpose, though, transcends mundane concerns. It aims, more fundamentally, at constraining the centrifugal forces of independent individuals and disparate groups—and, in the event, mustering them for pioneering ventures—and thus manifests a classical attribute of leadership in a strongly individualistic and mobile society.

The move to the coast and the sprawl of the village represent the two extremes of this dynamic and thus but old phenomena in new guises. The former exemplifies organised migration, redirected towards urban environments. The latter exemplifies unrestrained dispersal, replicating in space a contrast formerly manifested in time. Nowadays, the village core contrasts with outlying camps, both being occupied concurrently. In the past, the intermittent occupation of villages or clan-specific clusters for ritual or defence purposes contrasted with the occupation of scattered camps in the forest for the rest of the time (cf. n.221). In Krisa, the balance seems to have shifted towards semi-permanent occupation of the village already in pre-colonial times (ibid.). Among Mbo-speakers, prolonged absence of the population from residential centres was still a common complaint of patrol officers between the 1930s and mid-1950s (Thomas 1931; PR 30-31/6, 53-54/2, 55-56/4).[280] If continual instruction by the officers suppressed mobility, this surged again under wartime disruptions, as administrative attention lapsed and locals fled from Japanese destruction and allied bombing, seeking refuge in the forest (cf. PR 44-45/6, 46-47/9). Krisa people report how they abandoned in fear their barely finished village at Desawa and the embryonic first hamlet at the coast, and how both sites were covered in regrowth on their return (cf. pp.202,216).

If their flight was a response to exceptional circumstances, interrupting a trend towards sedentism which has continued for at least a century, dispersal to the forest is still a prominent feature of Krisa life. Some community members may reject it for ideological reasons, regarding it as the attribute of a backward and benighted lifestyle (see pp.227,240,268). Most, though, enjoy regular stays of various lengths in forest camps (BUS KEM: "bush camp"). These are usually single houses or shelters about an hour's or more walking distance from the village. They may serve as temporary accommodation on subsistence excursions that require overnight stays away from the village, such as extended hunting trips, gardening in the respective area, or processing sago from a local stand of palms. Their location near watercourses, a function of convenience (cf. p.218) and the conditions for sago growth, at once makes them prime retreats during arid spells, when wells in the village run dry and rainwater collection tanks empty.[281] People may then spend strings of days, weeks, or even months in their forest camps, the frequency and duration of visits peaking towards the end of the dry season, around August/ September (see n.359) They may return sporadically to the village, but will resume permanent residence there only with improvement of the water situation. Far from regarding this enforced migration as a burden, they cherish the opportunity for a getaway, which they may indeed portray in terms of 'holidays'.[282] They indulge in reminiscences of past stays and anticipations of the next, and look forward to the end of the school term (or the departure of the researcher), when they will be free to relocate their families from the village to the forest. In fact, some people enjoy staying at a forest camp so much that they install

themselves there rather permanently for up to several years. Thus, a few couples report having spent a considerable part of their histories living on their owns in one of these solitary camps. Their first children were born there, and they only moved back to the village—or down to the coast or roadside—when these reached school age. Conversely, once the children have completed formal education, some families return to their previous or another camp in the forest.

Clearly, the chief obstacle to dispersal in the forest is formal education, which concentrates people around the respective facilities, the more so the more schooling becomes the norm. One way out of the dilemma is to leave school-age children in the care of resident relatives, which though may result in the pupils' grief and subsequent lack of academic success. Another option is to compromise on solitude and move to the coast or roadside, thereby gaining access to urban educational and other services while retaining many of the environmental benefits of forest residence, including access to water. In fact, most of the present roadside camps derive from once solitary forest camps, used in the past during hunting trips or excursions to collect sea water, which were but shifted and/ or expanded with the advent of the road. And as with true forest camps, part of their current residents treat them as temporary bases only, which they occupy during school term or the working week. They maintain their principal houses in the village and resume residence there whenever possible. Others, though, have installed themselves rather permanently at the roadside or coast, returning to the village but sporadically for subsistence excursions, when they find accommodation in any previous houses or with resident relatives. Yet others hardly ever visit the village, living at the coast in the second generation. Their houses, in turn, provide convenient lodgings for visiting relatives from the plateau, who may indeed call weekly.

Much as therefore a fission of the community seems to be underway, into a coastal and a plateau-based fraction, so does individual mobility curb this process. Hence, residential division does not equal demographic division, as dwellings, and indeed households, are not unambiguously matched to specific individuals. People typically alternate between various places of residence to accommodate modern academic or work schedules; seasonal availability of water; or, more fundamentally, the necessity to use and maintain widely distributed resources and thereby maintain territory, the ultimate source of sustenance. Besides the periodic occupation of multiple domiciles, these are themselves shifted frequently, as people are always quick to escape from threats and to seize opportunities, whether traditional or modern. If individuals thereby pursue their idiosyncratic interests, preferences may become collective through force of circumstance or leadership, causing the demographic shifts which remain evident in oral histories.

These shifts are not necessarily innovative: groups tend to migrate between sites in the long term, much as individuals tend to commute between domiciles in the short term. Hence, many recent residential developments represent revivals of older ones (cf. Table 12 [p.201]). Thus, Duwi was reoccupied during cattle farming, Paltari subsequently; Wolu was hardly ever abandoned and was repopulated in the context of the logging sprawl; another ancient site towards Mt.Sawa was revived during the denominational secessions; old forest camps were adapted with the advent of the road, expanded by its decay, and boosted by cocoa farming (cf. pp.218,219). Generally, sites once opened are rarely given up for good, whether revival occurs upon particular incentives or in the context of regular residential shift. Such continuity enables at once continued use of perennial resources established in the past, and ensures their propagation for the future. Notable exceptions in this pattern of reoccupations are Yeble and Api. Yeble may have been so inconvenient that only extreme war pressure

made it attractive. Api may not have been accessed between ~1790 and ~1930 due to its unsafe position, and thus passed the window for renewed occupation, as the intervening five generations rendered the erstwhile occupants mythical spirit beings and hence the site sacred (cf. p.205). Incidentally, most nurtured perennials will have declined after this period.

Prolonged neglect of sites will therefore lead as much to a deterioration of resources as to a lapse of territorial control. Conversely, prolonged occupation will lead to a deterioration of living conditions, from sanitation problems to exhaustion of resources.[283] Hence, a balance needs to be struck between human absence and human presence. It is achieved by reconciling the antagonistic endeavours of dispersal and return in a mobility pattern that integrates transitory and scattered settlement with reoccupation, resulting in the continuous, and often asynchronous, circulation of people among fixed sites and resources. This pattern recurs in various timeframes, from the periodic occupation by individuals and their families of multiple domiciles within weeks and months to the episodic occupation by entire groups of multiple settlement sites across generations. The myth of the community's expulsion from Mt.Dale and reunion in the present territory (cf. p.199) conveys the ultimate manifestation of the same dynamic and thus reflects not only history and ideology, but at once an intrinsic feature of Krisa life. If this feature has manifested most dramatically in the context of warfare and modern incentives, it arises more fundamentally from subsistence requirements. Their systemic embeddedness may render them mute in local accounts as factors for residential mobility. Yet, the vital balancing act between seizing, launching and maintaining resources and territorial claims on the one hand, and avoiding overuse and overpopulation on the other entails the prototypical contrast between threats and opportunities, and must therefore constitute the template for fluid residential patterns at large.

If these are commonly contained within territorial boundaries, they also provide the physical means to transcend them, thus complementing the political means of kinship. The combined exercise of both in a directed fashion then enables the shifting of territories in the context of large-scale migration. Similar mechanisms may act beyond the region (cf. nn.241,255), rendering the effects of the Bewani expansion but one instance of a possibly common pattern of ethnic shift in New Guinea and a potential model for colonization of the island in the distant past.

Dimensions of Permanence, Transience and Transformation

The myth of dispersal and return may suggest a tension between ideology and history, unity and diversity, concentration and diffusion, permanence and transience, which though it at once collapses by revealing ideology as rooted in history, unity fashioned from diversity, concentration balanced by diffusion, and permanence integrated with transience. It thereby captures in one parable a recurrent characteristic of Krisa life and imagination, permeating both socio-political affairs and subsistence (see sections 5.2. and 5.3.), where disparate parts make wholes and flux engenders stability; where fluidity relies on models of stasis; and where an intense sense of history flows into a circular notion of time. If permanent transience results, at once transformation occurs, from the change of homelands, through community formation, to the impact of modernity. And yet, much as a global perspective may regard these as just specific instances of common scenarios, so a mythical perspective sees them as returns to a

preordained and recurrent state, the transient manifestations of a permanent and eternal pattern.

Thus, the community appears as timeless in myth, yet has historically formed, while the respective process appears unique within its historical trajectory, yet may but represent regionally recurrent scenarios of political disintegration, migration, and unification.[284] Establishment of the first village may have constituted a landmark event for the involved groups, which though manifested but a regionally common residential pattern (cf. n.221). The village may since have embodied the community, but represents only one residential cluster among many; has like them waxed and waned over time; and has occasionally been overshadowed. Besides, residential concentration represents only one form of settlement, complemented by residential diffusion, which classically occurs as dispersal to the forest, though more recently recurs as the sprawl of the village.

The resulting change of the village layout exemplifies the change of opportunities and threats during the last century, and the concomitant changes in residential and mobility patterns. In the past, the push through war and administrative pressure stimulated intense residential concentration in respectively the first and the original second village, but manifested only sporadically. It thus allowed intermittent occupation, leaving people to otherwise pursue their subsistence activities and indulge their individualistic tendencies, both encouraging dispersal and asynchronous rotation of residence in turn. In contrast, the pull from modern stimuli permits diffuse residence nearby but demands permanent occupation. The strict regimes imposed by formal education, employment and agricultural initiatives (an exception being cocoa farming—see p.303) then conflict with the desire and economic need for dispersal. In fact, this need may vanish altogether where employment or commercial land use come to substitute for subsistence. The resulting trend towards sedentisation combines with the synchronising effect of modern stimuli to draw the population off the better part of the land, thus leaving dispersed resources prone to deterioration and the reaches of the territory without control.

Besides, day-to-day mobility suffers from rising family sizes. These likely result from the combined effects of improved healthcare; decreasing observation of post-partum and other sexual taboos; decline of the formerly standard residential separation of spouses where men spent much of their time at the men's ceremonial house; and the teachings of the Catholic Church that bar contraception, abortion and infanticide, and encourage fertility. The increasing number of closely spaced children impede in particular women, encouraging them to stay near their place of residence.

The impact of modernity immobilises increasingly not only the population, but also the major residential clusters. The more these are fitted with modern infrastructure, in the form of roads (currently the Krisa–Pasi route), permanent buildings (currently aid post, school and teacher accommodation in the village), or supplies for water (currently occasional rainwater collection facilities, piped supplies having broken down) and electricity (currently for one tradestore in Pasi), the less easily they can be shifted. Hence, leaders may contemplate a second relocation of the village, but admit that any such move could only follow a breakdown of the present structures, which though is ironically what they otherwise fear. People are therefore increasingly caught between the conflicting desires for residential permanence to ensure modern amenities and residential shift to ensure recovery of one site and revival of another.

And yet, modern stimuli have acted not only to curb mobility, but also to support it. Thus, new opportunities have expanded the catalogue of dispersed

resources; their waxing and waning has contributed to collective residential shift; and new resource areas have emerged in form of the town and, incidentally, the sea. The Krisa–Pasi road facilitates transfer between plateau and coast and is much frequented by pedestrians after the end of the logging boom and attendant decline of motorised transport (cf. Klappa 1999c). Despite its decay, it represents a considerable improvement to the previous forest path—tortuous, arduous, and abounding with rocks and leeches—which was loathed by locals and outsiders alike (cf. Cheesman 1941:181; Willy 1996:66,68; PR 53-54/2). Still, the road and the centres which it connects support but localised activities, concentrate people, and tend towards permanence, whereas the traditional subsistence context of dispersed resources and individual clan territories ensures a wide and variable distribution of the population. If traditional patterns of residence and mobility therefore act as templates for the flexible approach to modern opportunities, they may at once vanish in the process.

Since these patterns manifest also socio-politically, this will in turn affect the structure of the community. After all, ongoing individual and collective mobility has rendered population and political units complex and fractured, blurring community composition and bounding of an outwardly cultural-linguistically unique population represented by six socio-political units. Thus, clans are both numerous and indistinct (cf. Table 11 [p.200], Figure 10 [p.204]), internally composite on the one hand and transcending the community on the other, as groups have historically become assimilated, associated or separated within and across cultural-linguistic units, through the residential changes attendant upon marriage alliances (cf. pp.203ff.), splits among agnates (e.g. F1/ F2) or calculating hospitality (e.g. G-W, F1-W) (cf. Table 11). Likewise, community members may derive their residence in Krisa as much from their membership in one of the Krisa clans, as from in-marriage, contemporary or ancestral kin connections, or special permission. Conversely, members of the Krisa clans may reside in other communities for similar reasons. Any such constellations may be but transient in turn, as people may alternate between sites across communities as much as within, adding a dimension of trans-community mobility to an anyway fluid pattern of residence, and blurring the confines of the community even for staunch locals with a good grip on local affairs. This fuzziness is reflected in modern administrative and electoral procedures, as temporary residents will fall under whichever Census Unit they happen to reside in at the time, while permanent residents who have consciously chosen their allegiance to one are considered "citizens" (SITISEN). The community is therefore as much virtual, the transient focus of ultimately independent individuals and clans, as the real product of the permanent members' deliberate sharing in a collective residential site and identity.

Both community coherence and socio-political fluidity rely on marriage by sister exchange, which, too, is changing through modernisation. In particular the introduction of modern currency has encouraged a trend towards progressive disintegration of the at once cohesive and adaptive networks between individuals and groups. In the 1940s, Australian money came to replace the traditional shell valuables whose exchange had previously accompanied the swapping of marriage partners. This innovation uncoupled both transfers, rendering them interchangeable as sister exchange on the one hand and brideprice on the other (cf. PR 49-50/13).[285] Subsequently, an increasing number of unions have been compensated with money. At present they comprise twice the number of sister exchange unions, which besides are concentrated with older couples, indicating that sister exchange is seriously on the decline and with it the multiple bonds of obligations and rewards between clans.

Brideprice itself is changing, with socio-political effects in turn. Classically, the groom pays the man who would otherwise receive the exchange bride, enabling him to compensate via this detour for his own bride in turn. In departure from this analogy to sister exchange, though, payments go increasingly to the bride's parents, especially the mother, or to any other person who has invested in her upbringing. The rise in the number of single mothers, as separation increases (see p.225), may reinforce this trend. This redefines the meaning of compensation as a reimbursement for effort expended rather than procreative potential lost, and hence favours the interests of individuals over those of the clan. In a similar vein, brideprice encourages partner choice according to inclination rather than political calculation (but cf. n.254). This at once enables an increasing number of mixed marriages reaching beyond the region. As employment distributes Krisa people throughout the country, and foreigners converge on Vanimo's urban area from across the province and beyond, the circle of eligible partners expands. Their different marriage traditions place the resulting unions outside the regional system of sister exchange, rendering brideprice typically the only alternative for compensation and eliminating the potential for politically useful ties.

Brideprice has increased not only individual freedom and the pool of potential spouses, but at once the instability of unions and the potential for discord between the involved parties. In contrast to sister exchange, it is potentially ambiguous, as sums can be up to interpretation and payments protracted and partial. Indeed, monetary compensation remains often incomplete and hence the union indefinite, due to the large sums involved which continue to soar. On the one hand, this encourages animosities with the bride's relatives, who may consequently disrupt the union through force or sorcery. On the other hand, it combines with the union's lack of social embeddedness and male investment in it to encourage separation by the spouses themselves.[286] If the strong matrilateral component of Krisa kinship promotes itself marital instability, sister exchange may traditionally have stemmed this tendency towards disintegration. As its decline pulls out this stop, and the concomitant rise of brideprice amplifies the underlying volatility, a process of positive feedback may rapidly lead towards a more atomised society.

Brideprice therefore erodes at various levels and scales the highly integrated system of multiple relationships which reciprocal marriage exchanges produce. The coincident decline of polygyny contributes to this process, as it at once reduces the incidence of half-siblingship and relaxes the pressure to find spouses abroad (balanced socially, but not politically, by increasing freedom of partner choice), thus weakening both intra- and inter-community cohesion.

Other effects of modernisation reinforce this development. In particular monetary compensation for land and resources readily separates and subdivides communities and clans (cf. p.217). This dynamic manifested most dramatically in the context of the timber rights purchase and subsequent logging operations. The ensuing greed led groups to fragment, recruitment and land use options to rigidify, and patriliny to intensify throughout the region (Kara 1996:41f.; Ketan 1992:13,15f.).[287] If these phenomena were largely transitory effects of massive cash flows, the formalisation attendant on written documentation and administrative procedures strengthens the patrilineal element more permanently. Thus, official records and dealings favour linear genealogies, clans or their agents, and discrete communities, and lend thereby institutional support to a reduced version of regional politics.

Such political streamlining is complemented by territorial and historical streamlining, as boundaries are surveyed and mapped and history is written down,

thus arresting flux and elevating a snapshot in time to permanent authority. After all, customary territories are subject to shift, and oral accounts subject to memory loss, interpretations and revisions. And yet, the contrast between transience and permanence obtains also traditionally, as accounts which narrate migrations coexist with others which claim that territories were occupied by founder ancestors or bestowed upon the Creation by divine act. In historical terms, these accounts may reflect various stages of occupation, which through their different genealogical depth attain different degrees of validity, as the transformation from human to mythical era at once transforms a transient to an apparently permanent condition (cf. p.205, n.230). Multiple tiers of landholdership result, with different groups often claiming concurrently variously assured rights to land use; present tenure of the territory; and the honour of first occupation. If present tenure is the tier officially recognised (cf. n.225), the State itself adds further sets of boundaries, for administrative, electoral and economic purposes, which cross-cut the ancestrally defined ones.[288]

Similar dimensions of permanence, transience, and transformation apply in regard to clans. Ideology may pronounce clan, blood, and territory as inseparable, and proclaim pure patriliny (cf. the quote on p.205); reality, though, sees clan takeovers and incorporations (cf. pp.212f.), occasional matrilateral filiation, and usufruct through female kin links, which in the long run may turn into landholdership. If the clans remain the fundamental units of Krisa socio-political life, they have also taken on new functions as clubs which man soccer teams and offer paid labour throughout the community. Indeed, the constellation of these reflects the political climate, as rapprochements and estrangements between clans tend to engender formation of respectively joint or separate clubs. The clan-based clubs are at once rivalled, though, by religious and residential clubs, formed by the Catholic congregation and Pasi residents. This situation exemplifies how the traditional units are cross-cut more generally by recent divisions into various denominations,[289] and into coastal and plateau-based fractions which, if not demographically exclusive (cf. p.221), are evident in rhetoric and ideology.

The increasing influence of modernity alters not only the foundations of landholdership and kinship, but at once redefines the role of the leader and the attributes of successful leadership. The mandate has remained to ensure the abundance of land and resources, and the welfare of individuals and the community; but the circumstances for these endeavours are changing, and hence the requirements for the task. Traditionally, a leader would exhibit personal traits like integrity, charisma, vision and courage; be an excellent orator, mediator, negotiator, and, if necessary, fighter; and hold the store of the group's historical knowledge and hence the legitimation for landholdership. This would enable him to unite and lead the group; defend its claims; and thereby secure and safeguard territory. Furthermore, though, he alone would hold profound esoteric knowledge about the covert meanings of myth, events in the depths of the mythical era, and secret details of history; about their manifestation in the landscape; and about the forces at the root of existence. Only he as an exceptional individual would be able to guard this knowledge, at once potent and perilous, and apply it to summon the powers which pervade the world, thus allowing him to heal, to influence the weather, and to replenish resources, rendering him both a spiritual leader and guarantor of physical survival.

Yet, modernity has brought changes to livelihoods, knowledge and politics which place additional or competing demands on leaders. In particular the Christian faith, the monetary economy and agriculture, formal schooling, and official procedures have left their mark. Catholic Christianity entered the region haltingly

from the late 1930s and more vigorously from 1961, when missionaries of the present, Passionist, order arrived in Vanimo (Cheesman 1941:179f.; Willy 1996:20-25).[290] In Krisa, a bible school operated for a few years in the mid-1950s, and the baptism register records an increasing number of converts from the mid-1960s. From the late 1980s, several protestant denominations arrived through informal channels (cf. p.219). Traditional ritual practices declined concomitantly. The men's cult was abolished in the 1950s, thus terminating male initiations and transforming the men's ceremonial, or spirit, house (PALI, HAUS TAMBARAN) to a plain men's house (WARUWAWEI, HAUS BOI), its loss of function reflected by the loss of its special, conical, architecture and its ornamentation.[291] The men's house was further used for fertility rituals until the mid-1970s, when a leader with prophetic ambitions cleared out all ritual paraphernalia (cf. Kocher Schmid & Klappa 1999:90)[292]. Thereafter, the house served only for the transmission of oral traditions and as a communal sleeping place for men. By the mid-1990s, even these functions had vanished, and an elder broke off the unused structure.

With the exposure to Catholicism and the decline of traditional religion, at once a new, syncretic faith began to rise. It promises not only freedom from evil according to Catholic doctrine, as manifested in the purging of malevolent spirits with holy water to render previously tabooed sites accessible. It furthermore involves the ritual control of superhuman powers through the observance of Catholic teachings and western-type agriculture, to bring about monetary wealth, infrastructure and the attributes of a modern lifestyle (see Klappa 1999b, Kocher Schmid & Klappa 1999). If this renders traditional rituals and the subsistence they support at once evil and obsolete, it retains the leader's role to provide spiritual guidance and assure livelihoods. Besides such prophetic leadership, influential status derives more generally from leading roles in the local congregations.

Much as esoteric knowledge remains therefore an essential attribute of leadership, so does historical knowledge. Yet, the authority exercised by expert individuals increasingly has to compete with official records and private notes, and oral with written accounts. New modes of recording and transmission, in turn, indicate the importance of new forms of knowledge for comprehending the modern world and succeeding in it, reflected in an expanded concept of knowledge locally. The traditional concept comprises historical and metaphysical understanding alone, excluding the mundane expertise integral to subsistence activities (conventionally termed 'local environmental knowledge' in academia). It has, however, come to include the expertise gained through prolonged formal schooling, exceptional exposure to modernity, and experience with higher level employment and/ or commercial agriculture. Besides conferring pragmatic skills, such expertise is widely considered a means of instant access to a modern lifestyle, rendering it at once esoteric and hence both an instance of locally recognised knowledge and an important new attribute of leadership.

If modern leaders are therefore increasingly literate and educated, they also display increasing commercial cunning.[293] Their capacity to secure riches may result in infrastructural benefits for the community, but more typically manifests as their exceptional material wealth which has escaped the customary levelling mechanisms (see pp.260ff.). Although such affluence readily rallies support through its seductive promise of collective prosperity, it clearly serves less community welfare than personal aggrandisement, and may indeed happen at collective cost, thus sabotaging progress and perverting the function of leadership.

Besides these transformations of leadership attributes, the State has added a new set of leadership positions, their development reflecting national politics and the

powers in charge.[294] In the early 20th century, German rule first established appointed village officials, the LULUAI and TULTUL; in 1964, the Australian administration replaced these with elected Councillors (WSDS 16; AA n.d.:82); in 1972, a Krisa leader was elected to the third national House of Assembly which prepared the country for Independence (PR 72-73/1). Like him, others have held traditional and public leadership positions simultaneously, even though the former have so far retained higher significance (cf. Kocher Schmid & Klappa 1999:107). Still, the public positions fulfil an important role for the community as they provide access to public funds and participation in infrastructural decisions. At the same time, though, irresponsible individuals may abuse this function for their own enrichment, thus rendering public office a leadership attribute as ambivalent as commercial skill.

The structural changes upon modernisation have been accompanied by changes in language and livelihoods. Until the mid-1970s, Krisa vernacular had remained the principal vehicle for conversation for most of the community. Tok Pisin had infiltrated slowly, but took rapidly over with establishment of the local primary school (cf. p.217).[295] Until the mid-1980s, most of the community's material culture had been fashioned from forest materials. Modern garments had gradually entered, but only with the logging boom came an explosive adoption of commercial ware, from iron sheeting to plastic combs, tin cutlery, and enamel dishes (cf. n.273). Manufacture of pottery, which served both local use and trade with Mbo-speakers, and which avowedly produced superior taste, had ceased already by the middle of the century, presumably upon increasing availability of metal pots.[296] Concomitantly, meal composition has shifted, as the traditional forest ingredients are increasingly supplemented, or indeed replaced, with garden produce and store foods (see esp. pp.238,240).

Dramatic changes have thus borne down on the community during the last century. In local perceptions, though, they constitute but one further epoch within the larger, cyclical, scheme of things that orders local universes (cf. Kocher Schmid 2000b). In this scheme, past and present coexist, as leaders identify with their ancestors (cf. p.205, n.229), and current events are considered to manifest patterns pre-formed in the mythical past. Thus, the adoption of new foodstuffs figures as the most recent stage in a legendary sequence of dietary revolutions (see pp.230ff. below); the looming language replacement as the replication of an earlier one in the depths of history (cf. p.202); and the adoption of Christian beliefs and customs as the recovery of ancient traditions concealed by the men's cult, which some claim Krisa adopted only from its Mbo-speaking neighbours.

Innovations are therefore at once restorations in the local ideology of change which apprehends permanence in transience. It thereby assimilates and reflects a historical process of continuous transformation, the concomitant of an expansive society and of generalised mobility ranging from day-to-day subsistence journeys to large-scale migrations upon cataclysmic change. Throughout the centuries, language replacements and cultural introductions must have been a regular occurrence as groups fused and communities united; so must have dietary changes which may, in fact, be accurately portrayed by legend (see pp.299ff.). Likewise, material culture must have been variable, the documented rapid abandonment of pottery presumably complementing its comparatively recent adoption.[297] Indeed, the ease with which innovations have taken hold in Krisa in recent times has suggested to Roger Kara (1996:19) a tendency for "continual modification" in the cultural substrate of what he labelled "a society of fast-acceptance-and-rejection". That Kara arrived at this very

appropriate characterisation after a merely preliminary survey of Krisa culture highlights the prominence of the respective trait.

Modernity, then, represents but one instance of change, which has been assimilated into the perpetual flux, much as tradition represents but a vanishing manifestation of transience. And yet, the principles which have up to now been governing the regional system of subsistence (see sections 5.2. and 5.3.) and of socio-political affairs—in particular the values governing landholdership, leadership, and kinship—may reach far into the distant past, providing the permanence for transience to occur. Conversely, they may unravel under the impact of modernity, as this transforms socio-political institutions and way of life and thought, atomising the society and arresting flux, and turning transience into permanence.

5.2. Livelihoods: A Journey through Space

The Origins of Food

According to Krisa legend, the ancestors ate first wild yams (*Dioscorea* spp.), then bananas (*Musa* spp.). There was as yet no sago (*Metroxylon sagu*). This changed when the cognatically named culture hero Sakao appeared and from the top of a local mountain broadcast sago palm suckers over the land, together with the bones of game animals. For Mbo-speakers, who share this myth, Sakao's act heralded their present diet of sago and game, which replaced its mythical analogue of soil and millipedes. For Krisa people, it but launched a third stage in the sequence of dietary changes, besides providing them with an allegory accounting for regional differences in sago palm distribution. Thus, the image of propagules being cast downwards makes sense of the contrast between the paucity of sago palm on Krisa territory, where it requires artificial propagation and is limited to thereby established patches, and its spontaneous and abundant growth in the Pual basin. This is notwithstanding people's readiness to summon the ecological explanation, that sago palm proliferation corresponds to ground water levels.

According to Krisa's paramount leader, the advent of sago occurred in the lifetime of generation 9 bp, when people still settled at Api, hence around ~1760 AD (cf. Kocher Schmid 1996). This date may refer more specifically to the advent of thorny sago, which Krisa people claim came from the Pual basin while the original Krisa sago was smooth.[298] Chronology and direction of this innovation would correspond to that of orally documented immigration pressure and attendant cultural introductions, rendering the account historically plausible (cf. p.201, n.216, Table 11, Table 12). It at once suggests that the myth of Sakao was originally part of the cultural inventory of Krisa's southern neighbours and adopted alongside. That it apparently came to substitute for the historical innovation suggests further that this resulted in intensification beyond the arithmetic increase implied by the apparent rise of landraces from three to seven (see below).[299]

The subsequent arrival of sweet potato (*Ipomoea batatas*) and cassava (*Manihot esculenta*) marks the fourth and final stage in the legend of dietary introductions. If this renders both crops ancestral, profane oral and written (PR 53-54/2) sources associate the first appearance of sweet potato with the colonial era, while omitting cassava altogether. There are no accounts regarding the adoption of true taro (*Colocasia esculenta*) and Chinese taro (*Xanthosoma sagittifolium*). Both, though, are typically regarded as ancestral. Indeed, *Colocasia*-taro occurs as a high-value foodstuff in traditional contexts, which may reflect its high protein content (cf. Table 2) as much as a time-honoured place in the local diet. The antiquity of taro in the region is also suggested by its legendary transfer from Vanimo eastwards.[300]

All of these starch foods contribute to various extents to contemporary Krisa diet. The staple is clearly sago, followed at some distance by banana, then by root crops—principally sweet potato, less frequently yam and taro, and rarely wild yam and cassava.[301] With the exception of non-yam root crops, their relative prominence at present diverges, however, from their degree of taxonomic differentiation, as illustrated in Table 14-Table 17 (pp.231-235). Together with the respective parameters and associated lore—reviewed below—this suggests that the legendary sequence of dietary introductions is historically valid.

Table 14: Krisa Sago Taxonomy

SU **sago,** SAKSAK, *Metroxylon sagu*

traditional Krisa forms*—original and introduced in prehistoric times

SUDEI	smooth
SUBOBO	smooth, no seeds
SIBU	smooth, small seeds
SOXOLU	thorny, no seeds
SUASE	thorny, no seeds
SUKANA	thorny, no seeds
SIOU	thorny, large seeds

'wild' sago, WAIL SAKSAK ≠ *M.sagu*!

SUBU (-BU: fake)	possibly several forms no starch production, use for incubating grubs

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total number of recognised forms:

3 smooth
\+ 4 thorny
\+ several 'wild' without starch production

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* Donohue & Crowther (2004: 112) list correspondingly: SÙ..SULEÍ, ~ SUBU'BO, ~ SÌPU', ~ SAKALÚ, ~ SUWÀSE, ~ SUAKANA, ~ SIYÒ, indicating thorniness for the same landraces as I have recorded. Additionally, they list ~ SAU and ~ APSAU, which may denote something else than locally recognised sago landraces, whose number is typically given as 6 or 7 only (cf. Kocher Schmid 1996).

Table 15: Krisa Banana Taxonomy

(Forms which I have recorded as also known among Mbo-speakers, if under different names, are marked with +; the actual number may be higher. Highlighted forms are mentioned in the main text.)

WI **banana**, BANANA, *Musa* spp.

traditional Krisa forms

(*differentiating characteristics see main text*)

	AOYA	
	ASASU	
+	AWIA (A/ WIA: pig/ bone)	
+	BALES	
+	BAUES = 'STOP' (short fruit!)	
+	DIPI/ NDIPI/ WINDIPI	
	EPIO	association with legend
+	ISOL	association with legend
	IWI	
	KALAPUA	
	(WURA)MAPU	
	PABA	association with legend
	PADIDI	association with men's cult and legend
	PAIAWI	
	PAURA	
	SAINA	
+	SISONG	
	'SKRU' ("joint") (= KALAPUA?)	fruit contains seeds!
	SUSUWOU	
	UWOL	
	WIAXAI	association with legend
+	WOXODI	association with legend (emerged from the corpse of one clan's ancestor)
	WUNUNG/ WIWUNUNG	upright inflorescence! association with men's cult, according to legend, the second food of the ancestors, after wild yams (cf. Kocher Schmid 1996)

forms introduced in historical times from

+	YAOWA	Rabaul, long established (prior to IWIRE)

IWIRE (-RE: like, i.e. resembles IWI)/ 'MADANG'	Madang
KIAU-KIAU	Rabaul
MUMA	Lumi
'BORDA'	the border
'BUKA' (I)	?
'BUKA' (II)	Karkar
'DPI' ("Department of Primary Industries")	Port Moresby police station
'MAPRIK'	Maprik
'OSKIN'	Oskin (East New Britain Province)*
?	Kavieng

'wild' bananas, WAIL BANANA, ?*Musa* spp.

WI KEI	possibly several forms, medicinal value
WI RUNOU	possibly several forms, no use value

total number of recognised forms:

at least 22 traditional
\+ at least 11 introduced in historical times
\+ several 'wild' without food value

* Probably an error of transmission or recording, with 'OSKIN' likely originating from Hoskins, West New Britain Province.

Table 16: Krisa Yam Taxonomy

(Highlighted forms mentioned in the main text.)

cultivates	
KUBISSA (MAMI) ≠ KUP	*Dioscorea ?esculenta* ("lesser yam")*
KUP (YAM)	*Dioscorea ?alata* ("greater yam")
'wild' yams, WAIL YAM†	*Dioscorea* spp.
BISANGAM	
KUBABULI	long tuber
KUBIARU	white tuber
KUBIBAB	red tuber, like KUBISSA
KUB'IRAM	white tuber, like KUBISSA
KUBISSARAM	red tuber, small
UKONG	thorns, tuber deeply buried?‡
UPAPO	red tuber, no thorns
WAXALAU	yellow tuber
WEPIS	according to legend, the first food of the ancestors§
WOUBLES	white tuber, no thorns, most salient**
WUSUPO	yellow tuber

total number of recognised forms:

2 cultivated

\+ at least 12 'wild'

* Identifications following French (1986: 9-14).

† Probably all of the listed forms are noncultivates, although I could not confirm this throughout.

‡ The characteristics suggest *Dioscorea nummularia* (French 1986:14), according to Barrau (1965:287f.) one of several ancient Oceanic food plants.

§ Contra Kocher Schmid 1996 who recorded its name as KASIBO.

** Maibala (1996:16), who was shown a specimen, described this type as "fairly long, hairy at the top (head), white inside, and brown skin". Contrary to the taxonomy and tentative identifications provided here, he recorded 'kup' (KUP) and 'uples' (WOUBLES) as contrasting forms, the latter comprising both cultivates and noncultivates in turn, and identified them respectively as *D.esculenta* and *D.alata*. Considering that his field research in Krisa was brief, my own data may be more reliable.

Table 17: Krisa Terms for Other Root Crops

non-yam root crop cultivates	
TEIPOU (TEI/ POU: tree/ roots)	**cassava** (*Manihot esculenta*)
NDUKU	**sweet potato** (*Ipomoea batatas*)— distinction of landraces by colour of tubers, leaf shape, maturation period of plant, or by the name of the person who introduced it; form KAROWAS introduced from Rabaul
PISSI	**true taro** (*Colocasia esculenta*)
OPUSO	**Chinese taro** (*Xanthosoma sagittifolium*)
'wild' taro (WAIL TARO)	
(PISSI) DAO	several forms, tuber like PISSI, no use value
WALAU	several forms, tuber like OPUSO, no use value

Thus, any root crops besides yam remain undifferentiated taxonomically; cassava is even labelled just metonymically as "tree roots" (cf. Table 17). This indicates the late adoption of these crops. The sole exception may be *Colocasia*-taro, which as mentioned exhibits some cultural salience, despite its relative scarcity. Both taros are also the sole cases for which 'wild' inedible relatives are recognised, which may include other members of the respective genera.

In contrast to all other root crops, yam is highly differentiated, with emphasis on the 'wild' forms, suggesting that these have been subject to extensive use in the past (cf. Table 16). In fact, only two labels seem to designate cultivates[302]: KUP, identified as YAM in Tok Pisin, hence presumably denoting the greater yam, *Dioscorea alata* (French 1986:9); and KUBISSA, identified as MAMI in Tok Pisin, hence presumably denoting the lesser yam, *D.esculenta* (op.cit.:10). Krisa people consider the former traditional, the latter exotic. Both are planted in gardens, whereas most, or all, of the others are 'wild', the label KUP at once extending to them. Their morphological variations suggest different species (or even landraces?) of *Dioscorea* (cf. op.cit.:9-14). WOUBLES seems the most salient; WEPIS is the one mentioned in the legend, although all of them are also collectively considered ancestral food. Yet, the absence of any further historical or mythical references suggests a considerable passage of time which has left only dim memories.

If the taxonomy of yams classes various noncultivates under a single term denoting at once the sole cultivate (a pattern which recurs with tree palms, see p.244), the taxonomy of bananas (cf. Table 15) classes variations among the cultivate itself, indicating an intense and sustained process of domestication under intentional selection (cf. section 4.5.). The forms recognised as 'wild' refer here to inedible members of the same taxon, WI, presumably paralleling their botanical membership in the genus *Musa*. Differentiation of forms is by a large catalogue of parameters: maturation time of the plant; number of hands on the fruit stalk; shape and size of the fruit; colour and thickness of the skin; colour changes upon ripening; firmness, colour and taste of the flesh; and suitability for eating raw, baking, frying or boiling with or without skin. Besides, there are the usual markers on the plants themselves, such as habit of plant, shape of leaves, or colour of leaf stalk. Of the forms which Krisa people recognise as traditional, several are said to be shared with Mbo-speakers, who though attach different names to them; some are truly ancient, as indicated by their association with local legends, myths and long abandoned practices of the men's cult. Thus, a mush of the forms PADIDI and WUNUNG, both edible raw, is said to have been fed to male infants in the men's ceremonial house in an era, dated to the time of residence at Api, when these were abducted from their mothers prior to weaning, to be brought up among their male kinsfolk. WUNUNG is furthermore recognised as the legendary second food of the ancestors. It is exceptionally characterised by an upright infructescence.[303]

Like the taxonomy for banana, that for sago (cf. Table 14) distinguishes variations among the cultivate and extends the taxon, SU, to inedible 'wild' forms, which though are botanically members of species other than *Metroxylon sagu*. The degree of differentiation is moderate compared to both Krisa banana taxonomy and the sago taxonomies of other societies (Flach 1997:33-43), suggesting a more shallow history than either. Thus, 7 forms of sago in Krisa contrast with over 20 traditional forms of banana there and over 20 forms of sago documented in East Sepik Province (cf. section 3.6.). Mbo-speakers recognise 11 forms of sago palm (pers.comm. Christin Kocher Schmid 2005), hence over 50 % more than Krisa people, which corresponds to their presumably longer history of intensive sago use and the

abundance of sago palm in the Pual basin, and reinforces the suggestion that additional forms were introduced from there. Parameters for sago differentiation in Krisa are largely limited to presence or absence of spines and seeds, although the various forms are said to differ additionally in their rate of growth and slightly in their leaves and the taste of their starch. Clearly, though, the catalogue of recognised parameters is considerably smaller than for banana in Krisa. Similarly, parameters for sago differentiation elsewhere include details such as size, shape and arrangement of spines; colour and shape of leaflets, frond and petiole; or thickness of cortex (op.cit.:33,38-40,43).

Ethnobotanical classification and associated lore therefore reinforce the image presented by legend and oral history, of a sequence in which the staple shifted from wild yams, through banana, to sago, while cultivated root crops as latecomers have as yet remained rather inconspicuous. More specifically, the absence of any historical or mythical references to yams suggests their demise as a staple beyond the depth of the longest genealogies, which span 22 generations or ~700 years—the actual historical time span being likely longer, considering that the distant end of genealogies presumably merges actual generations. Bananas seem to have filled the intervening period, which may have lasted anything from several centuries to millennia. Their continuing cultural significance shows in the extensive introduction of new forms in historical times, whereas the same phenomenon is absent for sago. Rather, exotic forms of sago are limited to the ones brought in prehistoric times from the Pual basin. This innovation, in turn, seems to have stimulated the comparatively late adoption of sago as a staple, resulting in its dominance probably no earlier than the mid- to late 19th century (cf. n.299).[304]

The contrasting histories and comparative characteristics of both forms suggest that this change was less ecologically than culturally motivated. Thus, smooth sago is claimed to have been present in Krisa before the change, hence thorny sago but supplemented an already existing resource. Furthermore, though, smooth sago is claimed to grow *faster* than thorny sago, which therefore offered no particular benefit.[305] Rather, the introduced forms were likely part of a different system of land use, brought by the immigrants, which supplanted an autochthonous system relying principally on banana and thereby contributed to the historical expansion of sago areas in New Guinea (cf. section 3.6.).[306]

Today, Krisa people regard sago as their principal food. Even though they appreciate an occasional change, a continual diet of the otherwise highly cherished commercial alternative rice makes boarding high school students invariably implore their mothers to send sago. Sago starch is generally used wet, both fresh and upon fermentation (cf. pp.91f.). The principal method of preparation is as jelly, by stirring the starch with boiling water (cf. p.92). The resulting food carries the same name as the plant itself, SU. Other traditional ways of preparation are boiling with water, which produces a firmer jelly, SUKO; or baking, typically mixed with mashed banana and grated coconut and wrapped in leaves, which produces DRA—appropriately glossed as "sago delight" in the I'saka literacy materials (San Roque 2000a). More recent ways, adopted from other regions and occasionally practised, are baking in a pot or between two griddles, which produces something akin to cake or pancake, respectively.[307]

Sago is most commonly combined with leaves of the TULIP tree (*Gnetum gnemon*), cooked in coconut (*Cocos nucifera*) milk, thereby supplementing the otherwise nutrient-poor carbohydrate staple with protein and fat (cf. p.91).[308] According to the results of a consumption survey (see Appendix 10), the sago-TULIP-coconut triad constitutes the main ingredient of meals for most people on most days.

The principal substitute for the starch component is banana, for the vegetable component garden greens, in particular AIBIKA (*Hibiscus manihot*). They are either eaten as second choice or added to the prototypical components. Further variety comes through adding other vegetable foodstuffs from garden and forest (see Table 24 on p.283 and respective columns in Appendix 15), with pumpkin (*Cucurbita maxima*)—both leaves and fruit—the most prominent.[309] Commercial foodstuffs come third in terms of frequency, but are the most preferred and eaten whenever cash is available, by many people from one to several times weekly. For those with a regular income, they have even displaced the prototypical triad. In this respect, rice acts as a direct replacement for sago and is typically combined with tinned meat or fish, while instant noodles may serve as a condiment at any time.[310] Most people also eat beetle larvae, especially of the sago weevil (cf. sections 3.2. and 3.6. [pp.34,91]), at least once per week, and game at least once every other week. Usually, both are consumed more often than that, besides being supplemented with further animal foods, in particular megapode eggs[311] (see also pp.269f.). Traditionally, animal foods derive exclusively from hunting or collecting; the keeping of livestock is a recent innovation, limited principally to chickens, and only rarely contributes meat to the diet.

Grubs, game and megapode eggs as concentrated sources of animal protein and fat also ranked as prestige foods in the past, providing the currency for which pottery was traded (cf. p.228), and the characteristic ingredient of meals at betrothals and at public wedding feasts, abandoned together with the men's ceremonial house (cf. p.227). Their significance is reflected in material culture, as they provide the main template for decorative objects and a typical inspiration for designs on use objects, with motifs representing for example the pig's heart (ABOU), ribcage (APESI) or ear (ATARO); or various grubs and their cocoons (U'APIOU, UKIA, UROU).

The value of game more specifically is reflected in the enthusiastic welcome, with drumming and dancing, which the return of successful hunters would stimulate in the past, and in the persisting magical practices associated with hunting. Thus, a hunter will seek success through charms in the form of special motifs engraved on his arrows and, in the past, penis gourd; through spells which imbue his arrows with the power of predator teeth—redundant, though, with the superior penetrating force of modern metal points and shotgun bullets; through medicine fed to his dogs, such as sandalwood (BUSUI—*Santalum* sp.) bark or ginger (SIBEI—?*Zingiber* sp.) root, mixed with the blood of the game animal to be pursued;[312] through invocations to certain ancestors/ ancestresses; and through the observance of food taboos banning items considered to sap speed and strength. Besides, clan elders may apply spells to close off their clan's forest, so that intending hunters will remain unsuccessful. The power and significance of these spells is regarded as far greater than that of analogous ones which individuals cast over distinct plant resources or garden boundaries to discourage intruders.[313]

The game animal par excellence is the pig (A), which taxonomically subsumes at once all other game animals and denotes meat at large (Klappa 1999b:117). Evelyn Cheesman observed a special 'kill-song' only performed upon the death of a pig (1941:183) and described Krisa people as "pig-people" emphasising the pig hunt and engaging in a pig cult (1958:256f.). Indeed, the pig figures prominently in Krisa myth and ritual. Thus, the two original clans share a story of Creation in which the world and human beings emerge from the segments of a mythical pig-man, APO, cut up by the creator being (Kocher Schmid 1996). The men's cult revolved around the worship of APO's spirit (TAMBARAN), resident in the men's spirit/ ceremonial house (PALI, HAUS TAMBARAN). The spirit's division in four was manifested in four ceremonial

brotherhoods which formed corresponding hunting teams cutting across clans. By presenting a pig's head to an as yet uninitiated boy's father, a man would designate that boy as a future team member with whom he would share any kill. The profusion of pig's skulls in the men's ceremonial house, cleared out among other ritual paraphernalia in the mid-1970s (cf. p.227) may have represented this practice.[314] The clearout at once terminated the performance of the principal ritual, ADI, considered to date from the time of Creation and to underlie all other rituals. It used to be held about once a year over a period of several days, with the men intoning chants under the cheers of the women, at first publicly, then in the men's ceremonial house, to replenish pig, all other game, and indeed environmental resources at large, and to thereby rejuvenate the land and perpetuate life.[315]

After the demise of the all-encompassing ADI ritual, reliant on community participation and a functional men's ceremonial house and aimed at the perpetuation of life in general and game or indeed pig (A) in particular, a minor, if related ritual remains, PUDI. It is suitable for performance by individual elders in their own homes and aimed at perpetuation of the forest (PU) and its non-game and vegetal resources, in particular the TULIP tree. The principal targets of both fertility rituals, game and TULIP, rank at once as the ancestral Krisa foodstuffs and identity markers par excellence. Although the legendary sequence of starch sources, too, refers to ancestral foodstuffs, and the current staple sago figures as an identity marker, none of them receives any ritual attention, while precisely their legendary succession testifies to their transience. This may indicate that they successively slotted into a system defined principally by game and TULIP and the practices, including ritual, which reproduced it—a proposition to which I will return at the end of section 5.3.

The most recent complement in this system, of sago, TULIP and game, may in turn be more fundamental culturally than the current dietary core triad of sago–TULIP–coconut (cf. p.237). This is also suggested by an apparent intensification of coconut cultivation during the last half century, stimulated perhaps by Krisa participation in the 1950s Vanimo copra project (PR 55-56/4; DOR 57-58/3rd, 58-59/3rd). Thus, coconut palms seem the principal vegetational marker testifying to the Krisa coastal migration (cf. p.217), whereas traditional forest camps are typically surrounded by an array of cultivated perennials. Also, declining prevalence of coconut with distance from Vanimo (ASWP 3: 1506,1511,1504—cf. Table 1) suggests in part a declining influence of modernisation, with present diets south of the Bewani mountains likely approximating Krisa diet several decades back.

Then even more than now, therefore, diets in the Vanimo hinterland featured resources associated by outsiders both with the extraction of 'wild' resources, an itinerant lifestyle, and correspondingly poor nutrition, as witness the Catholic Sister's quote which introduced chapter 2, and the excerpts from patrol reports reproduced in section 2.2. (pp.19f.; cf. also section 3.2., esp.n.29). Informed apparently by their own agricultural background, the nutritional recommendations of the day, and their personal appreciation of local foodstuffs, these self-appointed dietary arbiters imagined that local health problems were directly connected to local land use and lifestyle. Historical documents and comparative evidence suggest, however, an inverse scenario: that any malnutrition rather was—and with regard to the respectively persisting factors continues to be—a secondary function of poor immunity upon wartime distress and deprivation; contact with alien diseases; high parasite load; lack of health care; residential concentration and sedentisation; and possibly inequitable access to resources within the community.[316] Conversely, correlating the survey results regarding meal compositions in Krisa (cf. pp.237f.) with the nutrient levels of

the foodstuffs involved (cf. pp.33ff.,40f.,58f.,90f.) suggests local diets as well-balanced, rich in both calories (sago), and fat and protein (game, grubs, eggs, TULIP), and replete with the spectrum of minor and micro-nutrients that comes with a large variety of vegetal foodstuffs, in particular leafy greens. Oblivious to these considerations, though, patrol officers and missionaries have been zealously instructing locals to enlarge and maintain their gardens; adopt livestock and fruit plants; enhance the variety of their vegetable crops; and supplement sago with root crops.

As a result of their persistent indoctrination, gardening has indeed intensified in the region and some livestock farming been taken up (see section 5.3.). At once local diets have shifted, the recollections of old people indicating a vanished variety of foodstuffs obtained from the forest in the past. Prestige foods have changed alongside, with tins, chicken and white bread now favourite feast ingredients. The greatest force in this change, though, has been less the immediate pressure applied by outsiders than its local transformation. Agriculture and its produce, intended as a profane means of advancing local livelihoods and generating income, have in local conceptions become the metaphysical prerequisites for a modern lifestyle and financial wealth (see Klappa 1999b, Kocher Schmid & Klappa 1999). Thus, the new syncretic faith (cf. p.227) envisages a combination of intensive gardening, consumption of garden foods and domestic animals, and Catholic worship to precipitate an era of bliss and affluence, as perceived with the lives of outsiders. As this renders the ADI ritual and its fruits at once evil and obsolete, followers of the new faith abstain to various degrees from eating game and other forest foods, with a taboo on pork—the principal game meat—the prime marker of their religious convictions (Klappa 1999b). In contrast, their opponents, in particular members of non-Catholic denominations, emphasise precisely these foodstuffs and the associated lifestyle, partly as a means of distancing themselves, partly out of the conviction that their future lies in tradition.

If religion has therefore variously served to promote or obstruct agricultural progress as envisaged by outsiders, it has played only one part in an unremitting trend towards horticultural intensification. More generally, the agent has been the cultural pressure exerted with increasing penetration of the Vanimo hinterland by agriculturally-minded foreigners. It meant at once the pressure of their form of land use on the local population, akin to the pressure apparently exerted by sago economies on the autochthonous population on the Krisa plateau in the 18th century (cf. pp.230,237).

Beyond Food: The Scope of Resource Use

With their emphasis on garden crops as foodstuffs, the agriculturally-minded foreigners missed not only that nutritious food may originate from beyond gardens, but furthermore that livelihoods involve requirements beyond food (cf. section 4.7.). These, in turn, highlight even more the importance in Krisa of environments beyond the cropped plot, as almost every non-food need is met by resources other than garden annuals, most of them vegetal.

Many of these resources double as sources of foodstuffs; more generally, resources typically have multiples uses, with different plant parts, different vegetative stages, or different stages of processing exhibiting different utility (cf. pp.57,77, Table 3). Conversely, only employment of multiple resources typically enables

processing of a further resource or the manufacture of composite objects. Even the examination of single resources, procedures or objects can therefore quickly establish a sense of the complexity and scope of local resource use. Additionally, many applications permit interchangeable use of several resources, although there is often a gradation in suitability, while some resources are exclusive to certain uses. These correlations demonstrate both the importance of subtle differences in the resources' properties, and of their reflection in resource users' awareness (a sector of 'local environmental knowledge', cf. p.227). On the other hand, suitability does not dictate application, which is also tempered by resource abundance and cultural preferences. In particular, a trend towards modernisation has rendered numerous resources superfluous and several uses obsolete altogether, as synthetic materials and commercial goods have become adopted and lifestyles are changing.

Several case studies and synopses illustrate these aspects below, with most of the supporting data presented in overview in Appendix 15 and quantified in Appendix 16. In the interest of clarity, I will here refer to resources only with their common English/ Tok Pisin name and/ or vernacular name (e.g. "BOXORU"), besides indicating their life-form (here: "rattan"), but will cross-reference them with the numbers (here: 19) assigned to them in these Appendices, where they are further described and/ or identified.

A suitable point of departure for investigating the field is the processing and preparation of sago (cf. section 3.6.), since this involves not only the sago palm (SU, 1), itself one of the most versatile resources, but also represents a complex procedure involving numerous additional resources:

Case Study 2: Krisa Resource Use—Processing and Use of Sago Palm

The processing of sago is reliant on substantial equipment, which is partly sourced from the sago palm itself, partly from other plants. Axes to fell the palm and open the bole are nowadays commercial. Choppers (PAPU), though, continue to be locally made. Their basic design is of a pounding shaft lashed at an acute angle to a long handle, producing a hammer which is used exclusively for the processing of sago (cf. Appendix 7, Plate 5). The handle is from the stem of any suitably sized softwood tree, such as SUWE (92); the lashing of the split and polished stem of a strong rattan such as BOXORU (19).

The shaft takes one of three forms (cf. Plate 4). The first is flimsy but quickly made from readily available materials. A slender section of culm from the bamboo YAXAU (43) is cut so that one end remains with a node, its sharp, protruding rim forming the circular pounding blade, while the culm's hollow interior is from the other, open end filled with the fresh spongy inside of a sago rachis, to give the shaft weight and thereby the chopper momentum. A more durable and effective version of the shaft is from the strong lower stem of the rattan BOXORU (19), again a node forming the head. The best version, and therefore recycled in consecutive generations of choppers, is from hardwood trees such as YOPNO (76), armed with a circular piece of scrap metal for a blade. The metal ring may derive from sources as diverse as car exhaust pipes, bicycle frames, bed posts, or water pipes, the common use of the latter reflected in the Tok Pisin word PAIV ("pipe") for the hammer itself. In the past, the blade would be a concave stone head, analogous to the bamboo node, set in a wooden mounting.

The apparatus for washing the flaked pith is purpose-built on the spot and discarded after use, but incorporates valuable elements which are reclaimed (cf. Plate 6). In particular, these are the filter, a small plank to fit it, and a set of two pegs to secure it. The filter is nowadays often commercial fabric but traditionally the leaf sheath of either the coconut palm (SONG, 2) or the rattan WOUBRO (25), the former with fine, the latter with more open mesh. The small plank (SÖDI), about 20 x 5 x 0.5 cm^3, is made from sago cortex and used to drive

the filter into a furrow in the gutter, thereby stretching it across the gutter's width. The pegs, which hold the filter in place by fastening it to the gutter's rim, are made from branches of the tree AXAUTANO (75). Since this supplies the only durable material for this purpose, its wood allowing partial splitting without chopping, it at once lends its name to the object.

The gutter itself is the upper, grooved part of the sago leaf sheath, placed horizontally on a stand of crossed sticks, while the two sequentially arranged settling tubs are LIMBUM (ASI, 4) leaf sheaths, fenced in by frames of sticks in turn. The bucket element (SENAI), too, is made from LIMBUM leaf sheath, sewn into shape with the split and polished stem of a soft rattan, preferably WAIAU (24).

The recovered starch is nowadays collected in empty rice bags, but would in the past be wrapped in bark cloth, made from the inner bark of either breadfruit tree (DEI/ NUPO, 55/ 56), or the trees TIA (63) or PUDUBEU (64). Transport of the product back home is with the help of a carrying bag (WASA), made like the bucket from LIMBUM leaf sheath sewn with rattan thread, and fitted with a sling (WILISI). The sling is typically a strip of the entire unprocessed bark of the abundant small tree YAXALU (86) or its relative TEBLEI (87); more durable and attractive versions employ strips of robust bark cloth, made from the inner bark of TULIP (WISIA, 51) or TIA (63).

Cooking, serving and eating the starch require further equipment. The wet starch is crumbled into a basin (KOLOU), today typically commercial ware which accordingly constitutes one of the prime trade items in Vanimo's supermarkets, but in the past made like the bucket from LIMBUM leaf sheath sewn with rattan thread. Boiling water is added to the starch and any impurities are strained out. Strainers are like the basin typically commercial today, or involve materials like a flywire mesh stretched over a wire frame. In the past, the mesh would be the same material as the filter in the sago washing apparatus, the frame from the split stem of BOXORU (19); both would be joined together with rattan thread, for example from WAIAU (24). The starchy mixture is then stirred until it congeals, with a utensil in form of a paddle. This may be made from sago cortex like the planks used for fixing the filter for processing and is then called similarly SÖDI, or from hardwood, such as KWILA (YOPNO, 76), AMO (79) or several others, then called DEPUL.

The hot paste is apportioned with a pair of sticks (MAMO, "sago servers"), which may derive either from palms with firm cortex, such as LIMBUM (ASI, 4), MESME (10), AOA (13) or KOLOU (14), with sections of the stem used as they are from small individuals, or sticks carved from the cortex of large individuals; or from species with dense wood, in particular exotics like guava (*Psidium guajava*) or coffee (*Coffea* sp.) (83). The portions of sago jelly are placed on leaves, and after cooling wrapped in them, where they will keep for up to two days (cf. Plate 7). Typically, leaves are from large monocotyledonous herbs such as ABUSI (32), BOGOSI (33), TUBAPLU (34) or WOUBEL (35), although large soft leaves from dicotyledonous trees such as WOMO (67), SE (68), SUU (69) or TUBOPO (70) are also used. (Leaves from rattans, palms and banana are rather used when baking sago in the ashes, possibly because they withstand heat better while being less pliable.)

For immediate consumption, the jelly would in the past be eaten with chopsticks (NOUPAS—cf. Appendix 7), which served also the eating of leafy greens. A few traditionalists continue to use them in Krisa, and they constitute an item of considerable cultural pride, although they have been largely replaced by commercial ware. Their prongs can be fashioned from any source suited similarly for bows and arrowtips, and are typically produced from offcuts obtained in the production of these. Ideal sources are palms with very hard cortex, such as ANASI (5), YIY (7), PAXAU (11), SISEI (12) and others, or the bamboo YAXAU (43). Tying of both prongs to produce a fixed set of chopsticks is with any material suited for delicate binding, such as thread from the rattans WOUBRO (25), WASLAM (26) or WUU (27), the vine PAIAKAU (128), or the climbing fern KUKA (129).

Apart from the starchy staple, the sago palm provides numerous further foodstuffs and materials, most in the context of processing itself. Thus, discarded leached pith offers a substrate for edible sago mushrooms, unprocessed stem a substrate for sago grubs. Cortex removed to access the pith can be used for various objects, including the planks required for fitting the filter and the paddle for stirring sago (see above); also for tools like coconut

scrapers, shovels and spades, which though have nowadays almost totally been replaced by commercial ware.

The fronds, which are conveniently harvested when a palm gets felled for processing starch, remain one of the most essential items for house construction. Most importantly, the leaflets (pinnae) provide the near sole material for thatch (WUSU), substituted only in cases where forest camps have been set up far from any sago patch. Fresh pinnae become pliable after removal of their midribs, and can then be folded over roof batons, which may derive from various sources, although the stilt roots of the pandan SUBOU (30) are the most preferred. The pinnae are kept in place by stitching them together with rattan thread, with strips from the stems of the monocotyledonous herb SULUP (37), or indeed with strips shaved off the surface of a dry sago rachis itself. The resulting thatched shingles are left to dry and then lashed with rattan thread onto the purlins. The rachides are commonly used as walling material, or, when assembled horizontally, shelving inside the house. Wall elements are framed with sections of the rattan BOXORU (19), which also serves as support for the eaves.

Besides house construction, the fronds provide for several minor uses. The discarded midribs from the pinnae make toy arrows for children. The dry rachides are used for burning sea shells to lime (one of the ingredients for chewing betel), formerly also for firing pottery. Threads shaved off their surface serve not only the sewing of thatch, but can also be woven into blinds. The spongy pith of the rachis serves fresh as a weight for sago choppers (see above); dried it can be cut into various shapes which are then assembled into toy objects, or it can be integrated into headdresses to serve as a pinning base, akin to styrofoam, on which feathered picks are mounted. In the past, the pith would be used similarly to mount sago pinnae and decorative leaves on a body-size frame, itself constructed from sago rachides and tree saplings, which would constitute the disguise of the mask dancer in healing ceremonies.

Leaf sheaths are less used today, except in the sago washing apparatus, but would in the past provide material for several further objects. The upper, narrower and more rigid portion would be cut to size and fitted with a handle across, making a bailer (SINEI) for the traditional method of fishing: damming a stream in two positions; draining out the water; and collecting fish and crayfish by hand. The lower, wider and more supple portion would be flattened and used as a mat, or as a base for painted motifs, classically adorning the inside of the men's ceremonial house. Furthermore, it can be rolled into a cylindrical shape, stiffened with a rattan frame and fitted at the one opening with a grid (some hardwood sticks or bamboo splinters), and at the other with a handle (some rattan thread), and hung above the fire, to serve as a smoking rack (TINI) for game meat: "grandfather's cupboard" (TUMBUNA KABOD), as Krisa people call it jokingly.* Although some households still use this device today, others employ a hammock of wire mesh above the fire.

Finally, a few uses of the sago palm must be met outside of processing. The young shoot is a delicious vegetable commonly added to meals. The seeds make attractive beads in strung necklaces; they are typically obtained from the Pual basin since sago rarely flowers on Krisa territory. Juvenile fronds, harvested from the life plant, stripped of midribs and exterior of the leaves, and knotted onto a string, most typically from the inner bark of TULIP (WISIA, 51), used to be the sole material for women's fibre skirts (SAI—cf. p.208, n.273).

* Leonhard Schultze-Jena (1914:37, 38-fig.8) describes precisely this form of smoking device for the northern Bewani mountains.

The cursory review in Case Study 2 alone documents 4 food uses of the sago palm and about 20 non-food uses, plus over 10 further material culture uses, variously fulfilled by another 40+ plant resources. It also indicates that some of these plants are more heavily utilized than others, both in terms of life form classes and individual kinds. Prominent in this respect are the palms, in particular the LIMBUM/ ASI (4); the rattans, in particular BOXORU (19); the bamboos, in particular YAXAU (43), and trees used for fibre and hardwood.

Notably, LIMBUM/ ASI, BOXORU and YAXAU as the most outstanding representatives of their respective class subsume taxonomically at once all its other members (see Table 18 [p.249], Table 20 [p.253], Table 22 [p.257]. Krisa palm taxonomy (Table 18) is reminiscent of Krisa yam taxonomy (cf. Table 16 [p.234]), with the cultivates sago (SU, 1), coconut (SONG, 2), betelnut (PU, 3) and LIMBUM (ASI, 4) remaining unclassified, while the latter subsumes in turn all noncultivates, designated in Tok Pisin as 'wild' LIMBUM. These include both arecoid and non-arecoid palms, the decisive parameter being the soft tissue inside their stem rather than any resemblance between their crown anatomy and that of the true LIMBUM, ASI (cf n.17). This means at once inclusion of palms recognised as 'wild' analogues of other cultivates, with the sole exception of 'wild' sago (SUBU, 18; cf. Table 14 [p.231]). Krisa rattan taxonomy (Table 20), lacking a cultivate to group all noncultivates, employs the most versatile member, BOXORU (19) for this purpose. No life-form term corresponding to the Tok Pisin term KANDA ("rattan") exists, although a more encompassing life-form term, BEI ("climber") groups both rattans and vines. Krisa bamboo taxonomy (Table 22) follows the same pattern, as the most versatile member, YAXAU (43), denotes at once all others, without a life-form term corresponding to the Tok Pisin term MAMBU ("bamboo"). The sole cultivate, the giant bamboo TONI (45) remains undistinguished as such.[317]

The uses of palms, rattans and bamboos are numerous and essential for Krisa subsistence (see Table 19 [p.250], Table 21 [p.254], Table 23 [p.258]). Compared to dicotyledonous trees, these three classes fulfil not only a greater variety, volume, and value of uses in absolute terms (cf. Appendix 16), but also provide more resources in relative terms: 57 % of recorded bamboos, 77 % of recorded rattans, and 90 % of recorded palms are sufficiently important as specific resources to warrant inclusion in the appended synopsis, while the same applies to only 39 % of recorded trees (cf. Appendix 15). Furthermore, any uses of trees besides leafy greens, fibre, firewood, heavy construction and medicine can also be fulfilled by members of the three most prominent classes. Resources in the remaining classes of life-forms may be similarly substituted, even though in relative terms their numbers are substantial.

The abundance of uses with palms may, then, explain an apparent anomaly of Krisa subsistence history: that sago seems to be comparatively recent as a staple (cf. pp.230ff.), while sago palm is unquestionably the most versatile and important resource overall, suggesting long-established use patterns. In principle, though, these patterns are shared with other palms. The sole aspect which truly distinguishes the sago palm is its intrinsically superior starch production. Precisely the rising significance of this aspect for Krisa subsistence may therefore have engendered the rising prominence of the palm at large. Both the extensive food use of the sago palm and its extensive non-food use may have been equally boosted by the apparent intensification of sago palm management from the middle of the 18th century (cf. pp.230,237). Concomitantly, previously more extensive use of other palms may have declined, their past importance preserved today in their residual utility for people during stays in the forest (cf. Table 19-n.‡). The circumstance that dispersal to the forest was similarly more extensive in the past (cf. pp.220f., n.221) makes the hypothetical shift of resource use the more plausible.

In fact, this shift may have entailed increased reliance not only on the sago palm, but on the four palm cultivates more generally (cf. Table 18, Table 19). After all, the principal uses of both the LIMBUM palm (ASI, 4) and the betel palm (PU, 3), namely floorboards and containers for the former, and narcotic for the latter, may also be fulfilled by their analogues among the noncultivates. Similarly, the principal uses

of the coconut palm (SONG, 2), namely dietary fat and liquid snack, may be fulfilled respectively by other nut-bearing plants, insect larvae and game, and by water-filled climbers (esp. BOXORU, 19 and AXANI, 119). Indeed, with the coconut palm, intensification apparently took place only in historical times (cf. p.239), providing further evidence of a progressive shift towards palm cultivation.

What seems to have remained constant is a fundamental reliance on tree palms, their climbing relatives, and on bamboos and other members of the grass family. Two essential domains of Krisa material culture where these come into their own are the manufacture of containers and of arrows, described in Case Study 3 and Case Study 4 and illustrated with Plates 8 and 9. The one documents at once the extensive utility of a basically uniform object in different contexts, the other the technological interconnectedness of resources with composite objects as well as their replacement with modern materials.

Case Study 3: Krisa Resource Use—Manufacture of Containers

The large, pliable and waterproof leaf sheaths of the LIMBUM palm (ASI, 4) constitute the essential material for containers of all kinds and purposes in Krisa. These range from dishes/ bowls/ basins (KOLOU) for preparing and serving food; through water buckets (SENAI) for processing sago (cf. Case Study 2); to carrying bags (WASA), in Tok Pisin called LIMBUM like their vegetal source.

Food containers have largely been replaced with commercial ware and continue to be made and used mainly during stays in the forest. In this context, also sheaths of other palms may be employed, a similarity of names between the container and the palm KOLOU (14) possibly indicating the preferred source.* Buckets are still a typical element in processing sago, although aluminium cooking pots may nowadays also serve the purpose. The carrying bag, though, remains the possibly single most essential item of material culture in Krisa. Women carrying LIMBUM bags on their backs, filled with firewood, foodstuffs or domestic items, the straps slung around their foreheads, are a universal sight. Hence, "carrying the bag" (KARIM LIMBUM) ranks as one of the epitomal female occupations.†

The basic shape for any LIMBUM container is the oblong tub, made by cutting the sheath to a rectangular shape, folding it lengthwise in three, overlapping the ends on both sides, and sewing them together. For this, holes are first punched with a bone awl (derived from various bones of the cassowary leg), through which then a rattan thread is passed. To prepare rattan thread, all leaves and leaf sheaths with their spines need to be removed; the stem split lengthwise into two or more sections, depending on size; and the soft pith shaved away so that just the woody but flexible cortex remains. The most suitable rattan for sewing is WAIAU (24), since it is soft and supple, but in its absence other rattans may be used, as may thread shaved off the rachis of the WELE palm (17) or the stem of the SULUP plant (37).

The orientation of the sheath depends on the purpose of the tub: the upper, glossy, yellowish side becomes the outside of food containers, but the inside of all others. For making buckets, a handle from rattan thread is added across the length of the tub, which at once draws the two distant, stout, sides in, so that the two soft sides form spouts. For all other containers, the shape remains, and just the size varies; carrying bags get additionally fitted with a strap (cf. Case Study 2).

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* Although this conclusion seems obvious, I have no explicit records in this respect. Furthermore, I have often been deceived by the apparent similarity of terms, due to my difficulties with picking up the subtle tonal differences of the Krisa vernacular.

† One may therefore say that Krisa society is "LIMBUM dependent", analogous to the description of highland societies as "netbag dependent" (O'Hanlon 1993:69, quoting MacKenzie [1991:2]‡). Although the uses of LIMBUM bags and netbags are not totally analogous but overlap only in respect to their purpose as carrying aids for heavy loads, the former also serving as waterproof containers, the latter as baby cradles, small carriers, portable caches, adornment, or gifts (op.cit.:69f.), the dependency on either item and its role as cultural marker seem similar for both. It is notable that netbags assume a minimal importance in contemporary Krisa subsistence, although they are

significant in myth.

‡ MacKenzie, M. A. 1991. *Androgynous Objects: String Bags and Gender in Central New Guinea*. Chur: Harwood Academic Publishers.

Case Study 4: Krisa Resource Use—Manufacture of Arrows

There are basically three parts to an arrow: the shaft; the head; and the connection between both. The prototypical material for the shaft is the culm of a reed grass, BOU (47), which like its Tok Pisin name, TIKTIK, doubles accordingly as name for the object. Alternatively, a thin, hard culm of the bamboo WANI (44) or stem of the palm MESME (10) may be used.

Arrow heads take two forms. The one is the point, single or multiple, needle-shaped and facultatively fitted with barbs. It is used for small game, that is marsupials and birds. The other form is the blade, lance-shaped and usually with an unbroken edge. It is used for large game, that is pigs and cassowaries, and formerly for human enemies in war. The traditional sources of the respective material are similar as for chopsticks (cf. Case Study 2): palms with very hard cortex, the most preferred being PAXAU (11), and the bamboo YAKAU (43). Palm cortex used to supply the material for points, occasionally for blades, and for an additional support piece in case of a bamboo blade. Bamboo used to be the typical material for blades, and occasionally for multiple points. Bamboo blades require that the tip of the blade coincides with the node of the culm, to give the point stability and penetrative force. They would be worked with a knife from the harder bamboo WANI (44) before the availability of metal knives.

Once the head has been inserted in the shaft, this needs to be bound tight around it. The best binding material comes from the vine PAIAXAU (128), its suitability indicated terminologically, as PAI is the term for arrow. There are, however, some alternative materials suitable for at once delicate and durable binding, namely thread from the rattan WUU (27), from the rachis of the palm WELE (17), or from the stem of the climbing fern KUKA (129). The binding then needs to be fixed with glue—the heated sap of the breadfruit tree (DEI/ NUPO, 55/ 56). This, in turn, is covered with ashes, and potentially with a second layer of binding, to prevent it from sticking. Finally, the shaft is cut to length, and its nodes are shaved off to prevent it from catching.

If arrowshafts remain of vegetal material in Krisa today, most other parts have become replaced by modern materials to various extents. Glue may be store-bought, although breadfruit sap is attributed superior qualities. Binding may be commercial string, or strips of rubber obtained typically from old inner tubes of car tyres. Rubber at once removes the need for glue.

Most importantly, arrowheads are near exclusively from scrap metal now, which is forged into shape locally. A typical source for single and multiple points are the suitably sized grid wires used in town to fence off verandas and windows or to reinforce concrete. A typical source for blades are culvert steel or the S-hooks used to clamp the bases of logs. Apparently, many S-hooks were lost during logging operations and have led to an inflation of metal blades since. More generally, the expansion of town and infrastructure has increased the availability of scrap metal and thereby rendered metal heads standard. Still, the relative scarcity of the material, the effort involved in forging it, and its superior quality makes such heads objects of desire. Thus, I was warned not to leave the respective arrows—part of the artefact collection—outside on my veranda overnight as they could easily be stolen, while the same was considered unproblematic for traditional arrows.

Case studies 3 and 4 demonstrate also the detailed technical expertise required for the effective use of resources, and the next two examples shall highlight this aspect further. Case Study 5 illustrates the one end of the spectrum, by comparing

properties among similar resources; Case Study 6 the other end, by describing several paradigmatic resources and the terminological reflection of their suitability.

Case Study 5: Krisa Resource Use—Differential Suitability of Resources

Often, several biologically related resources are suited to the same purpose, though to various degrees, due to subtle differences in their properties. Some of the prototypical uses for rattans and hardwoods provide a few examples of many.

Thus, all rattans can principally supply thread or string, its production described in Case Study 3. The particular qualities of such string, though, vary, and therefore the respective applications for which each is most appropriate (cf. also Table 21). For example, string from the prototypical rattan, BOXORU (19), is at once strong and flexible, which makes it useful for both robust and delicate tying as well as for making fire with the traditional fire saw, in which the material is swiftly pulled back and forth beneath a piece of softwood until this begins to smoulder. The same string is neither tough enough, though, to serve equally well as bowstring, nor soft enough to serve as sewing material for LIMBUM containers (cf. Case Study 3). Rather, these two purposes are ideally fulfilled, respectively, by YEYKI (21) and WAIAU (24). Either purpose, though, may also employ several other rattans, as may the purpose of tying.

There are two particular instances of tying, though, which require again particular rattans. Interlace work, such as armbands and decoration on bows, is best performed with thread from WOUBRO (25), WASLAM (26), or WUU (27), with the second the most preferred, since on top of its technical qualities it has an attractive shiny surface. WUU (27) is additionally suited to tie arrowshafts to their heads, possibly the sole rattan used that way, since the purpose requires a thread which is at once strong, very flexible and slightly elastic and can be sliced extremely thin.

That use follows not only a resource's qualities but also its abundance and cultural preferences is demonstrated by the case of WASAM (N/A). It carries a Krisa vernacular name and occurs on Krisa territory, but seems to be rare and presumably therefore is hardly used, whereas in Imonda, south of the Bewani mountains, it is employed extensively, including for tying, basketweaving and bowstrings, as reported by an in-married man native to this area and demonstrated by the objects he produced for the artefact collection.

Similar gradations as with rattans obtain with hardwoods. Applications which require such material are in particular combs and other delicate objects, tool handles, and house posts. The first requires dense wood which can be carved into fine shapes without fracturing, a quality found most perfectly with PUDUTOMO (77), but also with some other trees, in particular KWILA (YOPNO, 76), AMO (79), and the exotic species guava and coffee (83). PUDUTOMO (77), together with SIL (78), is also ideally suited for axe handles, since its toughness can withstand the perpendicular forces occurring in use. Furthermore, it provides substitute material for house posts. The supreme source for house posts, though, is KWILA (YOPNO, 76), since its wood is at once hard, heavy, and rot resistant, its lack of toughness irrelevant in this context. Again, though, these qualities do not dictate use, as demonstrated by Krisa's Mbo-speaking neighbours, whose taboo on KWILA used to ban it for profane use, reserving it for use in men's ceremonial houses and ceremonial objects upon the appropriate rituals (Kocher Schmid 2004—cf. Table 8).

Case Study 6: Krisa Resource Use—Paradigmatic Resources

In several cases, the paradigmatic resource for a purpose is indicated lexically, through metonymy. Thus, the name for flute doubles as that for the bamboo used, WANI (44); that for pegs as that for the sole tree supplying suitable material, AXAUTANO (75)* (cf. Case Study 2); that for house post as that for its principal source, the KWILA tree (YOPNO, 76)† (cf. Case Study 5); that for arrowshaft as that for its principal source, the reed grass BOU (47) (cf. Case

Study 4); that for bow as that for the most preferred palm, YIY (7); that for bowstring as that for the most preferred rattan, YEYKI (21) (cf. Case Study 5). Superb suitability for combs (TOMO) is implied in the name of their principal source, the tree PUDUTOMO (77) (cf. Case Study 5); for tying arrowshafts to arrowheads (PAI) in their principal source, the vine PAIAXAU (128) (cf. Case Study 4). String for making netbags (PA) is supplied among others by the inner bark (SI: "skin") of the tree PASI (89)[‡].

[*] In fact, Donohue & San Roque (2004:113) list the term, spelt AKAU TANA, only as that for the object, although it is also listed under trees, spelt AKAUTANU, in the supplementary list produced by a community member (op.cit.:116).

[†] Analogous to n.*, Donohue & San Roque (2004:112) list the term YOMUNÓ, YOKONÒ solely as denoting "pile, stilt". The spelling is surprising, though, since among my many references to the term there is no single one with a 'K'.

[‡] This explicit reference to net bags and the material from which they are made suggests that contrary to current appearances net bags may have been more common at some time in the past, a suggestion supported further by their mythical significance (cf. Case Study 3-n.†).

As illustrated by several case studies and obvious from Appendix 15, uses often cluster with certain classes of life-forms, such as bows, arrowtips and chopsticks with palms; thread/ string with rattans; food wrappers with monocotyledonous herbs; heavy construction with trees. Yet, uses can also reach across classes. For example, not only hardwoods may supply material for tool handles and combs, but respectively also the palm ANASI (5) and the giant bamboo TONI (45); not only rattans may supply material for delicate tying, but also a vine, a palm, or a climbing fern; not only monocotyledons may supply food wrappers, but also dicotyledonous trees. Food uses, finally, span all classes of life-forms.

A rich and varied catalogue of resources and the associated expertise therefore ensures both abundance and nuance in the fulfilment of needs, which though diminish with the adoption of synthetic materials and commercial ware (cf. Appendix 15, nos.137-143; also p.228, n.273). Ready-made goods have a particularly simplifying effect, as they eliminate at once entire objects and manufacturing/ processing procedures, and thereby the respective multiple involvement of resources. Modernisation results therefore in a disproportionate decline of traditional resource use, which the attendant loss of expertise cements. Formal schooling reinforces this trend by physically preventing children from acquiring such expertise; instilling a notion of its inferiority vis-à-vis formal knowledge (cf. p.227); and eroding the vernacular (cf. n.295). The first victims of language loss are invariably local terms for resources and the corresponding awareness of their natural history and technical properties. The increasingly common absence of community members for prolonged periods due to academic or professional reasons accelerates this process. Thus, high-school and college graduates and children of policemen who respectively have boarded or grown up outside the community regularly profess considerable ignorance of the respective subjects. More generally, people assert that the scope of individuals' expertise has declined during the last generations. As the catalogue of resources shrinks, though, at once dependence on their modern substitutes increases, and thereby on the financial means to acquire them. A self-amplifying process of simplification is therefore leading Krisa subsistence economy towards that ultimate uniform resource, money.

Table 18: Krisa Taxonomy of Tree Palms

cultivates

1* SU (SAKSAK, sago) *Metroxylon sagu*

2 SONG (KOKONAS, coconut) *Cocos nucifera*

3 PU (BUAI, betel) *Areca catechu*

4 ASI (LIMBUM) ?*Gulubia costata*†

noncultivates

'wild' LIMBUM (WAIL LIMBUM)†

5 ANASI *Caryota rumphiana* var. *papuana*

6 KISSI

7 YIY

8 PASSAPO

9 PASSA

10 MESME

11 PAXAU (WAIL BUAI)

12 SISEI ("ANASI minor")

13 AOA (WAIL KOKONAS), 2 kinds

14 KOLOU

15 SABLEI

16 TEBE (WAIL BUAI)

17 WELE (WAIL BENSIN)

N/A PUEN

N/A WAXALU

'wild' sago (WAIL SAKSAK)

18 SUBU

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* Reference numbers tally with those provided in Appendix 15.

† For the locally variable designation and corresponding management of LIMBUM, cf. n.17.

Table 19: Krisa Use of Tree Palms

ref.no.*	description†	use‡
1	SU	(cf. p.85, Table 3, Appendix 15 and Case Study 2)
2	SONG	fruit: food, drink fruit shell: scoop, dish fruit husk: fire preserver shoot: food leaf sheath: strainer mesh midrib of pinna: skewer, broom fibre stem: body for hand drum
3	PU	fruit: narcotic cortex: roof batons
4	ASI	cortex: floorboards, planks sheath: containers, mats infructescence: broom
5	ANASI • fishtail palm • cortex very hard, black (→ "black palm" [e.g. Mihalic 1971:122]) • fruit cherry- to walnut size, red	stem: incubating grubs cortex: arrowtips, spears, clubs, tools, tool handles fruit: beads
6	KISSI • fruit onion size	cortex: {floorboards}, tools

* Reference numbers tally with those provided in Appendix 15.

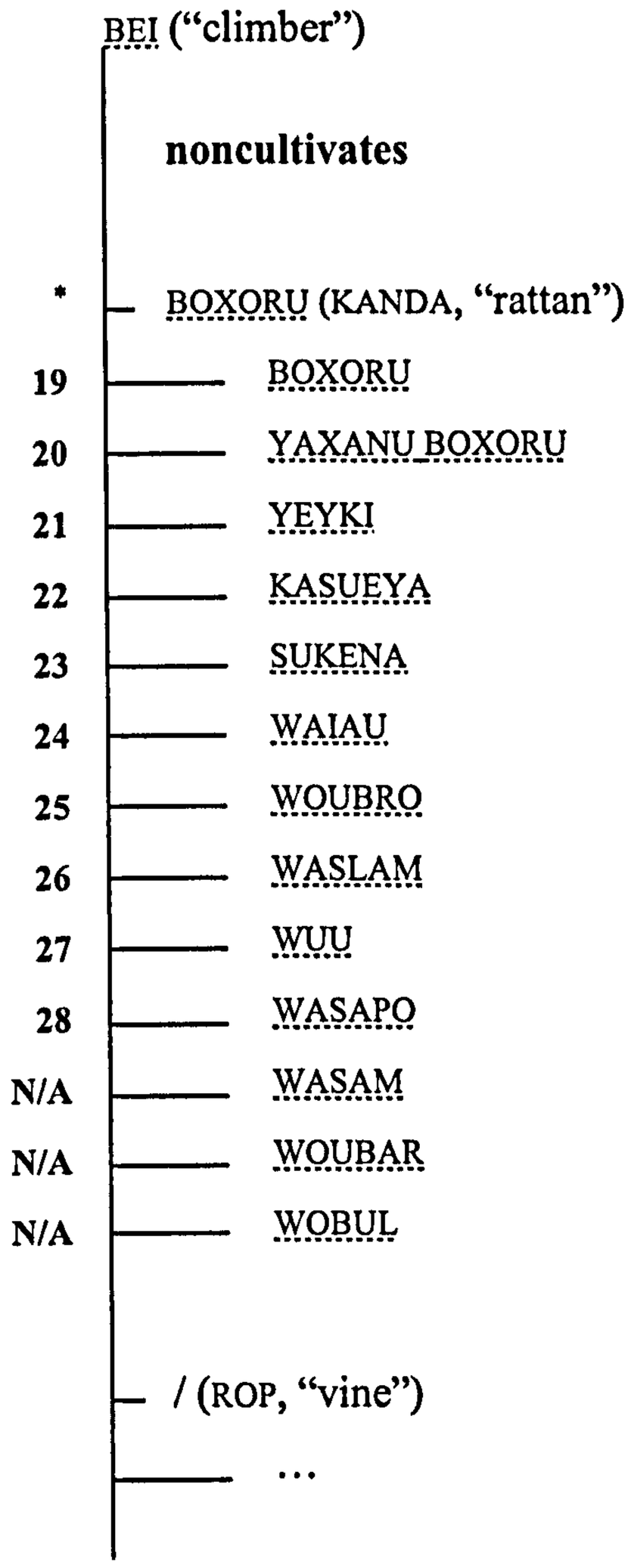
† Descriptions are variously based on specimens, own observation and local information.

‡ Uses include only the more common ones and inventories are likely incomplete. They have been compiled from use samples and generic local information. Curly brackets indicate use with stays in the forest. Highlighting indicates most typical or preferred resource for the respective use.

7	YIY ("bow") (→ LIMBUM BANARA) • large arecoid palm cortex: bows, arrowtips, chopsticks
8	PASSAPO • large fan-leaved palm • fruit hazelnut size cortex: bows, arrowtips, chopsticks
9	PASSA cortex (large): bows, chopsticks leaves: {thatch}, tying tobacco together
10	MESME • fan-leaved palm cortex (large): bows, chopsticks stem (small): arrowshafts, sago servers
11	PAXAU • taste and stain of fruit like betel, but no narcotic effect (→ WAIL BUAI) • fruit barley grain size, red • juvenile leaves red cortex: arrowtips, chopsticks, roof batons
12	SISEI cortex: arrowtips, chopsticks, forks
13	AOA cortex: arrowtips, chopsticks, sago servers leaves: food wrappers
14	KOLOU • fruit barley grain size shoot: food cortex: {floorboards}, sago servers fronds: {roofing}, hides sheath: {small containers?}
15	SABLEI shoot: food cortex: {floorboards} fronds: {roofing}

16	TEBE • fruit with narcotic effect like betel (→ WAIL BUAI) fruit: narcotic shoot: food cortex: {floorboards}
17	WELE/ ~ SOXOU ("shoot") • leaves hairy hence flammable (→ WAIL BENSIN) shoot: food midrib of pinna: broom fibre skin of frond petiole: sewing material for containers
N/A	PUEN [no use recorded]
N/A	WAXALU [no use recorded]
18	SUBU stem: incubating grubs

Table 20: Krisa Taxonomy of Rattans



* Reference numbers tally with those provided in Appendix 15.

Table 21: Krisa Use of Rattans

ref.no.*	description†	use‡
19	BOXORU • large rattan • large leaves, large spines • similar rattans: YAXANU BOXORU: smaller leaves, similar whips WAIAU: smaller spines	stem in-situ: – contains copious amounts of water – host for edible moth larva whole stem: – durable pounding head for sago pounder – roof & wall frames split & polished stem: – frames for headdresses and other objects – string in fire making equipment – {sewing material for containers} – delicate and robust tying and lashing heart: – food fruit: – snack leaves: – food wrappers
20	YAXANU BOXORU ("hornbill BOXORU") • small rattan • similar rattans: BOXORU: larger leaves, similar whips	split & polished stem: – bowstring – sewing material for containers and thatch whips: – as grappling hooks for removing the young of the hornbill (YAXANU) from their nest

* Reference numbers tally with those provided in Appendix 15.

† Descriptions are variously based on specimens, own observation and local information.

‡ Uses include only the more common ones and inventories are likely incomplete. They have been compiled from use samples and generic local information. Curly brackets indicate surrogate use. Highlighting indicates most typical or preferred resource for the respective use.

21	YEYKI split & polished stem: – bowstring – string in fire making equipment – delicate and robust tying and lashing
22	KASUEYA split & polished stem: – bowstring
23	SUKENA • long leaves, dense spines split & polished stem: – bowstring
24	WAIAU • small rattan • small spines, small leaves • yellow stem (WAI: red, yellow) • similar rattans: WASAM: stem not yellow WOUBRO: similar leaves BOXORU: larger spines whole stem: – rafters split & polished stem: – sewing thatch and containers – robust tying and lashing
25	WOUBRO • small rattan • very spiny, small leaves • similar rattans: WASLAM: large rattan, leaves & spines similar WAIAU: similar leaves split & polished stem: – bowstrings – robust tying – delicate tying & interlace work – sewing of containers leaf sheath: – strainer mesh (bigger mesh than coconut sheath)

26	WASLAM • large rattan • similar rattan: WOUBRO: small rattan, leaves & spines similar split & polished stem: – robust tying – delicate tying & interlace work
27	WUU • small rattan split & polished stem: – delicate tying & interlace work – tying arrowtips to the shaft (possibly the only rattan used that way—otherwise vines used)
28	WASAPO • small rattan shoot: – food
N/A	WASAM • small rattan (extensive use in Imonda for bowstrings, tying, basketweaving; in Krisa possibly too rare)
N/A	WOUBAR • big leaves
N/A	WOBUL

Table 22: Krisa Taxonomy of Bamboos

*	YAXAU (MAMBU, bamboo)	**noncultivates** (but cf. n.317)
43	YAXAU (MAMBU TRU, "real bamboo")	**(cultivate)**
44	WANI	
45	TONI	**cultivate**
46	KAR	
N/A	AUWA	
N/A	UL	
N/A	WARR	

* Reference numbers tally with those provided in Appendix 15.

Table 23: Krisa Use of Bamboos

ref.no.*	description†	use‡
43	YAXAU • most salient (MAMBU TRU, "real bamboo") • medium size culms	whole culm: – pounding head for sago pounder – baking mould for sago/ water container split culm: – tongs – butchering knives, arrowblades – Jews' harps – chopsticks, sago servers
44	WANI • slim but hard culms • slender & delicate leaves	whole culm: – flutes – arrowshafts – roof batons – fruit picker split culm: – tool knives, razors – arrowblades – Jews' harps
45	TONI • giant bamboo	split culm: – combs – {chopsticks}, sago servers – roof batons – children's toys (shoots: food at the Sepik)

* Reference numbers tally with those provided in Appendix 15.

† Descriptions are variously based on specimens, own observation and local information.

‡ Uses include only the more common ones and inventories are likely incomplete. They have been compiled from use samples and generic local information. Curly brackets indicate minor use. Highlighting indicates most typical or preferred resource for the respective use.

46	KAR • thin culms, large leaves leaves: – food wrappers (shoots: food in Bewani)
N/A	AUWA live plant: – {decorative} whole culm: – {fruit picker}
N/A	UL • small bamboo whole culm: – {baking mould for sago}
N/A	WARR • small bamboo

Approaches to Resource Appropriation and Consumption

Resource appropriation is subject to a legal code which assigns organisms to one of three categories, according to their subsistence value and/ or the effort expended on their management:

1. Individual (or, upon inheritance, lineage) property arises from garden preparation and other deliberate plant management activities. Hence, it includes live plants as well as firewood within the confines of a garden, and perennials which have been artificially propagated and/ or nurtured. Also in this category belong the two most commonly eaten types of larvae, themselves high-value food items (cf. p.238), which are likewise subject to deliberate management. Larvae of the sago weevil belong obviously to the owner of the palm; larvae of a related weevil, infesting the dead stems of the ANASI palm (5), belong rightfully to the person who discovered the palm, felled it and covered the stem with fronds to enhance incubation.[318]
2. Clan property arises from territorial control. It includes high-value resources within the confines of the territory, in particular game and megapode eggs (cf. p.238).[319]
3. Common property is free for appropriation by the finder, irrespective of clan land boundaries. It includes unmanaged vegetal resources and small fauna.

As long as resources remain in-situ, the respective legal constraints apply. Even so, transgressions are common, from hunting on alien land to the theft of garden produce. Legal prohibitions are therefore frequently reinforced with magic. Clan elders may cast spells over hunting grounds to keep game in hiding; resource owners commonly attach taboo-signs to nurtured perennials and garden boundaries, whose powers threaten intending thieves with bodily harm (cf. p.238). Besides, people aim at keeping their property under close observation, limiting fruit trees to the vicinity of their dwellings, and attractive crops to nearby gardens which they can visit frequently. Similarly, they safeguard the far reaches of the territory and its resources through regular patrolling or indeed permanent residence (cf. p.215).

If resources are jealously guarded in-situ, they fall under intense pressure of enforced distribution once they have been appropriated and hence mobilised. This pressure is the more severe the higher the resource's subsistence value; the more variable and hence unreliable its supply; the greater its perishability; and the larger its accumulation with certain individuals. Even quantities of ripening garden crops are therefore prone to incessant requests for sharing until the crop has been depleted. Hunting quarry is another obvious target for the need to share. In the past, its distribution was apparently regulated through hunting brotherhoods (cf. p.239).[320] Unregulated today, its sharing is however common among relatives and/ or neighbours, judging from survey results (cf. Appendix 10) which indicate that about half of all meals containing meat bear no relation to hunting activities by household members. Sometimes, though, meat is preserved through smoking in special devices (cf. Case Study 2 [pp.241ff.]), and part of the discrepancy documented by the survey may derive from this practice.

Apart from smoked meat, few items are regularly kept for future use. The sole other foodstuff is sago starch, which is fermented in large containers, presumably for a range of reasons including mode of preparation, nutritional enrichment and taste (cf.

pp.91f.,237), besides the need to store the large yield from a single bole. Otherwise, storage is only for inedibles which are obtained in the course of procuring foodstuffs and find no immediate application. They range from cuscus fur and bird feathers for festive body decoration; through lizard skin for hand drum membranes; to LIMBUM (ASI, 4) leaf sheaths for containers and rattan stems for construction and tying purposes. Animal material derives primarily from sources of meat, while plant material is collected in its own right, from species which are not always readily available. Thus, a LIMBUM sheath will be saved when a palm has shed a frond; a rattan stem will be cut when encountered on a subsistence excursion. On the other hand, material which can easily be obtained from known locations, possibly even from planted sources, such as culms of reed grass (TIKTIK/ BOU, 47) or bamboo (43-45) from existing clumps, will remain in-situ until the need for it arises. Besides the saving of meat, sago starch and certain materials, some finished goods may be stored, when their production proceeds en-masse to make use of available material and economise on labour. Items which are regularly stockpiled in this way include arrows, bamboo tongs and LIMBUM containers.

Stored matter which thus clearly serves the convenience of its owner is largely removed from enforced distribution, although there may be requests for sharing when the respective need arises. Items of value exceeding the immediate satisfaction of their owner's needs, though, invariably fall under the imperative of sharing. The resulting circulation of resources not only makes good economic sense, as it collectively evens out irregular and perishable supplies, which beyond the limited smoking of meat and fermentation of sago starch are prone to instant decay.[321] It also reinforces social ties while preventing the accumulation of mobile wealth, which could be strategically redistributed for political ends and thus threaten an egalitarian society. Rather, wealth in Krisa lies in immobile assets, namely planted and/ or nurtured perennials and territory, which provide economic security respectively for individual and group.[322] As these assets are unavailable for accumulation and redistribution, they do not provide a means of gaining political influence, whether through the competitive exchanges so characteristic of New Guinea highlands societies (e.g. Strathern 1971), or through inequitable access to resources.

In Krisa, therefore, territorial control and planted/ nurtured perennials guarantee continued availability of resources, while resources once mobilised meet either decay or enforced distribution. Hence, it makes sense to leave them in-situ right up to consumption, and to approach appropriation in a relaxed, casual, and basically ad-hoc fashion. Of course, the concurrent need for management and the complexity and duration of some subsistence processes may require advance planning and integration of tasks, while recurrent subsistence needs generate regular schedules. The following overview illustrates these aspects, but indicates simultaneously that even comparatively organised tasks are performed in a relaxed way (data are partly derived from a consumption and activities survey—cf. Appendix 10):

- Gardening (see section 5.3.) consists in a fixed sequence of tasks, which though tend to be performed sporadically over about half a year. While they are in principle dependent on the seasonal climatic cycle, in practice deviations from a meteorologically determined schedule are common. It is also common for people to prepare gardens less than annually (cf. p.61). The respective frequency and the sequence in which crops ripen determine in turn potential harvests, which though may not be fully realised.

Harvesting is typically carried out together with weeding, a management task necessary to prolong the life of the plot.

- Processing of sago starch from a single bole recurs once every week or fortnight per consumption unit.[323] It is common to wait for supplies of starch to run out, which may even manifest in meal patterns: survey results indicate that root crops or banana sometimes replace sago before a new bole is processed. Each processing episode takes a single worker about 4-5 days.[324] Women generally spend between 2-5 days in sequence on this task, most usually between 3-4 days. The sequence may be interrupted for up to a week for other tasks, or to allow fungal infestation of the starch for enhanced taste.[325] Processing combines almost throughout with the collection of weevil larvae; often also with the collection of leaves for thatch. Besides, it provides an opportunity to perform the management tasks necessary to perpetuate the patch, namely cleaning the palms (i.e. removing undesirables) and replanting suckers.
- House construction requires that posts, construction wood, thatched shingles (cf. Case Study 2), LIMBUM floorboards and walling material are all available prior to their assembly. The task recurs about every 2-10 years, depending on the inhabitants' residential mobility and the quality of the construction: thatch typically wears out after 5-7 years, floorboards last slightly longer. If need be, construction can be completed within a few weeks. Commonly, though, it is a protracted business lasting several months, with intermittent spells of intensive work during which distinct stages are completed. Resources are therefore typically procured successively. With the addition of extensions and annexes to existing houses, building work becomes an ongoing occupation like other subsistence activities, to which people attend on and off.
- Community work occupies two mornings per week. It requires people to offer their labour for communal purposes such as cutting grass in public areas, construction work on teachers' accommodations, and lately in particular road maintenance. The actual work is typically preceded by a meeting which addresses political and legal issues. This tends to constitute a large part of the collective activities, rendering them as much a social as an economic event.[326]

The casual approach towards subsistence tasks is yet more pronounced with other provisioning jobs. A pick-as-you-go approach applies to fulfilment of most dietary needs, as illustrated by local statements like "well, if a person has food around, they will have a meal"—in reply to my question whether morning and midday meals were common; "oh, she must have gone picking some TULIP leaves; she must have been hungry"—in explanation of the fact that I found my interviewee not at home; or "we go searching for game when we like to eat meat"—to satisfy my naive curiosity about the frequency of hunting. Similarly, resources are often collected en-passant as they are encountered (cf. p.261). Besides, people typically alternate periods of intense physical labour with extended leisure periods, as during a day so during the week. Thus, individuals commonly interrupt work for prolonged cigarette breaks or the preparation of some food on the spot; members of a workgroup often take turns with their task, presently nonparticipating ones watching the others while they themselves relax; women tend to rest for one or two days after a spell of processing sago. People

also spend much time nurturing and enjoying social contacts, which renders visits an integral part of social life and a salient feature among the daily ongoings in the village.

The relaxed pace of life and the tendency for immediate consumption and demand sharing extends to modern contexts. Whereas they stabilise the traditional subsistence system, though, in which people are mobile but assets are not, they obstruct the modernisation and monetisation which most community members desire, but which relies on sustained accumulation of mobile personal wealth upon observation of rigid work schedules and residential permanence. Thus, employment opportunities may be quickly realised, but as quickly abandoned again upon satisfaction of immediate financial needs; unconvincing cost-benefit ratio; decline of work satisfaction or plain boredom; spatial and temporal incompatibility with subsistence requirements; or indeed emergence of new options—similar as for opportunities at large (cf. pp.215ff.). Modern equipment, such as kerosene cookers or chainsaws, are subject to compulsory borrowing and shared use, which combines with a casual attitude towards possessions to cause premature wear and discourage any future investments. Consumables, such as cigarettes, biscuits, or cooking oil are drained from the owner until any inequities have been balanced. Money as the apotheosis of mobile wealth ranks as the luxury par excellence and thus becomes the ultimate target of the levelling mechanism, if it is not instantly consumed—vividly labelled as KAIKAI MONI ("eating money"). Financial wealth in Krisa exists therefore typically as dormant capital in form of unsettled debts or unmarried sisters (meanwhile also daughters, cf. pp.224f.), which can serve as security against which credit may be granted in informal transactions within and beyond the community. Liquidity, in contrast, is low.

The drain on liquidity constitutes an added problem for local enterprises, which tend to follow a similar pattern as employment. Entrepreneurs themselves may erode business capital; their clients regularly deplete stocks and profits by plain demands for gifts or incessant requests for credit (DINAU) which may forever remain outstanding. Entrepreneurs who nonetheless manage to prevail become ready targets for death sorcery (SANGUMA), the last resort of egalitarian politics.

The systemic lack of money is aggravated by the scarcity of income generating opportunities on the one hand, and the increasing dependence on money (cf. p.248) on the other. Chronic financial deprivation combines with the physical demands of subsistence labour to convince many community members that "life is hard in the village", which they contrast with the apparently effortless generation of money and goods in modern contexts. Accordingly, they tend to seek metaphysical means to attain modernity (cf. pp.227,240,268), and thereby miss the opportunity to apply their time, effort and hopes to more realistic options for financial improvement.[327] Disappointment is destined and lack of money becomes endemic.

On the other hand, modern forms of wealth permit cunning and unscrupulous individuals to enrich themselves at the cost of the community. In particular communal schemes of income-generation, such as logging, cooperative cash cropping, or the collective rearing of livestock are prone to exploitation, as are public offices which permit access to public funds (cf. p.228). After all, money as a mobile and at once compact resource is not only easily redistributed, but also easily shifted, concealed and converted, and indeed channelled out of the community, and thereby removed from the levelling system. In fact, the respective individuals may remove themselves for shorter or longer periods, thus escaping at once demands for redistribution of their wealth and threats of sorcery.

Monetisation therefore permits individual bonanzas for those who are ready to break the traditional code of sharing, while collectively it thrusts people into endemic and systemic want. By perverting the traditional approach to resource use, money paradoxically becomes the principal obstacle to modernisation.

Economic and Domestic Units

The fundamental economic unit and basic element of domestic arrangements in Krisa is the conjugal pair. Husband and wife can between themselves muster all the labour required for survival and for the raising of their children, complementing each other in subsistence tasks which follow a sexual division of labour.[328]

Prototypical male activities are hunting, the preparation of gardens (see section 5.3.), and house construction, due respectively to their metaphysical (cf. pp.238ff.) and physical demands. Excellence at these tasks, indicating a man's capacity to sustain several wives and their offspring, would in the past constitute the prerequisite for him to engage in polygyny. The attendant demographic effect[329] seems to have made such excellence a further attribute of leadership (cf. p.226), besides its role model function. Indeed, the apparent prerogative of leaders to sustain plural unions (cf. n.249) may conversely have manifested the suitability of polygynously married men for leadership positions.

Prototypical female activities are childcare; the cooking of meals; the provision of firewood and drinking water; other domestic chores such as dishwashing and laundry; the harvesting of gardens; and all tasks associated with the processing of sago starch. "Processing sago" (WOKIM SAKSAK) and "carrying the bag" (KARIM LIMBUM)—filled with domestic items, firewood, garden produce, or sago starch—rank accordingly as the epitomal female occupations in Krisa and the region (cf. Case Study 3 [p.245]).

A corresponding sexual division of labour applies to the manufacture of the respective objects and their technological relatives. For example, production of bows, arrows and chopsticks—which typically derive from bow- and arrow offcuts—is the domain of men (cf. Case Study 4 [p.246]), while production of LIMBUM carrying bags and other LIMBUM containers is the domain of women (cf. Case Study 3). Most other activities, in particular the collection of animal and vegetal foodstuffs and materials tend to be performed by both sexes.

The economic independence of the conjugal pair manifests most obviously with families' prolonged stays in isolated forest camps (cf. pp.220f.). Besides, each married couple prepares individual garden plots, not shared with any other persons.[330] Husband and wife also co-operate closely in sago patches. Men typically collect sago grubs and thatching material while their wives process the starch (cf. p.262). Furthermore, they tend to fell the palm and may indeed assist with flaking and leaching the pith, in departure from the traditional pattern in which women performed all tasks associated with starch production (cf. PR 49-50/13). Possibly, the increasing involvement of men corresponds to the decline in hunting (see p.268 below), which frees up male labour time.[331] Today, husbands are the most typical companions for women on excursions to sago patches, ahead of female relatives or neighbours, in turn ahead of brothers. Conversely, wives may accompany men on hunting excursions, although they will not participate in the hunt itself (see n.332).

The self-sufficiency and autonomy of the conjugal pair render the conjugal household the domestic prototype. While extensions are the norm, reductions are

barely viable, as the complementarity of gendered subsistence tasks demands the domestic complementarity of two opposite-sex adults. Single-households may therefore exist physically, but barely economically.

In particular the presence of an adult male is indispensable, since the prototypical male activities are indeed exclusive to men.[332] Before marriage, therefore, women will stay with their parents (or surrogate), while upon separation or widowhood they will move in with relatives, with corresponding political implications for any of their dependent children: staying with an adult son or a member of the erstwhile husband's clan will confirm the children's paternal clan; staying with a brother or clanmate will engender the children's strong alignment with their maternal clan (cf. p.207). Occasionally, women may be acknowledged as sole household heads, but even then will associate strongly with another household headed by an adult male. Of 70 households surveyed (cf. Appendix 10), three (4 %) conformed to this condition, two of them with one, one with two female household heads, all with dependent children.

In contrast to the prototypical male activities, the prototypical female activities may be performed by men also if necessary, apart from the independent processing of sago. Bachelor households are therefore viable in principle, although in practice they rely on female work input or need to seek alternative carbohydrate sources. Young men or adolescent boys, who typically prepare their own gardens from an early age and may set themselves up independently alone or with some mates as soon as they are capable of constructing a house, will therefore tend to remain associated with their household of origin, with whom they will in particular take their meals. Confirmed bachelors or widowers too old to remarry will typically join the household of a married male relative or invite him and his wife to join his. Of 70 households, only one (1.4 %) conformed truly to the concept of an independent bachelor household. In this case, the staple was shifted away from sago, which was occasionally obtained from female relatives and otherwise replaced with other starch crops. One further bachelor household and a widower household were each associated with another, larger household.

Following economics, therefore, independent households comprise almost throughout at least one married couple.[333] Most comprise more adults. Of 70 households, 30 (43 %) had as their sole adult members husband and wife; a further one mimicked this constellation by joining a bachelor and a separated mother. The remainder (minus the few single-households) were enlargements of the prototype, arising frequently upon the addition of an unattached relative (see above) or during a household's developmental cycle. In particular, households get lineally extended, when couples remain with one of the spouses' (typically the husband's) parents early on in their relationship; return later when the parents become frail; take a widowed parent into their own household; or continue to accommodate a grown-up yet unmarried child. Lineal extension may combine with collateral extension, when several siblings continue to live in their parents' household with their spouses and possibly some dependent children. Within one household, several such arrangements may combine, producing all kinds of amalgams of nuclear, extended, truncated and composite families. While the average household among 70 comprised three adults, two comprised seven, and one nine.

Social complexity may combine with the physical separation of sleeping and cooking quarters, which permits various combinations for communal living and commensality, to blur the boundaries between individual households.[334] Thus, the number of hearths may be as high as the number of adult women representing a

nuclear or truncated family (thus excluding unmarried daughters). Separation of sleeping quarters, though, may be merely through partitions within the same dwelling, if at all. Conversely, several women may share cooking facilities and take turns with the preparation of meals, while they (and their families) use separate dwellings for accommodation. In between these two extremes, any combinations are possible. Accommodation arrangements may mirror hearth arrangements, but they do not so necessarily or even usually.

Whatever the domestic arrangements, work arrangements rely on the basic economic unit of husband and wife. The various couples within a household may live and eat together, but will go their separate ways for subsistence tasks. Single women will attach to a couple for tasks which require male support, but otherwise tend to remain independent.[335] Similarly, collective work groups may form for labour-intensive tasks, in particular building a house, clearing a site, or planting a garden, without infringing the fundamental autonomy of the conjugal pair. Most frequently, the respective temporary associations within and across households are between parents and children (or their spouses), and between (classificatory) siblings. Visitors, whether individuals or families, will join the accommodating family in its work. Sometimes, people enlist the help of selected community members or of one of the clubs (cf. p.226), which typically involves financial reward for their support.

Much as work arrangements beyond the co-operation between husband and wife are flexible and temporary, so are domestic arrangements. Families living within the same camp may become more or less independent as new buildings are erected and old ones demolished; conversely, one family may move out of the camp altogether, leaving its dwelling to another. Indeed, household size and composition may vary within weeks, as in particular children and adolescents, but also single and indeed married women circulate frequently among households for social, economic, or academic reasons. More generally, mobility between accommodations often manifests as the fluidity of households rather than their concerted relocation (cf. p.221). Households are therefore in constant flux, adding a social dimension to the otherwise geographically manifested multi-level mobility which characterises Krisa life (cf. pp.215ff.).

Resources, Activities, and Environments

Krisa people distinguish four environments, from which traditional resources originate, and in which subsistence activities take place: the forest, PU (BUS); the sago patch, SUA (PLES SAKSAK); the garden, PILI (GADEN); and the dwelling place, I, which includes similarly the village (PLES) and any camps (KEM) (cf. p.215, n.265). A further environment, the target of commercial activities and source of modern resources, has been added since the inception of Vanimo as a patrol post and mission station: the growing town. Its goods, services and opportunities have been assimilated into local lifeways, with modern materials and ready-made objects increasingly substituted for traditional resources (cf. pp.228,248); consumables, equipment, and commercial activities subjected to the traditional approach to resource appropriation and consumption (cf. pp.263f.); and the location itself integrated into traditional patterns of mobility (cf. section 5.1.). If such assimilation may prove erosive in the long run, the shift of context highlights the original subsistence functions and meaningful integration of the respective processes, institutions and environments.

The four labelled environments carry different semantic values, PU being the most elemental. It denotes not only forested areas, but at once spatial units and indeed states of the world, demonstrated by its common combination with toponyms (e.g. Kubli PU: "the area Kubli") and use for indicating conditions (e.g. PU KISI NUO: -ness/ dark/ great = "midnight"). In particular, it denotes the ground itself, reflecting that forest constitutes the default condition of the land.[336] In spatial terms, it encompasses SUA and PILI, but is opposed to I, a space inhabited by humans—or, since I extends to sites where ancestors roamed and spirits dwell, more generally a space transformed by the presence of spirit(ual) beings.[337]

Commensurate with the default state of their land, Krisa people like to portray themselves as 'forest people' and thus hunters, in contrast to the fisherfolk of the coast (cf. pp.216,217; Cheesman 1941:182f.). At the same time, the rugged topography of their territory renders them 'mountain people', a self-assessment likewise echoed by Cheesman (1941:182, 1958:255).[338] This identification is reflected in local concepts of orientation and topographic reference, with the sharp contours of crests (MAUNTEN) and spurs (KIL) providing the typical markers for wayfinding and identifying locations. Many of these are individually named and denote by extension the surrounding area.

The three highest mountains on Krisa territory (cf. p.199) constitute at once topographic markers for land use zoning. They are banned for any activities other than hunting and collecting eggs and plant foods, and even this is prohibited on top of Mt.Dale. On the slopes of all three, trees must not be felled, whether for preparing gardens, obtaining construction material, or commercial timber extraction. They were accordingly designated as reserve areas prior to logging and therefore retain their cover of oldgrowth forest, PURE (forest/ real, BIKBUS: "deep forest"). Their current vegetation and tabooed status contrast, however, with memories of ancestral occupation (cf. p.201), which remains manifest in vegetational markers (cf. p.215). Particularly well-known is the story of a named ancestress 8 generations bp who planted reed grass (BOU/ TIKTIK, 47), the principal resource for arrowshafts (cf. Case Study 4) and an obligatory cultivate, on the summit of Mt.Sau, then the residence of clan D (cf. Table 11 [p.200]), where clumps of it survive today. If such tangible evidence reveals the untouched forest of the present as a product of past transformation, it is paradoxically integral to the current taboo, as it indicates the intangible presence of ancestor spirits, which constitutes one of the most powerful motivations to avoid sites (cf. p.222).

In fact, the designation of oldgrowth or deep forest—PURE—discounts not only the impact of ancestral cultivation activities, but also of more recent logging. Hence, vegetation of this status covers at once the slopes of the three highest mountains which have been spared from timber extraction altogether, and other areas where this has passed more than 5-10 years ago and no gardens have been prepared since.[339] Indeed, gardening constitutes the decisive parameter for distinguishing between zones of human impact locally, the designation of PURE entailing a ban on it by definition. The ban applies to much of the territory, the restrictions on large-scale felling of trees having been lifted but temporarily for the purpose of commercial timber extraction.

Preparation of gardens is permitted only within a radius of about 15-20 minutes' walking distance (ca. 1-1.5 kilometres) from the village or in the close vicinity of forest and roadside camps. Krisa people portray such zoning as an ancestral measure to provide a retreat area for game, besides pointing out that distance encumbers garden preparation and maintenance and fuels fears of sorcery, and

thereby serves itself to limit the spread of cultivation activities. Accordingly, only the vegetation in a large circle around the village and in smaller circles around camps is recognised as secondary growth or, more accurately, nearby forest, IWESAU[340], a term including groves of planted trees. The distribution of sago patches follows the same pattern, as sago palm is planted either in damp spots within or adjacent to gardens; along streams near the village; or close to forest camps, themselves set up beside watercourses (cf. p.220).

Most subsistence activities take place within these circumscribed areas.[341] House construction and the manufacture of artefacts are typical occupations in dwelling places, besides the complement of regular domestic chores, including the cooking of meals. Garden preparation and maintenance and harvesting of garden produce are by definition limited to garden plots. The processing of sago, and associated activities such as collecting weevil larvae and thatch and maintenance tasks occur commonly in sago patches, occasionally in gardens, depending on the location of the resource. Only the hunting of game and the collection of small fauna and vegetal foodstuffs and materials reaches beyond garden and sago areas, and indeed beyond areas of nearby forest.

Hunting targets principally the deep forest, PURE, which is identified as the environment where "the game stays in hiding" (ABUS I HAIT I STAP). Nearby forest, IWESAU, serves as a rich source of game also, whereas the garden, PILI, remains outside hunters' attention.[342] Hunting is at once the defining activity of traditional Krisa life, as demonstrated by the value, cultural salience, and ritual importance of game (cf. pp.238f.). It remains essential for local identity and subsistence, although its overall importance has certainly declined over the last century upon the increase of sedentism (cf. pp.220,223f.); decline of ritual (cf. p.239); intensification of gardening (cf. p.240, section 5.3.); and availability of tinned meat and fish (cf. p.238).

Besides, logging will have had an impact on hunted fauna, although local testimony is ambiguous in this regard. While people typically assert that "there is still plenty of game", they may append a qualification that "it is harder to find now"—the former statement possibly conveying more the belief in ultimately inexhaustible resources than representing an actual assessment of abundance, which may rather be contained in the latter. The one game animal which has likely increased in abundance is the pig, as suggested by the stimulating effects of habitat change upon logging,[343] and by observations of a disproportionately high pig population (Menzies 1999:1,2). High pig numbers, in turn, have potentially negative consequences for terrestrial fauna (op.cit.:2), and will thereby aggravate any pre-existing imbalances among game animals. In fact, a faunal survey "revealed ... disappointing mammal, reptile and amphibian lists" (op.cit.:1), although I have not recorded any specific local complaints.

Yet, any potential decline in game populations is locally not necessarily attributed to environmental change, but linked by some to the demise of the fertility ritual (cf. p.239). Despite associated feelings of loss, the respective processes are regarded as integral to the ongoing transformation of local lifestyles within cyclical concepts of the world (cf. pp.222ff., esp.228f.). Indeed, the paramount leader declared explicitly that the fertility ritual had become redundant upon the replacement of money for game (pers.comm. Christin Kocher Schmid 1999). His conviction encapsulates the new, syncretic faith, which perceives salvation in a modern way of life and accordingly damnation in the ancestral one, which in turn is epitomised by hunting and the associated rituals (cf. pp.227,240). The pig as the principal target of both and hence of the new religious avoidance (cf. pp.238f.,240) accordingly

experiences a particular remission in hunting pressure. Pig numbers have apparently risen in response, with the respective knock-on effects on other fauna (see above). Via rising pig populations, ritual decline may therefore indeed have engendered faunal decline, thus confirming local perceptions. The ecological impact of logging will have reinforced the trend. If its short-term effects on fauna were particularly dramatic, with people remembering that "the animals fled", this coincided with massive cash flows at the time, which must have supported notions of an impending changeover from game to money.

Yet, people also assert that upon completion of logging "the animals returned", and despite any lasting environmental and cultural changes, hunting remains a frequent activity, judging from anecdotal evidence and the number of meals which include game meat (cf. p.238). In fact, the most common quarry remains pig, notwithstanding the novel taboo. This, in turn, affects anyway only followers of the new faith, who themselves tend to contravene it to greater or lesser extent (cf. p.240). The continued popularity of pork in spite of the decline in hunting indicates that its past prevalence must have been immense. On top of this, the traditional spectrum of game is large, although it, too, is shrinking as some animals are dropping out of the catalogue of acceptable prey. A prime example is the python, which only a few traditionalists continue to hunt. The most typical game animals besides the pig are wallabies, cuscuses, bandicoots, bats and the cassowary. Other birds, apart from the hornbill, seem to be hunted primarily for their feathers rather than for food nowadays; indeed, the results of the faunal survey suggest low hunting pressure for canopy birds (Menzies 1999:1). Occasionally, piglets, wallaby cubs or cassowary chicks—sometimes hatched in captivity—are adopted, raised to adulthood, and then slaughtered. While such fostering is rare, oral accounts indicate that in particular the rearing of piglets may have been more common two generations ago and given up together with the pig-centred rituals. Still, livestock seems to have never been kept regularly in the past (cf. p.238).[344]

Hunting expeditions occur commonly overnight. Typical scenarios are of a single hunter undertaking a one-night foray from his home into an area of 'nearby' or 'deep' forest in the vicinity, or of two or more men venturing further into deep forest for several days, encamping in shelters or mountain caves. As the high-value resource game constitutes clan property (cf. p.260), hunters must by default limit their activities to land of their own clan. They have, however, dormant rights on the land of their ancestral clans, in particular their mother's, which they can activate through asking, or indeed joining the respective relatives (cf. pp.207,212,215). Typically, men hunting together are therefore (classificatory) cross-cousins.

Hunters may be accompanied by dogs, occasionally well-fed and groomed, but mostly scrawny and scruffy and left to scavenge in the village when idle. Dogs take the status of hunting weapons and may be the ones actually effecting the kill. Inanimate weapons are most commonly bow and arrow, with arrowheads nowadays made near exclusively from locally forged metal, partly an effect of logging (cf. Case Study 4 [p.246]). Some men own shotguns, with parts often home-made, though ammunition is rare and its acquisition regulated by the police. Simple catapults may be used to shoot birds. Pit traps and deadfall traps were used in the past, but seem to have been abandoned altogether. Snares, from looped string or nowadays also from wire, are occasionally employed, mainly by young boys, who thereby supplement family meals with small mammals.

Besides hunting, the collection of megapode eggs (cf. n.311) constitutes one of the prototypical subsistence activities locally, and especially women frequently devote

a day solely to this purpose. In the past, it targeted presumably all areas of deep forest, but has after logging become limited to the slopes of the three mountains, where megapode breeding mounds survive in truly oldgrowth vegetation.[345] Since eggs constitute a high-value resource like game, collectors are limited to the confines of their own clan's land (cf. p.260).

Small fauna and vegetable foodstuffs are typically free for collection by the finder (cf. p.260) and gathered in areas of both 'deep' and 'nearby' forest, by both men and women. As with game animals, the spectrum is large in principle, but the catalogue of acceptable and commonly taken items is shrinking (cf. pp.240,268). A typical case is that of the tarantula (ISONG, KUKA BILONG GRAUN). Krisa people still know how to catch it, by vibrating the web sealing its burrow with the help of a leaf rib and humming sounds, and quickly grabbing it when it leaps out, taking care to avoid its venomous bite. Yet, they express disgust at the thought of eating it, whereas it still ranks as a delicacy among their Mbo-speaking neighbours (pers.comm. Christin Kocher Schmid 1999). Some other fauna is still consumed, but rarely procured, in particular fish, crayfish and shellfish. Partly, this is due to a decline in activities in the forest in general and fishing in particular (for the traditional method cf. Case Study 2 [pp.241ff.]). Partly, it is a consequence of logging, which damaged streambeds, thereby lowering water levels and raising silt content, thus adversely affecting aquatic fauna. Partly, it reflects local health concerns as water quality is considered declining through overuse.

The most frequently collected invertebrates are the larvae of beetles, butterflies and moths, in particular those of the sago weevil; of a related weevil, which infests the dead stems of the ANASI palm (5); and of several wood-boring beetles, which infest decaying logs and tree stumps. Together, they contribute the most commonly eaten animal food, ahead of game (cf. p.238). Larvae are free for collection by the finder, save for the grubs infesting sago and ANASI palms, which constitute individual property (cf. p.260). Removal of the ANASI grubs, though, leaves the palm cortex, itself a highly valued material for objects (cf. Table 19 [pp.250ff.]), again free for appropriation by anyone.

The principal vegetal foodstuff gathered from the forest are the leaves of the TULIP tree (WISIA, 51), which occurs abundantly upon spontaneous growth, although it is also planted and/ or nurtured near houses and in old gardens and then owned by the nurturer. TULIP leaves which are from 'wild' plants and thus common property are often collected alongside tree grubs, and this combination of tasks represents one of the most common reasons for excursions to the forest.

Another typical motivation is the collection of construction material, in particular LIMBUM palms (ASI, 4) for floorboards and various trees for house posts and frames. LIMBUM is harvested from planted groves belonging to the erstwhile cultivator; trees are sought in areas of reasonably mature growth close to the construction site, itself confined to clan land by default (cf. p.215), which renders the respective trees typically clan property also. In the aftermath of logging, though, suitable tree specimens have become scarce, as the respective species tend to be targeted at once commercially. Search distances and times have therefore increased considerably, which constitutes the most common grievance in the affected communities throughout the region.

If the search for construction material on the one hand, and game, eggs, or grubs and TULIP leaves on the other tends to provide the principal motivations for excursions to the forest, other resources may be gathered opportunistically en-passant.[346] Foodstuffs will supplement the next meal; materials, in particular the

versatile rattan stems, may be stored for future use (cf. pp.261,262). Although harvesting may instantly follow a chance discovery, it may as well happen upon repeated inspections or indeed strategic resource management. Case Study 7 illustrates various instances of both opportunistic and targeted resource appropriation, and how these may combine in a single foray into the forest, rendering an excursion akin to a broad-spectrum shopping trip:

Case Study 7: Combination of Resource Appropriation Activities

The following episode occurred while I was collecting herbarium specimens with Daniel Waki of Krisa community. Our foray was into an area roughly half an hour's walk from the village, where logging operations had been completed several years earlier, and lasted a few hours. Besides its scientific aim, Daniel used it at once as an opportunity to examine a sequence of potential resources.

At first, we pass by a large tree, between whose roots Daniel suspects the sett of a bandicoot. He strikes in with his bush knife, but hits nothing, hence abandons his fleeting expectation of bandicoot for dinner. As we proceed, he makes a little detour to check out an ANASI (5) palm which he has felled a short while ago to incubate weevil larvae. Another disappointment, though, awaits him: someone else has already collected—stolen!—the grubs. It only remains for him to come back at some later point to collect the palm's cortex for objects, now loosened through the action of the insects and hence more easily removed.

At last, though, animal food is round the corner, as we chance upon masses of greyish pellets littering our path. Less the seeds which my botanical curiosity imagines than insect excrement, they indicate equally many caterpillars above our heads, in the denuded crown of their host tree. Daniel would later announce the discovery to his parents, who went out the following day, cut down the tree, and collected the highly cherished larvae. Indeed, they returned home with three large leaf packets, containing about 100-200 apiece.

Later, we pass by a medium-size KWILA tree (YOPNO, 76), which Daniel has ringbarked a while ago, for it to dry out, be felled and used as house post. Finally, we proceed to a fruiting TON tree (TINIA, 57) in the vicinity, which Daniel cut down a week earlier for harvesting, only to discover that its fruits were yet unripe. As the renewed inspection shows, though, some have meanwhile matured, and we enjoy them during a short break.

Combination of activities is typical not only for forays to the forest, but similarly for excursions to a sago patch or garden (cf. pp.262), which in turn tend to involve walks through forest areas, with the respective opportunities. Much as single excursions thereby tend to encompass a spectrum of activities, so do activities tend to get varied throughout the week, a tendency which is reinforced by the casual approach to subsistence tasks (cf. pp.261ff.). Combined with the wide distribution of resources—dispersed over deep forest, nearby forest, sago patches and gardens—extensive daily and day-to-day mobility results: the smallest magnitude of the multi-level mobility which characterises Krisa life (cf. pp.215ff.).

As people thereby circulate through their territory, they both minimise local impact and come into repeated and intimate contact with environments and resources on a large scale. In the process, they acquire a profound familiarity with land and landscape, the location of resources, and their natural history. As a result, they can read tracks; identify animal sounds and mimic them; and vividly describe and represent artistically animal anatomy and behaviour. They are aware of animal nesting preferences and food sources; seed dispersers; indicator species; and other interactions in the web of life. They habitually take note of the sites of (prospective) resources, to return for appropriation at a suitable time later on. They photographically remember

vegetational and topographic features of the landscape and are able to provide pictorial descriptions like "where on the second shoulder of the hillside the path turns right", which serve not only for wayfinding but also to relate past experiences to the landscape.[347] They know their territory like the back of their hand.

Beyond the reference to living persons' experience, the landscape bears witness to the events of the past and relates the physical and metaphysical worlds. Thus, the detailed toponymical dictionary serves as much for geographical identification of areas within and indeed beyond the actual territory, as it indicates ancestral acquaintance with them and may testify to the presence of ancestor spirits. Hence, Krisa people can claim: "The Vanimo area has been named long ago. Krisa people have been roaming this forest in the Vanimo area, therefore landmarks remain: the streams have names, the women—the spiritwomen."[348] After all, the spirits of ancestors long deceased continue to exist in the world. The mysterious era of HISTORI (cf. p.205) is less an age in the past into which the far end of genealogies disappears, than a parallel universe—the sphere of the invisible which coexists with the visible world of the living and thereby manifests the recurrence of time in space (cf. p.228, n.337). If the landscape remains therefore the abode of spirit entities, it represents at once the congelation of their activities. There are valleys which people identify as passageways broken by mythical creatures, and rocks which they claim have been placed in prominent locations by ancestral heroes. There are trees which survive in the sites of legendary men's spirit houses, whose dangerous power they retain. And there are, more profanely, vegetational markers, which indicate both persisting and expired claims to territory (cf. p.215). Beyond their legal value, they provide a tangible and personalised link to the past through their association with the erstwhile nurturer. By embodying his activities, they testify to his personal history, and by extension to the history of his clan.[349] As they connect the physical environment to oral accounts, they become therefore both historical signs and tokens of collective identity.

If only leaders can comprehend the deeper significance of the landscape and are able to muster the metaphysical powers pervading it (cf. p.226), the experience of environments and topography, and their correlation with the public versions of legend and myth is open also to ordinary mortals. Moving through the forest is therefore never just a matter of subsistence, much as the forest is not merely an aggregate of resources. It is at once a journey through one's home country; an expedition into history; and a voyage into the realm of the unseen.

Logging threatened all these spheres. The basis for subsistence was eroded as oldgrowth forest was removed (cf. p.267); game populations became unbalanced (cf. p.268); megapode mounds were levelled (cf. p.270, n.345); aquatic fauna was damaged (cf. p.270); availability of construction wood declined (cf. p.270); and planted/ nurtured perennials were knocked over. The familiar environment was torn apart, as ancient trees were cut down and dragged through the remaining vegetation; the soil was churned up and compacted; landslips were triggered; tracks were driven through the forest; and streams were blocked.[350] The ancestral landscape was brutalised as markers of the past were ruined and sacred places invaded. And yet, such aggressive mutilation may prove less consequential to environment and local way of life than a much more subtle, but at once more relentless change, borne not by the rapacious appetite of greedy companies, but by the missionary zeal of the well-meaning advocates of 'civilisation': the transformation of local plant management strategies towards agricultural forms (cf. p.240), in a process whose foundations and intricacies I shall explore in the next section.

5.3. Gardens: Articulation of Space and Time

The Meaning of Gardening in Krisa

After over nine months residence in Krisa, I still entered into the garden survey (see Appendix 11) with the agricultural perspective typical for most outsiders, attuned to the cultivated plot and its produce. The first major adjustment came when it turned out that for locals this exercise was clearly fraught with meaning far beyond the academic generation of data. Some apparently felt appraised in their efforts to agriculturally inaugurate a new age (cf. pp.227,240,268). Many, though, who the former accused of making no gardens or hiding them, became fearful of the consequences. They expected either a connection with divine judgment in the run-up to the year 2000, or suspected another dubious scheme for commercial land use, with similarly disastrous consequences as logging (cf. Kara 1996:47). Clearly, the cropped plot variously represented local notions about modernity and corresponding feelings of inadequacy. Once emotions had calmed somewhat, and the survey was underway, the second major adjustment of my own outlook was due. For, in the second stage of the survey, people asked to list and describe their gardens included without hesitation plots which were badly overgrown, in which crops were all but exhausted, or in which the sole yield was from mature coconut palms (cf. Niofiarl 1998:4—quoted on p.20). Clearly, the Krisa category of garden diverged substantially from mine, which comprised well-maintained assemblages of annuals (cf. p.21, n.15). The third adjustment came in the third stage of the survey, as I inquired anxiously of the owner of rather exhausted and overgrown gardens, who had not yet commenced any new ones: "But what will you eat once you have finished your AIBIKA?"—the principal garden green and second most frequently consumed leaf vegetable (cf. p.238). With a laugh, he replied:

> "We'll eat the TULIP which is all around!"[351]

Clearly, garden crops were not essential for people's survival.

By some remarkable symmetry, these encounters with the principles of Krisa land use coincided with an equally illuminating encounter with the perceptions of agricultural advocates. For, a Catholic Sister visiting the village at the time lamented, as quoted at the outset of chapter 2:

> "If you go to Wasengla, they're still nomads, they don't make gardens; that's why there is so much malnutrition."

Together, these experiences proved seminal for me to develop the principal argument of the present study: that agriculturally-minded outsiders succumb invariably to misconceptions about the subsistence system in Krisa and the region, revealing both their ethnocentric bias and leading to potentially fatal consequences for local environments and livelihoods.

As it turns out, gardens in Krisa are less the hub of food production which outsiders imagine than the nucleus of anthropogenic environments providing countless vegetal and animal resources, partly spontaneous, partly deliberately managed. Cropping in the present represents but one aspect of a plot's use, whose significance reaches far into the future in the form of planted and/ or nurtured perennials and regrowth communities. The most conspicuous traces of past gardening

activity are vegetational markers, which record human presence for generations to come (cf. p.215, also pp.267,272). The garden (PILI) is therefore not merely a finite environment in space (cf. p.266). It contains at once the seed to project the present into the future and thereby constitutes the element of subsistence which articulates space and time.

The Swidden Cycle and Its Legal Context

As an activity with high impact and long-term effects, gardening in Krisa is by default limited to the land of one's own clan, although kin links offer avenues to access the land of other clans also (cf. p.215).[352] Besides territorial limitations, gardeners need to respect ancestral zoning, which excludes all areas presently designated as deep forest, PURE (cf. p.267f.). Otherwise they are free to prepare gardens wherever they like.

Plot preparation follows the sequence common for swidden systems, as outlined in section 3.4. It commences with the clearing of tall woody growth, commonly at least 15 years from any previous gardening activities in the same site (cf. ASWP 3:1511). Clearing turns the vegetation from forest (WISAU, cf. n.336) into garden (PILI), the process itself being conceptualised as "cutting a garden" (PILI BAXAI: garden/ you cut). Its product, the clearing, is laconically termed "lack of trees" (TEI MOU: trees/ finished), a phrase, though, whose similar applicability to other human-made clearings, especially upon logging, contrasts with the term for windfall clearings (TENG KAIKERE: "the wind has uprooted trees"), and thus clearly identifies human agency. Conceptually, therefore, the garden (PILI) is similarly opposed to forest (WISAU) as the dwelling place (I) is to the land (PU), both referring to spaces transformed by humans (cf. p.267). Indeed, both oppositions frequently coincide, as dwelling places not only require initial clearing but tend to be surrounded by gardens, while forest constitutes the regular vegetation and default condition of the land (cf. p.267).

The conceptual transformation from forest to garden is accompanied by a legal transformation, as clearing converts common to individual access (cf. p.260). By clearing, gardeners establish their exclusive rights to a site and its contents as long as they continue to maintain a garden there. Beyond the lifetime of the garden itself, though, they secure their ownership of perennials which they will plant and/ or nurture in the plot. In fact, only exclusive access ensures that deliberate plant management will materialise in lasting property rights to resources. In legal terms, therefore, garden preparation is essential for the subsequent nurturing of perennials.[353] Since sites may be used repeatedly by different people over the course of decades, owned perennials may survive from previous gardens. They remain the property of the erstwhile nurturer, thus creating islands of external ownership within the plot.[354] Useful perennials which have established without human assistance, though, enter into the property of the current gardener.[355] In both cases, gardeners will retain the plants in the process of clearing, typically cleaning their bases to reduce their susceptibility to fire during subsequent burning, and lopping or coppicing larger dicotyledonous trees to prevent their crowns from overshadowing the plot later.

Clearing proceeds in two stages: the removal of undergrowth (WEI BEI: shrubbery/ you clear), followed by the felling of trees (TEI BAXAI: trees/ you cut). Once the cut matter has dried out sufficiently, branches and twigs are gathered, heaped, and lit—the stage of firing the plot (PILI TI BLASO: garden/ fire/ you set).[356] Depending on the success of the operation, the procedure is repeated a few times until

all material other than tree stumps and felled trunks has been reduced to ashes. The plot is then cleared of any remaining tangle to render a smooth ash surface. Upon this, gardeners will wait for a few days of light rain to soften the soil before they commence planting.

Four forms of propagation are recognised, their substantial degree of differentiation suggesting a longstanding tradition of cultivation:

- BAPLEI: broadcasting tiny seeds by shaking the dried plant by its roots;
- BEPERO: broadcasting larger seeds by throwing them over the plot;
- BAWAI: planting of various kinds of propagules by digging;
- MOU: planting by inserting suckers deep into the ground.

Only the two latter require tools, which in turn are limited to a piece of branch and a bushknife to make smaller or larger planting holes respectively, and a digging stick to make cavities for banana or sago palm suckers (see Plate 10).

Once planting has been completed, the garden in the narrower sense has been established. It remains a "young garden" (PILI YONOU) during about its first year, then turns into an "old garden" (PILI TÖNI). The transition takes place between the fruiting of the originally planted banana suckers and the fruiting of new suckers established from these. It is accompanied by gradual vegetational change, as the original variety of crops, harvested in the succession of their maturation periods, gives way to an increasingly uniform and ever dwindling complement, while at the same time the regrowth advances and deliberately managed trees and tree-palms may get established. Weeding activities (SUSUP BEI: herbs/ you clear) are instrumental in this change, as they shift from blanket coverage for the entire plot towards specific attention to single plants. Individual rights contract accordingly, remaining only for the nurtured perennials, while the plot reverts to common access, in a pattern common to swidden systems at large (cf. p.64).[357]

There are, therefore, three floral and legal dimensions to gardening in Krisa, captured by three corresponding local concepts:

1. planting garden crops: PLANIM KAIKAI ("planting food")
   —establishes individual ownership within the transient confines of the plot;
2. regrowth: SAMTING KAMAP NATING ("things growing by themselves")
   —shares the individual ownership of the plot in the short term, which though it obliterates in the long term;
3. planting perennials: PLANIM OL STRONGPELA SAMTING ("planting the firm things")
   —establishes individual ownership within the transient confines of the plot in the short term, which it transcends in the long term.

Human assistance for perennials, whether through planting or weeding patterns, therefore ensures both their ecological and legal survival. The interchangeable use of two Tok Pisin phrases denoting the respective maintenance activities reflects this correspondence: "cleaning the bottom" (KLINIM AS) of a tree or tree palm qualifies simultaneously as securing ownership over, or "looking after" (LUKAUTIM) the plant—a concept which applies similarly to the safeguarding of territory through human presence, to which the respective plant management is in turn integral (cf. p.215).

In fact, human assistance for perennials transcends not only the transitory ownership of garden plots, but may transcend the very land rights which control gardening itself, producing vegetational markers which reflect territorial claims (cf. pp.215ff.). On the one hand, therefore, the planting and/ or nurturing of perennials in particular, and gardening in general, is principally a male affair, due as much to its physical demands (cf. p.264) as to its legal implications, which affect primarily men as representatives of their clans. On the other hand, planting of perennials remains tightly regulated under peaceful, nonexpansive conditions, to prevent confusion of land rights. It remains strictly limited to the land of one's own clan, even though gardens may upon consent also be prepared on the land of another (cf. p.274).

Presumably due to the political importance of gardening, any male will prepare his own gardens from adolescence onward, and thus form the head of a separate gardening unit, irrespective of his marital status and of economic or domestic attachments otherwise (cf. p.265). Females, though, will remain with their unit of origin until marriage. Only separated or widowed women form rudimentary gardening units which rely on male labour input but maintain recognised gardens of their owns (cf. p.266, n.335). The number of gardening units can therefore substantially exceed the number of households, manifested in the contrast of 90 units ascertained during the garden survey (cf. Appendix 11) vs. 70 units ascertained during the consumption and activities survey four months later (cf. Appendix 10).

Regardless of a plot's complement of individually owned perennials, the plot itself reverts invariably to common access as the regrowth advances. As its special legal status lapses, so it dissolves conceptually, merging back into the forest. The precise point of either transition, though, remains vague. In fact, both the demarcations themselves and the correlations between them become ever more diffuse as a garden advances in age. The original transition from forest to garden doubles straightforwardly as that from common to individual access, and happens unmistakably with clearing, which leaves a human mark on the default environment and thus effects a categorical change (cf. pp.267,274). The transition from 'young' to 'old' garden is much less distinct in time, yet still clearly defined botanically (cf. p.275). The subsequent transition from individual to common access, though, is hazy, and does not necessarily occur in unison with the further transition from 'old' garden back to forest. This is similarly hazy in turn and occurs imperceptibly some time between the takeover of regrowth (WEI ANUWI: shrubbery/ grows) and the emergence of tall trees (TEI NUO: trees/ big)—a process which may span several years and remains ecologically vague. The sole true discontinuity in the entire sequence, both conceptually and legally, is therefore the act of clearing. Importantly, neither is the cropping of the plot, nor much less plot abandonment.

If the outlined sequence describes the framework in which gardening proceeds, actual cases vary extensively within and across gardening units in terms of schedules, sites, cropping patterns and management schemes. Indeed, such variability is a defining aspect of the system and essential for its functioning. By offering the individual a wide-ranging freedom of choice, it encourages both the generation of a resource-rich environmental mosaic and supports the mobile lifestyle necessary for its maintenance and use. Case Study 8 presents a selection of information collected during the garden survey (cf. Appendix 11), to illustrate the range of parameters which I will address more systematically under the following headings.

Case Study 8: Variability of Gardening Parameters in Krisa

Catherine Ai currently cultivates a small garden just outside the village and not far from her house, adjacent to the Krisa–Pasi road on land shared by her husband's and another clan. Its establishment followed a combination of serendipity and observation. During the long dry season of 1997, fire set to the roadside for maintenance spread to a large KWILA tree a bit further up the embankment. This toppled, tearing a sizeable clearing, which recommended itself for a garden plot, considering site characteristics and the couple's advanced age which encumbers work. Thus, the area had been used for gardening in former generations, tantamount to a reputation for fertility, which proved itself later on. A few years ago, it had been logged, hence regrowth was little advanced and easy to clear. Besides, the road is only a few metres away, and therefore access convenient. So Catherine suggested to her husband they make a garden in the site, upon which he cut the remaining trees.

Gertrud Bewa likewise used an existing clearing to establish a small house garden, which though has subsequently not thrived too well. Rather, in this case a virtue was made of necessity when it turned out that an intended construction site was poorly drained. Thus, Gertrud and her husband, living at the outskirts of the village in his father's camp on his clan's land, had planned a new house just opposite from their old one. The site had been a cattle corral some years ago, and was now cleared by a relative for their purpose. But when the work was completed, the couple realised that the ground was too wet for a house. They decided to make at least some use of the cleared space, planting crops tolerant of high moisture. As the soil is however not of good quality they do not invest too heavily into maintenance and do not intend to continue the plot for a long time.

Hermann Kei and Pauline Aire are currently cultivating two small gardens, some 5 and 15 minutes respectively from the last house at the outskirts of the village, and another 5 minutes from their own, both on the land of Hermann's clan. The couple and their children had been away from the community for three years during which Hermann pursued wage labour. When they returned not long ago, they had therefore no recent plots and wanted to establish new ones quickly, which both locations permitted.

The nearer site is part of a larger one that had originally been cleared by a distant relative of Hermann's who also offered another parcel to a third member of the clan. The whole site was obviously gardened in the past, as it contains mature TULIP trees and a betel palm. At present, the crops in the two adjacent parcels are already fairly advanced, while Hermann and Pauline are only in the process of planting theirs. On the day of the survey, Pauline carries with her two banana suckers, which she leaves at the site to plant them on her return in the afternoon, and several AIBIKA cuttings, with which she proceeds to the second, more distant site.

This had been gardened by Hermann's nephew—his sister's son—only a few years ago, who though abandoned it when he left the community for study. As Hermann and Pauline were one day making sago in the adjacent patch, they realised the potential of the site for their purposes: a parcel of fertile soil slopes slightly downhill; regrowth was little advanced and hence the site easily cleared within a day; and surviving banana plants, spared during clearing, promised an immediate harvest. In fact, regrowth had not been too advanced even when the nephew prepared his garden, since another garden had been in the site previously when people took advantage of a landslide that opened up the vegetation. A more recent landslide took however part of the nephew's garden away, and Hermann and Pauline are afraid that further slips might happen. Therefore, they do not plan to expend too much effort on the site. After all, they only want to bridge the gap in their supply of garden foods until a larger garden will be yielding which they are currently planning in a different part of the area.

They can, however, fall back on at least two further gardens of previous years. One is located roughly in-between the two new ones, prepared before Hermann had left for employment. Members of the extended family had cut a large plot in a communal effort and then subdivided it into smaller parcels for Hermann, his two brothers, his two sisters who are both married to non-Krisa men, and their widowed mother, respectively. Some perennial crops remain in the site, but it has been badly damaged by a landslip meanwhile. The other

garden, with a similar history, they almost fail to mention, as it is located at the other end of the village on the land of Pauline's clan. It was prepared by her male relatives, who cleared a large plot and then subdivided it among themselves and several female clanmembers, including Pauline. From both old gardens, the nephew's garden, and a surviving small house garden, the couple occasionally harvest banana, AIBIKA and pumpkin vines. Otherwise, they rely at present on sago and TULIP leaves.

Arum Ukong* made use less of opportune circumstances than set out with firm ideas for preparing his two most recent gardens, which he commenced several months ago when he had otherwise only a house garden. They are set in contrasting, yet both originally promising locations; however, each got afflicted by a different kind of mishap and thus did not develop to its full potential.

The nearer one is a small plot not too far from his house, within the confines of the village grounds, thus free for use by anyone. The area is old garden land with fertile soil and replete with planted trees. Indeed, in Arum's garden itself, an AIBIKA bush of enormous size testifies to a former garden in exactly the same location. Arum had special plans with this plot: "It's small because it's really just a fake garden. I wanted it more as a kind of nursery for banana suckers. As it's nearby it is easy to take the suckers and plant them in another garden... I liked making a garden here, it's a good site—how could I know a landslide would happen!?" Now he keeps maintaining and harvesting what the calamity has left.

The more distant garden is about 20 minutes' walk from his house, situated on the land of his mother's clan, which represents his sole Krisa ancestry and with which he has chosen to reside and affiliate, his late father having been native to one of the Mbo-speaking communities. This plot is large and located in an area of tall forest, several years after logging. Although it is near a camp abandoned only some years ago and an area where gardens were made in the past, Arum is not aware of any gardens ever made before in this very location. He chose the site because he felt drawn to preparing a garden right in the forest, cleared the site all by himself and contributed some of the felled trunks to a house he helped to build at the same time. Unfortunately, the burning afterwards did not proceed well so he could plant only patchily, and yields are limited. But the soil in this location is excellent, so he plans to clean and burn the garden again at the height of the dry season for replanting, and also to extend the plot further in the future. Meanwhile, he lives mainly off sago and TULIP leaves provided by the female in-law with whom he has formed a household.

Bewa Tou as one of the oldest members of the community is a keen gardener despite his advanced age and can look upon a long history of gardening, which reaches back beyond the second world war. He has a number of gardens in various locations and stages of growth: some more recently prepared, some matured over many decades, others repeatedly re-done. Often, their stories are intricately connected with his personal history or with that of the community, or indeed can be linked to major outside events.

He prepared one of his very first gardens before the war together with his maternal relatives on their land, being closely associated with them at the time as his mother and her children had gone to live with her own clanmembers upon his father's early death. In this particular garden site, the soil was exceptionally fertile, and until recently he indeed harvested MAMI ("lesser yam") from there.

Another site, not too far from his present house at the outskirts of the village, was already cleared by his father. It was subsequently re-done twice by Bewa himself and established as a LIMBUM grove, the last time before he took his family to live in the Mbo-speaking community of Ossima when missionaries first established an agricultural station there (cf. p.217). Upon his return to Krisa over a decade later, he cleaned the plot once again to plant not only garden crops but also cocoa trees for cash cropping, which had become fashionable with the agricultural extension service. Most of them have meanwhile died, while the LIMBUM palms established before his departure have matured and were recently felled and processed for use in his new house.

Another site, yet closer to his house, in which he currently maintains a large garden replete with crops, has a similarly long history. As a very young and yet unmarried man he first prepared an even larger plot there, together with two of his brothers. Later, he planted

AIBIKA together with his wife, a third time banana, none of which survive. When he prepared a garden there the fourth time, he also moved his house to the present location and planted a banana next to it which has extraordinarily survived and grown to gigantic proportions. Subsequently, a relative cleared the site for establishing a cattle corral, then the latest in agricultural projects, which though was abandoned after several years (cf. pp.218f.). Since the site is very fertile, Bewa decided to make a garden yet again in the site two seasons ago.

Last year, he established a garden in the ancient settlement site Api, rendered spiritually safe only some years previously through application of holy water (cf. p.227) and subsequently affected by logging. He is currently clearing a further plot in its vicinity.

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* Arum sadly died a few months later, around the turn of 1998/ 99 in between my two spells of field research. He was reportedly the victim of death sorcery directed at a relative engaging successfully in commercial agriculture, for whom he had begun to provide his labour.

Variability—Schedules[358]

The timing of gardening is suggested by a combination of the technicalities of plot preparation, the crops' vegetational cycle, and the seasonal climatic cycle. On the one hand, plot preparation commonly takes about five to six months from the first clearing activities to the completion of planting, while crop plants typically take up to a year to mature sufficiently to yield propagation material. On the other hand, dry and wet seasons in the region follow the monsoon, with rainfall diminishing around the middle of the calendar year and peaking around its turn.[359] Hence, gardens are ideally made annually, with work commencing around July. Thereby, propagation material can be taken from the previous year's garden; plot preparation coincides with the dry season, to aid the drying and burning of vegetable matter, keep weeds at bay, and limit the exposure of unprotected soil and gardeners to downpours; and the onset of the wet season aids establishment of the newly planted stock.[360]

Yet, deviations from this ideal are common, borne from necessity as much as from preference. Thus, meteorological or personal circumstances may lead to a shifting of the schedule, or may suggest to downscale or indeed suspend activities for the year. Prolonged rains may put gardeners off work altogether; premature rains may hinder burning and promote weed growth, thereby reducing effective garden size and hence labour requirements; prolonged drought may spoil crops already planted and render further efforts redundant; temporary absence, illness, or more pressing commitments during critical periods may prevent gardeners from applying themselves fully to the task or cause delays; and lack of manpower may impair the ability of gardening units to perform the labour-intensive stages of plot preparation.

Besides such external determinants, the principal source of a gardeners' dedication is his personal inclination and attitude (gardeners are principally male—cf. pp.264,276). At the one end of the spectrum are men who will prepare one or more plots every year with considerable commitment, and equip them with an array of different crops. They clearly enjoy laying out plots and planting; take pleasure in their gardens and the food they yield; take pride in the number of plots prepared; and bask in the admiration of like-minded gardeners who will bestow on them the epithet APIANAI ("APIA's son"), recalling the habits of a bird which reputedly clears plots in the forest, akin to human gardeners.[361] In the past, their zeal would have constituted one of the prerequisites for polygyny (cf. p.264). At the other end of the spectrum are men who go for years without making a new garden. Yet, once they decide to

establish one, they may expend great effort in terms of plot size and vegetation type cleared. A frequently quoted motivation for such an irregular undertaking is that one "just felt like it that year". If this casual approach has come to be viewed disapprovingly by adherents of the new faith (cf. p.273), traditionally it remained without sanctions. In terms of human ecology, it is entirely permissible, considering the secondary role of garden crops in the diet (cf. pp.230ff.,239,273).

Variability—Sites

Regarding the relative location of a garden, a threefold distinction generally applies in Krisa, into

- house gardens;
- nearby gardens within easy walking distance from the house or village;
- distant gardens in the vicinity of forest camps.

In conceptual terms, though, only the two latter are commonly classed as gardens. House gardens, in contrast, are recognised as the same principle ecologically, but are semantically classed apart, as "space around the house" (ARERE LONG HAUS), which serves aesthetic purposes and fulfils the role of a pantry, providing convenient access to food during illness or heavy rains.[362]

The fundamental conceptual contrast between true garden and domestic space suggests that this distinction is prior in evolutionary terms, while the differentiation of gardens in reference to their distance from the village may be a later elaboration, reflecting the increasing sedentisation of the population in the residential centre (cf. pp.220f., n.221). After all, distant gardens are at once either nearby or house gardens for forest camps. They may, therefore, have similarly been labelled as either "garden" or "space around the house", respectively, during an age when dispersal to the forest was yet the norm. In any case, the present-day differentiation continues to reflect that gardening is limited to the proximity of dwelling places (cf. pp.267f.). Today, nearby gardens are those most commonly prepared, followed by house gardens. Gardeners may simultaneously maintain all three types, or only a selection, and may vary the respective pattern in the course of their lives.

The precise location of a garden is largely determined by a combination of soil quality, accessibility, and original vegetation type. Soil quality is the overriding parameter and receives much attention, without though manifesting taxonomically. There are several ways to establish fertility:

- tradition:
  sites remembered as repeatedly cultivated thereby demonstrate their value;
- present gardens:
  prolific yields suggest similar productivity of adjacent ground;
- original vegetation:
  lush growth indicates a rich substrate;
- soil characteristics:
  soft, black matter equals fertility.

No fertilisation is practised beyond the original burning of the plot.[363] Plots which prove unproductive in the cropping phase are temporarily abandoned, then stocked with undemanding perennials.

In contrast to the unequivocal value of soil quality, the value of accessibility and original vegetation type depends on the abilities and purposes of the gardener. Convenient access, in particular through former logging roads, usually constitutes a bonus. So does proximity, which facilitates maintenance, both aspects at once discouraging depredation by pigs, which are deterred by human sounds carrying over from dwellings, and by human smells persisting in the vegetation. Still, there are some gardeners who prefer hidden sites in the forest. Similarly, slopes are favoured for root crops because of their good drainage, but are prone to landslides and awkward to work when too steep. Likewise, easily cleared vegetation appeals in particular to older men and single women, while young men may choose to cut a plot in tall forest, which at once generates plentiful construction material and firewood.

Shape, size and distribution of gardens follow partly environmental givens, partly individual preference. The prototype is quadrangular or rectangular, but adjacent gardens or topographic features such as gullies may necessitate an adaptation of plot boundaries. In terms of area covered, gardens fall into three major categories:

- small:
  ca.100-300 square metres—boundary lengths some 10 metres;
- medium:
  ca. 500-700 square metres—boundary lengths some 20 metres;
- large:
  one to several thousand square metres—boundary lengths 30-50 metres or more in elongated shapes.

Compared to swidden sizes worldwide, which average around 0.5 ha/ 1 acre (cf. p.49), Krisa gardens are therefore situated at the lower end of the spectrum.[364] Any kind of garden—around the house, nearby, or distant—may assume any size, and gardeners may maintain any combination of these. Large plots are sometimes cleared collectively by relatives, but then subdivided into a number of medium-size parcels.[365]

Large gardens, if with parcels in various stages of growth, may also result from smaller plots prepared successively in adjacent locations, either by relatives or by individual gardeners. Such sequential extension of plots is one of broadly two spatio-temporal patterns of gardening. The other is the scattering of plots, both synchronically and diachronically, from as little as some hundred metres apart to as much as opposite parts of the village or indeed the territory. Plot extension is advisable if a prolific garden suggests that adjacent locations are similarly fertile; it also facilitates the transfer of propagation material and the harvesting of variously mature resources, and is therefore particularly attractive for older and less mobile gardeners, including women with many children. Plot scattering, on the other hand, enables gardeners to take advantage of a variety of environmental conditions, variously suited for different crops, thus adding variety to the menu and promoting diversity among the environments that develop. It also supports the coherence of subsistence activities, offering more opportunities to access gardens in conjunction with other tasks, such as processing sago, hunting, or collecting larvae and TULIP leaves (cf. pp.268ff./n.341,p.271). Furthermore, it spreads the risk of such imponderables as landslides, pest infestation, or pig depredation. Aside from any tangible benefits, though, it may as much satisfy someone's liking for change. As with most other parameters of gardening, no hard and fast rules exist and individual choice is paramount. Besides, one course of action does not preclude another, and individual

gardeners may combine various approaches, increasing variability within as across gardening units.

Variability—Crops

Plants introduced into the plot during initial preparation comprise almost exclusively food crops. The sole exceptions are tobacco and occasional decorative annuals such as *Tagetes* or *Zinnia*. Table 24 (p.283) provides an overview of the crops grown regularly, while Case Study 9 (p.285) and Plate 11 illustrate crop abundance and diversity by example of one richly stocked garden.

Overall crop diversity is amplified by differentiation into landraces. Over 30 different forms of banana are named (cf. p.236, Table 15 [p.232]); numerous forms of other crops remain without individual names, but are identified by their morphological characteristics; in particular:

- sweet potato: colour of tuber, leaf shape, maturation period
- AIBIKA: leaf shape, stem colour
- sugar cane: taste, colour
- pumpkin: fruit shape, leaf shape.

Arrangement of crop plants in the plot is in keeping with their growth habits and plot microclimates. Thus, banana suckers tend to be positioned close to tree stumps and fallen trunks, presumably since they can outgrow their shades quickly, while initially receiving protection from nightly chills. Yams tend to be planted close to remaining stems which can serve as stakes. Crops with slim growth habit, such as sugarcane, PITPIT, or corn, may be placed close together, while those with large leaves, such as banana or taro, are placed at a distance from one another and other crops to prevent shading. Vines forming a dense ground cover, such as from sweet potato or pumpkin, are relegated to an otherwise unoccupied portion of the garden to prevent suffocation of other crops.

Although gardens may be stocked with the entire selection of crops listed in Table 24, actual crop composition in any one plot, and the corresponding degree of diversity, or intercropping (cf. pp.50ff.), depends on a combination of location, garden age, and gardeners' personal crop inventories. Location may limit the selection of crops planted following considerations regarding the crops' characteristics and appeal to fellow humans and pests. Thus, the further a garden from the gardener's dwelling, the more difficult it is to guard valuable crops (cf. p.260); deter pigs (cf. p.281); maintain delicate crops; and monitor fast ripening crops in order to harvest them rapidly upon maturity. Crops especially affected by distance are:

- sweet potato, Chinese taro, sugarcane and corn—relished by pigs;
- OUPA, KABIS, and corn—mature quickly early on;
- pineapple—requires diligent weeding over a long time.

Table 24: Krisa Garden Crops

			IV	V	VI-VIII			IX
English and/ or Tok Pisin name	Krisa vernacular name, and, if applicable, reference number corresponding to Appendix 15	botanical identification (after French [1986])	plant part used: **s**eed crop **v**egecrop	mode of propagation: **s**eed culture/ self-**(s)**eeded **v**egeculture	availability			relative frequencies (impressionistically assessed)
					early pioneer conditions	1st year	>1 year, depending on maintenance	
starch crops								
banana/ BANANA	WI, 31 (cf. Table 15)	*Musa* sp.	v	v				++++*
taro/ TARO	PISSI (cf. Table 17)	*Colocasia esculenta*	v	v				++*
Chinese taro/ TARO KONGKONG	OPUSO (– " –)	*Xanthosoma sagittifolium*	v	v				++
greater yam/ YAM	KUP, 44 (cf. Table 16)	*Dioscorea ?esculenta*	v	v				++
lesser yam/ MAMI	KUBISSA (– " –)	*Dioscorea ?alata*	v	v				+
cassava/ TAPIOK	TEIPOU (– " –)	*Manihot esculenta*	v	v				+
sweet potato/ KAUKAU	NDUKU (– " –)	*Ipomoea batatas*	v	v				+++*
leafy greens								
AIBIKA	WASI, 37	*Hibiscus manihot*	v	v				++++
amaranth/ OUPA	WASA'I	*Amaranthus* spp.	v	s, (s)				++
?Indian mustard/ KABIS	—	*Brassica ?juncea*	v	s, (s)				+
KARI	—	(an aromatic Apiacea)	v	s				+

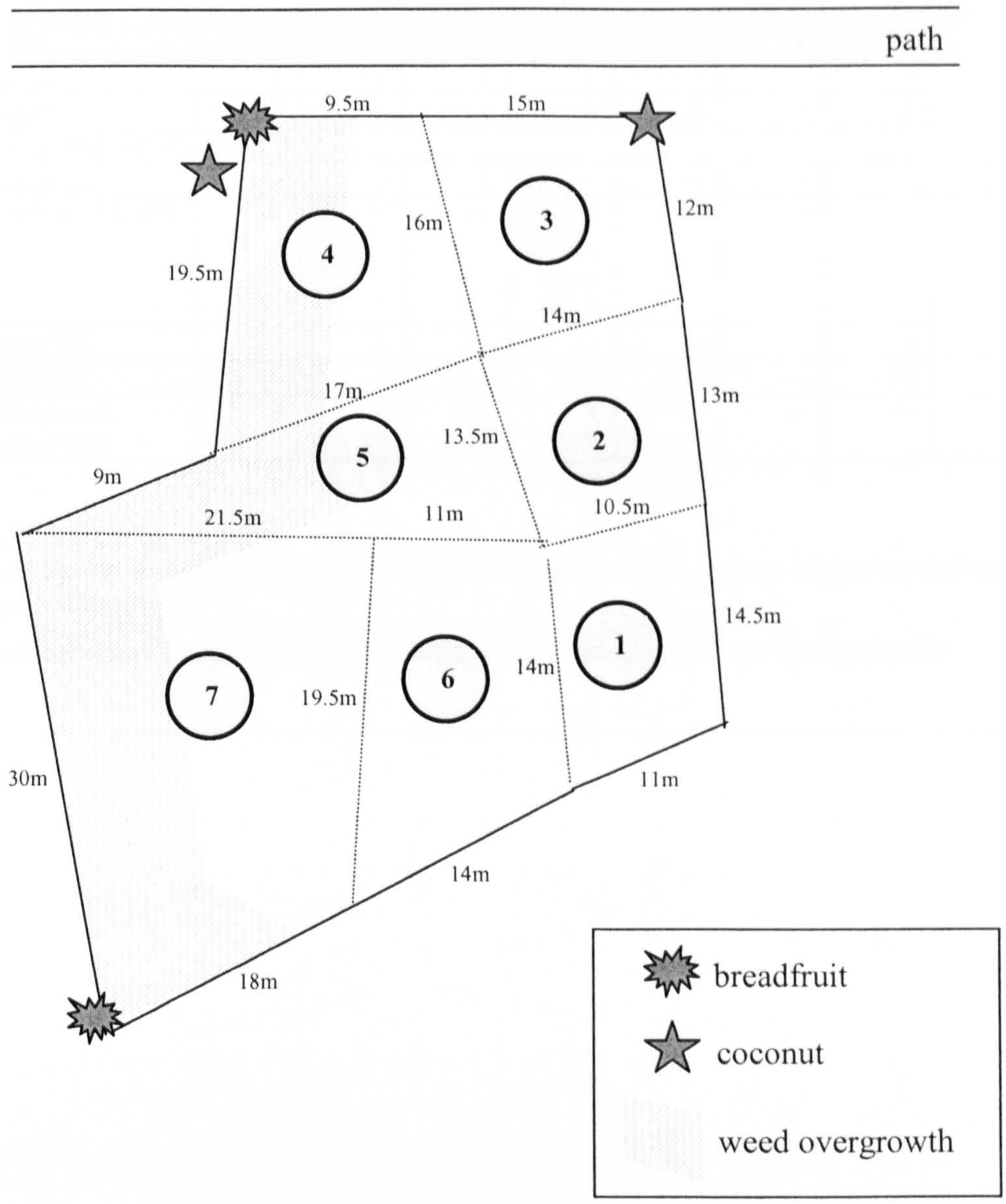
* The relative frequency of sweet potato as ranging in between banana and taro accords with their relative frequencies as foodstuffs (cf. p.230), but cf. n.301.

stem/ inflorescence								
PITPIT	PUIWAR, 49	*Saccharum edule*		v	v			++
sugarcane/ SUGA	NOU, 48	*Saccharum officinarum*		v	v			++
seed & fruit								
pumpkin/ PAMKEN	SINEGU	*Cucurbita maxima/ moschata*[†]	s	v	s			++
choko/ SAKO	– " –	*Sechium edule*	s	v	s			+
melon/ MELON	WII ("water")	*Cucumis melo*	s		s			+
cucumber/ KIKOMBA	– " –	*Cucumis sativus*	s		s			+
corn/ KON	SAU ("pandan"), cf.29	*Zea mays*	s		s			++
bean/ BIN	—	*?Phaseolus vulgaris*	s		s			+
peanut/ PINAT	—	*Arachis hypogea*	s		s			+
tomato/ TOMATO	—	*Lycopersicon esculentum*	s		s			+
pawpaw/ POPO	—	*Carica papaya*	s		s, (s)			+
pineapple/ PAINEPOL	WII ("water")	*Ananas comosus*	s		v			+
stimulants								
tobacco/ BRUS	SOXAI, 36	*Nicotiana tabacum*		v	s, (s)			++

[†] According to the Agricultural Systems Working Papers (ASWP:chpt.2-data field 24), the species of pumpkin cultivated in PNG is *Cucurbita moschata* (cf. Table 1), while Powell (1976:116) refers only to *Cucurbita maxima*. French (1986:102) lists both species as cultivated in PNG, with the specification that *C.moschata* "is better suited to coastal areas" and "does not have hairy stems". Concerning the former criterion, therefore, the species cultivated in Krisa might be *C.moschata*, although its commonly hairy stems rather suggest *C.maxima*.

Case Study 9: Crop Abundance and Diversity in Krisa—Example

The following plot layout (below) and crop inventory (overleaf) describe a 'nearby garden' (cf. p.280) of an avid gardener, about 5 minutes' walk from his house at the outskirts of the village, roughly 2,000 square metres in size and approximately one year old; the same garden is shown in Plate 11:



	number of individual plants in sector							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**TOTAL**
crops (cf. Table 24)								
banana	16	13	21	22	14	22	16	**124**
taro	8	36	15	21	54	2	24	**160**
Chinese taro	—	—	3	4	—	—	—	**7**
greater yam (YAM)	1	3	—	—	—	—	—	**4**
cassava	—	1	1	1	—	—	—	**3**
sweet potato	*	*	—	†	*	*	†	(see notes)
AIBIKA	14	11	17	14	16	16	34	**122**
sugarcane	1	—	1	1	—	—	—	**3**
pawpaw	—	—	—	1	5	1	2	**9**
other plants (cf. Appendix 15)								
coconut (2)	—	—	1	—	—	—	—	**1**
breadfruit (55, 56)	—	—	—	1 large, many small	—	—	—	**>>1**
mango (58)	—	—	—	—	—	—	1	**1**
ABUSI (32)	—	—	—	—	—	—	~17	**~17**
various trees, unidentified	1	—	2+1	1	—	—	—	**5**

* tubers harvested, but vines proliferating and covering the whole section; original mounds no longer distinguishable

† tubers harvested, but some vines remaining; original mounds no longer distinguishable

As a general rule, therefore, the degree of intercropping increases with proximity to a gardener's dwelling, house gardens typically comprising the largest selection.[366] Besides the aspect of distance, the crops' demands on the substrate may lead to further selection. In particular, root crops benefit from good drainage and are therefore preferably planted on slopes (cf. p.281). Banana and AIBIKA are most tolerant of a wide range of conditions and accordingly most widely distributed.

Garden age further limits the selection of crops present through its effects on crop survival (see Table 24 columns VI-VIII). Crops which thrive under pioneer conditions, such as OUPA, KABIS, and corn, establish, mature and perish quickly and are therefore only found in gardens within the first few months, excepting self-seeded individuals of the two former, which are later used for repropagation. The majority of crops establish more slowly and reach maturity during the garden's first year, then die, as the plants reach the end of their life cycle, are killed through harvesting, or are suffocated by the advancing regrowth. Yet, appropriate maintenance can prolong the life of some. Thus, the tops of taro and yam can be replanted upon harvesting, while all perennating crops benefit from diligent weeding. With such care, banana and AIBIKA can indeed survive for up to 10-15 years. Without it, only they, the canes and pumpkin, which can all persist among substantial weed overgrowth, will survive beyond a garden's first year. To various degrees, therefore, crop variety plummets as a garden advances in age, with banana and AIBIKA as the most enduring crops remaining the most widely distributed in time, as they are in space (cf. above).

The relationship between garden age and crop survival, in turn, is the most important factor contributing to gardeners' personal crop inventories, and hence to the maximum selection they can plant, due to the principles of the repropagation cycle (cf. pp.59ff.). In a scheme shared with swidden systems at large, established gardens constitute the principal repository of propagation material in Krisa. In fact, planting days usually commence with a visit to a previous plot, where banana suckers, AIBIKA cuttings, taro tops, sweet potato vines or similar are collected, before gardeners proceed to the newly prepared plot to instantly plant the procured stock. Seed material may likewise be obtained en route from live plants, in particular self-seeded individuals of OUPA and KABIS and surviving individuals of tobacco. Incidentally, their instant transfer minimises the loss of their tiny seeds. They may, however, also be stored from a previous harvest, as are typically the larger seeds of such crops as the cucurbits, corn, beans, peanuts and tomatoes.

Ex-situ storage, short life spans of the parent plants, and low crop frequencies, though, all entail threats to the availability of propagation material. Ex-situ storage, which is necessary for most crops propagated by seeds, requires two additional steps in the process of repropagation, introducing additional risks. Thus, seed collection may suffer from inappropriate timing or fail altogether due to adverse environmental conditions or unavailability of the gardener, while seed storage may expose material to scattering, storage pests and loss of viability. Short life spans of the parent plants reduce the likelihood of repropagation within a crop's lifetime, which renders personal crop inventories the slimmer the less frequently gardeners prepare new plots. Low crop frequencies, in turn, not only manifest the risks of both ex-situ storage and short life spans, but amplify them by increasing the danger of total crop failure upon stochastic events such as adverse weather conditions or pest infestation, unexpected lack of soil fertility, or unintended lack of plot maintenance.

The overall crop profile for the community reflects these aspects, with the type and endurance of propagation material corresponding to crop frequencies (see Table 24 columns V-IX). Thus, short-lived crops propagated by seed and lacking self-

seeding are found at the bottom of the scale; long-lived crops propagated vegetatively at the top. Banana and AIBIKA top the list overall, benefiting not only from perenniality and vegetative propagation, but also from their tolerance of a wide range of environmental conditions (cf. p.287). The distribution of individual crop profiles reinforces this contrast, as only avid gardeners are able to maintain infrequent crops through prompt repropagation, while occasional gardeners need to content themselves with frequent crops, principally banana and AIBIKA, which tolerate sporadic repropagation. A broad selection of crops is therefore principally a function of gardeners' zeal, rather than of their appreciation of variety, which though may prompt their enthusiasm.

More generally, individual crop inventories reflect to some extent personal inclination, with tobacco found mainly in the gardens of smokers (as likewise the perennial betelnut in the gardens of chewers), and selections of banana landraces indicating as much the taste preferences of their growers as availability. Also, uncommon crops are always the object of some horticultural desire, and I have repeatedly been asked to save and pass on seeds after returning with rare produce from the market. Sporadic gardeners may try to replenish their stocks in the same way, by asking relatives for propagation material. Avid gardeners may indeed accomplish the same for the community at large, acquiring new landraces during visits to other places. In this way, more than 10 forms of banana have been introduced in Krisa in historical times (cf. Table 15 [p.232]). Beyond such manifestations of personal endeavour, though, crop profiles for both individuals and community follow by and large the laws of the repropagation cycle. They are less a reflection of the crops' popularity, than this is a reflection of the combined effects of crop longevity and the rate of plot preparation.

Variability—Management Schemes

Plant management schemes in Krisa represent various modes of balancing the addition, protection, and promotion of desirables with the removal of undesirables (cf. Table 9 [p.140]). They operate across the three dimensions of gardening recognised locally (cf. p.275). Thus, the crops ("food") introduced initially constitute only part of the desirables ever present in a plot. Various perennials ("firm things") may be added later on, their uses spanning the whole spectrum of subsistence needs. Depending on their demands, their establishment requires variously extensive removal of undesirables, engendering a variety of weeding regimes. Yet, the regrowth ("things growing by themselves") itself contains numerous desirables, which are either routinely nurtured in turn, or whose protection is balanced against that of added plants, within or across plots. In this way, most vegetal resources in Krisa rely in one way or another on initial plot preparation. Garden crops (cf. Table 24) represent but a fraction of them. The majority are perennials which benefit from gardening through direct or indirect management, and through the legal security provided by the plot (cf. pp.260,274). Only a few vegetal resources require long-term absence of human impact and are thus limited to oldgrowth forest. The respective management practices are presented in overview in Appendix 17, its format matching the presentation of uses in Appendices 15 and 16 (cf. p.241). Management schemes for particular plots integrate these requirements as well as site characteristics, personal preference, and the individual and collective need to ensure resource abundance in time and space.

The principal type of site characteristics are land rights. They determine the selection of resources that may be deliberately managed, excluding potential vegetational markers on alien land (cf. pp.215f.,272,276). This rule was once memorably clarified to me by one gardener who not only had gained access to a site through his wife, but whose wife's clan could only use that part of the territory through some ancient agreement with yet another clan. As I was wondering why he let his plot overgrow without supplementing the remaining banana plants with trees, I received the self-evident answer:

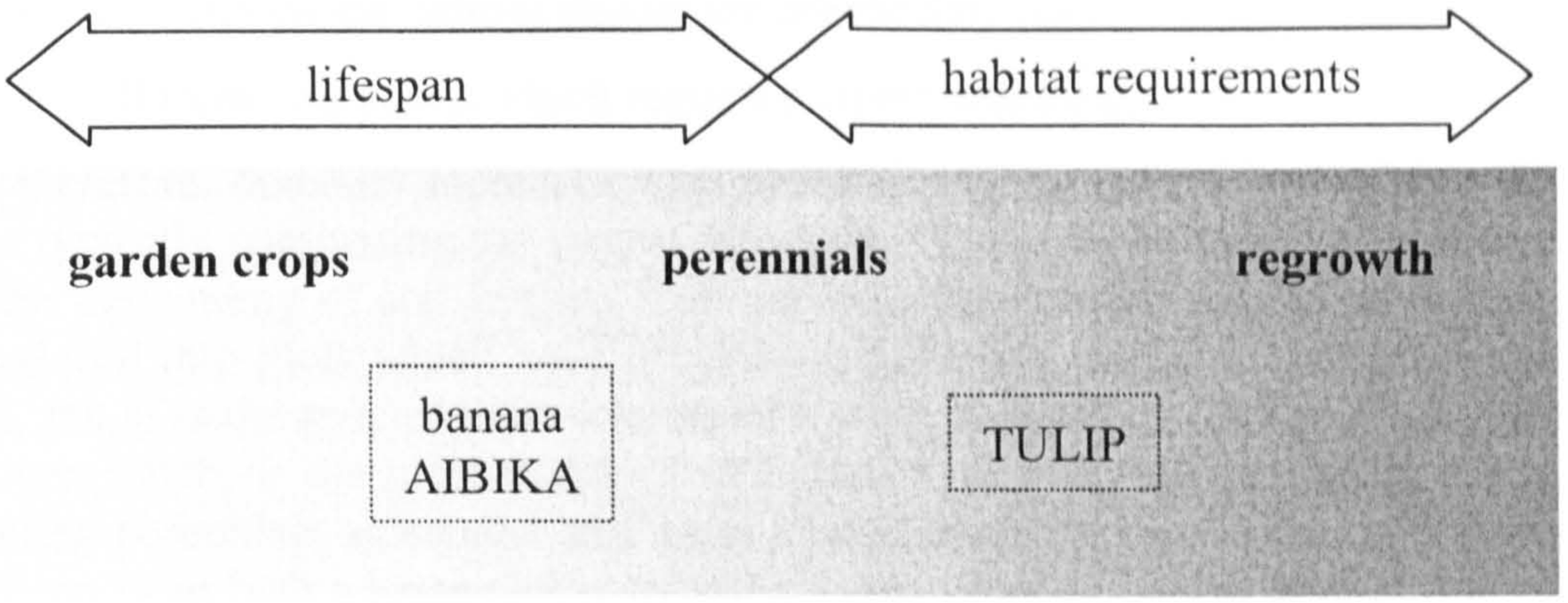
> "As I told you before: it's the land of [clan F2], hence we can only plant food; we cannot plant any of the firm things!"[367]

Of course, the threefold division of resources into "food", "firm things" and "things growing by themselves" may seem ambiguous in ecological terms. After all, the distinguishing criteria—lifespan and habitat requirements—are continuous (see Figure 15a on p.290). Thus, long-lived crops like banana and AIBIKA blur the boundary between garden crops and perennials, while generalists like TULIP blur the boundary between planted/ nurtured perennials and regrowth. In legal terms, though, boundaries are clearly delineated, and this is the sense in which the categories are understood locally. The critical parameters are woodiness and persistence rather than lifespan per se, distinguishing "firm things" from "food"; and management activities actually expended rather than possible, distinguishing them from "things growing by themselves". Indeed, the category of "firm things" requires that both criteria coincide (Figure 15b). Only then can ownership transcend the transient confines of the plot and thereby turn the plants into vegetational markers which reflect past human activity as transmitted in oral accounts.

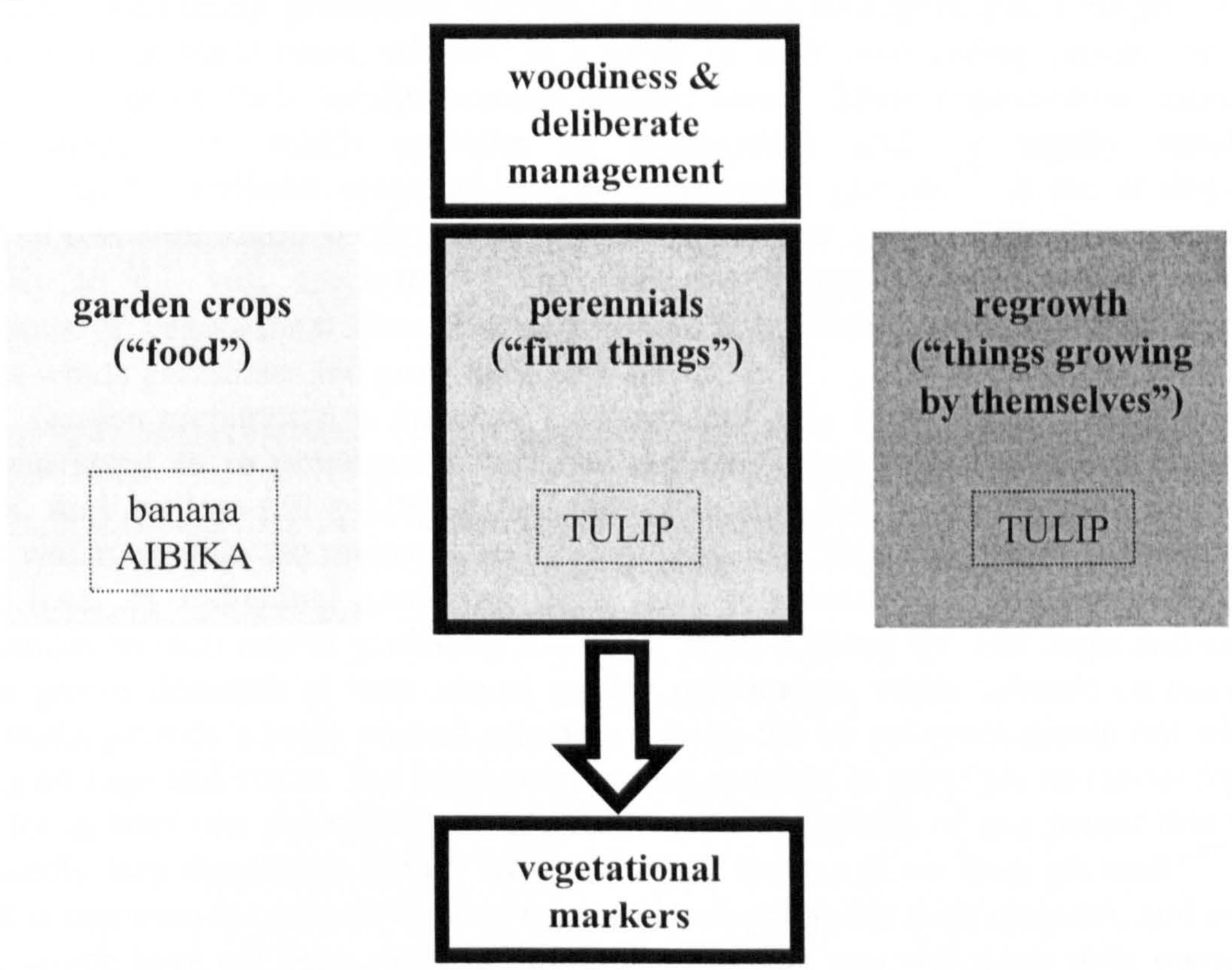
Hence, the range of long-lived resources which qualify for this purpose is limited, comprising principally trees, tree palms, the cordyline shrub (YUWA, 110—cf. pp.215f.), and partly bamboos and canes; ideal are vegetatively self-propagating plants, which thereby extend their lifespans, such as breadfruit, sago palm and reed grass (BOU, 47—cf. p.267). These in turn require planting and/ or nurturing for ownership to accrue. With obligatory cultivates like reed grass, both parameters are necessarily linked. With facultative cultivates like TULIP or breadfruit[368], though, two scenarios are possible. Thus, a tree which germinates spontaneously among the regrowth in an old garden reverts to common access together with the surrounding vegetation. If the gardener, though, begins to clean it, or has indeed introduced it into the plot as seedling or sucker, he establishes his exclusive rights to the plant. As he thereby establishes at once the rights of his clan to the site, he provides through his (publicly known and hence politically effective)[369] actions not only economic security for himself and his lineal heirs (cf. pp.215,260), but at once long-term territorial security for his entire clan—the ultimate form of economic security in turn. This correlation restricts deliberate management of "firm things" to the land of a gardener's own clan, even though he may by permission prepare plots for garden crops also elsewhere (cf. p.274). For, planting potential vegetational markers beyond one's own territory stakes new claims, indicates expansion, and thereby threatens the original landholders, as the Krisa migration to the coast has vividly demonstrated (cf. pp.216f.).[370]

Figure 15: Three Categories of Pl ant Management in Krisa

a) in ecological terms:



b) in legal terms:



A plot's location may therefore prohibit the deliberate management of perennials altogether due to land rights. It may also limit the spectrum of managed species following considerations similar as for garden crops (cf. p.282). In particular, distance discourages the planting of

- fruit trees, whose valuable crop is prone to plundering later on;
- coconut palms, whose shoots are relished by pigs;
- all trees and palms which require diligent weeding.

Again, therefore, diversity increases with proximity to a gardener's dwelling, house gardens typically comprising the largest selection. On the other hand, perennials tend to be less demanding of soil fertility than garden crops, and in particular palms may be introduced into plots which have proved unproductive during the cropping phase. Overall, TULIP as the species most tolerant of a wide range of conditions, especially of weed overgrowth, is the most widely distributed. If in this respect it takes the same role among perennials as banana and AIBIKA take among garden crops, it benefits in comparison from both a longer lifespan and a vastly more extensive habitat (variously mature secondary growth as opposed to garden), and is therefore yet more abundant.

As TULIP extends the principles of cropping patterns in Krisa in time and space, it demonstrates thereby the extension of the repropagation cycle to woody perennials (cf. pp.59ff.,287). After all, perennials, too, have a finite lifespan—even though this much exceeds that of garden crops—and require eventual repropagation if future supplies are to be ensured. Certainly, TULIP and other perennials may survive for at least one human generation; suckering plants like breadfruit much longer. Still, they will die at some point, whether as a result of their own ageing process or the gradual change of their habitat towards mature forest. Their regeneration requires garden preparation, which provides an ecologically and/ or legally suitable environment for artificial propagation and spontaneous growth.[371] If the ecological aspect of this connection is obvious for regularly planted/ nurtured species, it applies similarly to the vast spectrum of common access species which thrive under conditions of vegetational disturbance. The sole exception are the common access species which germinate and grow in mature forest.

Garden preparation is therefore essential, not only to propagate garden crops, but even more so to propagate perennials and encourage regrowth. Its frequency, though, may be low (cf. p.279). It depends ultimately but on the lifespan of those plants which provide the mainstay of local livelihoods. This correlation is illustrated at the level of individual gardening units by the influence of gardeners' dietary preferences on their rate of gardening activities. Thus, a liking for root crops and early garden greens demands at least annual garden preparation, while reliance on banana and AIBIKA permits a more relaxed schedule, which can be yet more drawn out when relying on sago and TULIP. The latter combination requires in principle no labour input at all for at least one generation, as reflected by the complaint of one parent that her supposedly lazy daughter's family was "living off the TULIP *we* have planted!"[372] In fact, it is common for parents to plant trees and tree palms for their children, and even plants which have not been explicitly designated in this way will upon their owner's death pass to his lineal heirs. Ensuring economic security is therefore an intergenerational task.[373] This principle extends to regrowth species, whose proliferation relies similarly on prior gardening activities. With TULIP belonging at once in this category, its abundance is destined. As a long-lived woody perennial

tolerant of a wide range of conditions and without the need for human assistance beyond vegetational disturbance, it is predictably "all around" (cf. p.273).

If individual food supplies are not endangered by extremely drawn-out schedules, collectively the present system of land use in Krisa is geared towards more frequent plot preparation. I shall argue under the next, and final, heading that this development may be historically recent, and that the slow rate found with some gardening units may represent the vestiges of a pattern once common throughout the community. Reproduction of the present subsistence system, though, requires comparatively frequent gardening. After all, local sustenance relies heavily on perennial cultivates, as the correlation of management practices and resource valuations demonstrates (cf. Appendix 17). Recurrent gardening ensures not only a continued and abundant supply of these individually owned resources, but incidentally generates the rich spectrum of collectively accessible disturbance species which are second to them in importance.

The resources' various ecological requirements engender a variety of propagation and maintenance regimes. They represent variations of the local swidden cycle, conforming to a basic pattern by which successive introduction of increasingly long-lived plants into the plot parallels successively declining maintenance through weeding (cf. pp.274ff.). Thus, plots are initially stocked with a selection of garden crops according to site characteristics and gardeners' personal crop inventories (cf. pp.282ff.). Perennating crops may be introduced at once or after several weeks, and replenished occasionally throughout the first year. Successively, also woody perennials may be added and/ or nurtured, again in keeping with site characteristics (landholdership/ distance/ fertility—cf. pp.280,282,289ff.) and personal crop inventories (possibly limited regarding rare fruit trees—cf. p.291f.). The most typical perennials are coconut (SONG, 2), betelnut (PU, 3), LIMBUM (ASI, 4), TULIP (WISIA, 51) and breadfruit (DEI/ NUPO, 55/ 56); less common are fruit trees like the Pacific lychee (TON/ TINIA, 57) or mango (SAUWE, 58); sago (SU, 1) is the most common overall, but occurs only occasionally in gardens (see Plate 12).

The method of propagation (cf. p.275) and arrangement of perennials in the plot depends on the species' ecology. For LIMBUM, TULIP, and occasionally TON, which are small-seeded and tolerant of weed overgrowth, their seeds may be broadcast in young gardens, for their seedlings to establish when the garden turns old. This schedule presumably economises on labour, as it permits weeding activities to proceed without regard for seedlings early on, and to cease once garden crops have been exhausted. If plots are to be maintained for longer periods, such species can also be planted around the garden edges, which may as much agree with their habitat requirements as facilitate weeding inside the garden. It will also facilitate renewed plot preparation in the same site later. Coconut and betelnut as more delicate species require separate germination, transplanting into a new plot, and diligent cleaning from weeds. For coconut, fruits may be carefully manured and sprouted at home, before being planted out; for betelnut, it is common to prepare nurseries in a sheltered spot in the garden, ideally close to a decomposing tree stump which provides warmth, and distribute the seedlings in patches or rows over the plot once they have reached a height of around 20-50 centimetres. Both species need careful cleaning subsequently, until plants have grown to about 1-2 metres. Careful cleaning is also necessary for sago, which is reproduced from suckers, as may be breadfruit. Several species can also be transplanted from wildlings, germinated spontaneously under previously managed trees or without any such definite association in variously mature regrowth areas, the former case typical for coconut, betelnut, breadfruit and mango, the latter

also for TULIP. In particular TULIP may also spring up in the plot itself, and may then be nurtured in-situ. In contrast, regrowth species not regularly subject to planting/ nurturing will be removed during weeding, even though mature specimens will be retained upon clearing the plot. This is the case for example for KUMU MOSONG (WASI, 54), DIBE (93), or KWILA (YOPNO, 76)—respectively sources of leafy greens, medicinal bark, and construction wood. Besides trees and tree palms, numerous other perennating species, including various vines, shrubs, canes, and zingiberaceous plants, may be introduced into the plot through sowing, planting or transplanting, and maintained through regular cleaning.

Weeding regimes are geared to the complement of plants introduced, and in combination with these determine the type of environment which develops. Without any interference, regrowth will be knee-high after a few weeks and have reached a man's height after several months. Generally, therefore, weeding tends to be a regular and frequent occupation during the cropping phase of the garden, with weeds initially pulled up by hand in monthly intervals and later on scythed off with a bushknife. In the long run, maintenance activities invariably concentrate on individual surviving crop plants and potentially added perennials, and eventually cease completely. Their intensity and duration up to this point, though, varies greatly.

Overall, four emblematic schedules and corresponding garden types may be distinguished, their extremes illustrated by Case Study 10 and Case Study 11 (pp.296ff.). At the far end of the spectrum are gardens in which no other plants than food crops are ever propagated, and in which maintenance activities cease accordingly within the first year or two. Proximate reasons include in particular lack of either landholdership or attention during critical periods. Upon abandonment, regrowth rapidly takes over. Remaining crop plants become too awkward to harvest and get smothered over the next few years. The plot is lush and weedy at first, making it a source of useful species which flourish under open canopy or in the half-shade of the plot margins: herbaceous plants, climbing ferns, tree saplings. It turns progressively into an impenetrable thicket, which over the years becomes more open again as the canopy rises. Little sunlight filters through and the floor is covered with leaf litter, the vegetation now a source of plants like bamboos and small softwood trees. As the vegetation matures further, it successively approximates forest, encouraging the growth of various rattans and tree palms (see Plate 13).

Further along the spectrum are gardens in which some woody perennials have been propagated and/ or nurtured and maintenance activities accordingly been extended. Regrowth is initially curbed through weeding, subsequently through crown development, and establishes therefore in a diffuse pattern, without forming a closed canopy. After several years, taller trees and palms alternate with shrubs, surviving crops, pockets of thicket, and herbaceous plants; ground cover is predominantly weedy. Overall, the environment appears lush and park-like; its utility lies both in deliberately managed and spontaneous plants.

Palm groves represent a special manifestation of this type. Although palms may, like dicotyledonous trees, be individually propagated in gardens, forming single emergents later on, they are more commonly propagated en masse. Gardeners may thereby take advantage of the plants' slim growth habit to economise on labour during propagation and/ or maintenance, considering that LIMBUM seeds are typically broadcast, while young coconut and betelnut palms require diligent cleaning (cf. p.292). Shading alone through the developing crowns or additional weeding limit regrowth to various extents. The more this is allowed to proliferate, the more the developing environment resembles a park; the more it is curbed, the more two stories

develop: of towering palms above and low undergrowth below. Utility lies principally in the palms, though additionally in spontaneous vegetation as far as this is present, in particular in the plot margins. Sago patches constitute particular instances of palm groves, mass propagation here spread out in time and suggested by the palms' ecological requirements (cf. nn.353,371).

House gardens, finally, combine and intensify the dynamics of both park-like environments and groves. They tend to be stocked extensively with both annual and perennial cultivates, and be diligently maintained and replenished over many years, during which they may contain almost exclusively plants deliberately managed. The spectrum of species not only spans the regular garden crops and woody perennials, here expanded to include various species not planted elsewhere for their valuable fruit, such as LAULAU (*Eugenia malaccensis*), mango (*Mangifera indica*) or soursop (*Annona muricata*). It also includes aromatic and ornamental species used for food seasoning, medicine, magic, and festive body adornment, or simply for the olfactory and visual aesthetics of the plot. Indeed, gardeners may introduce unnamed plants from the forest purely for their aesthetic appeal. The ornamental function of house gardens is supported by the decorative effect of many primarily economic species, such as betelnut (growth habit), breadfruit (foliage), or LAULAU (flowers). House gardens can vary widely in elaboration and in their persistence in the same location, but among all environments in Krisa conform most closely to the Western notion of a garden. Still, they, too, are given up eventually, typically together with the respective dwelling. Once maintenance ceases, the high density of managed plants defers establishment of regrowth, carrying the features of park and grove to the extreme and identifying thereby former sites of residence (see Plate 14).

Although the described garden types constitute heuristically useful categories, they have no equivalent in local concepts, save for the generic distinction between regular and house gardens (cf. p.280). In fact, they represent less distinct modes of gardening than a clustering of characteristics along a continuum of regimes. Transitions between them are fluid, due to the freely variable balance between propagation, maintenance, and regrowth. The point at which this arrests for a particular plot is ultimately determined by the dedication of the gardener, itself arising from a combination of long-term subsistence need (cf. p.292), overall zeal (cf. p.279), commitment to the particular plot, and availability of labour.

The latter, in turn, relies significantly on the gardener's mobility. A highly mobile lifestyle permits distribution of plots throughout the territory, but restricts maintenance on each; conversely, a more sedentary lifestyle limits plots to the proximity of the focal dwelling, but permits their diligent maintenance.[374] Increasing sedentism, therefore, permits increasing elaboration of house gardens and increasing reliance on plants affected by distance, in particular those which are prone to pig damage and/ or require diligent care (cf. pp.282,291). It is notable that this affects precisely the plants which seem to have gained subsistence prominence only recently, namely sweet potato and Chinese taro, both of which may have been adopted only during the colonial era (cf. pp.230,236, also p.230/n.301); coconut, whose cultivation has apparently intensified during the last half century, and whose subsistence analogues comprise several faunal and floral resources of the forest (cf. pp.239,245); and betelnut, which belongs to the group of palm cultivates whose subsistence analogues grow spontaneously in the forest and were apparently used more extensively in the past (cf. p.244). These considerations can inform the modelling of evolutionary scenarios, and I will return to them under the last heading.

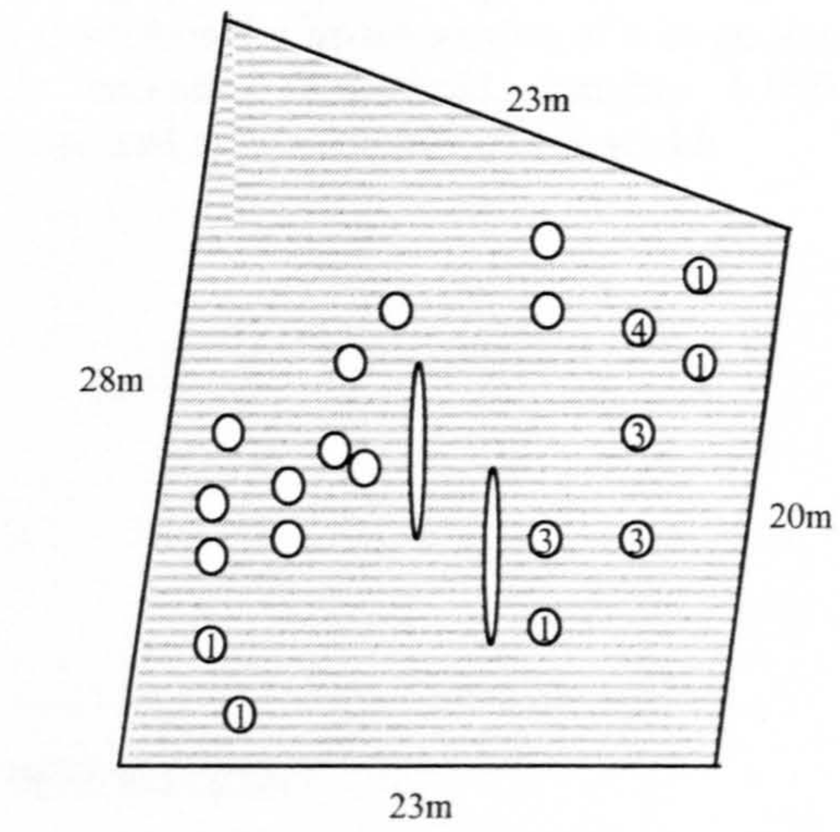
The type of environment which develops upon plot preparation depends not only on the degree of management afforded to the plot, but also on the extent to which gardening activities recur in the site. Typically, the swidden cycle can recommence only after an interval of at least 15 years. Indicators which suggest sufficient recuperation to gardeners are that the ashes have reverted to soil; remaining trunks have decomposed; and pioneer trees have reached some height. Exceptionally, very fertile sites may be recut earlier, and occasionally plots are redone when they have failed upon adverse weather conditions or premature plot abandonment and thus retain substantial fertility. Otherwise, repeated cropping in the same site can only happen many years apart. Ageing gardens may, however, be cleaned through burning, which encourages the sprouting of surviving perennials such as AIBIKA and PITPIT, and permits replanting of less demanding species. Plot management becomes thereby layered, enhancing human impact and increasing overall environmental variability. Besides such temporal extension of plot management, plots may be spatially extended (cf. p.281), generating large expanses of heavily transformed and variously mature vegetation.

An extensive range of management schemes therefore translates the uniform act of clearing into an extensive range of resource-rich environments. Recurrent plot preparation enhances this diversity, as it results in the concurrent existence of similarly treated plots in different stages of maturity. Much as individual gardeners accordingly tend to maintain a number of variously treated plots in various stages of growth, so does the vegetation around residential sites represent a mosaic of variously composed and mature environmental forms. This pattern multiplies in space and time through the successive shifting of residences, and indeed residential clusters, and hence of the focal points of gardening.

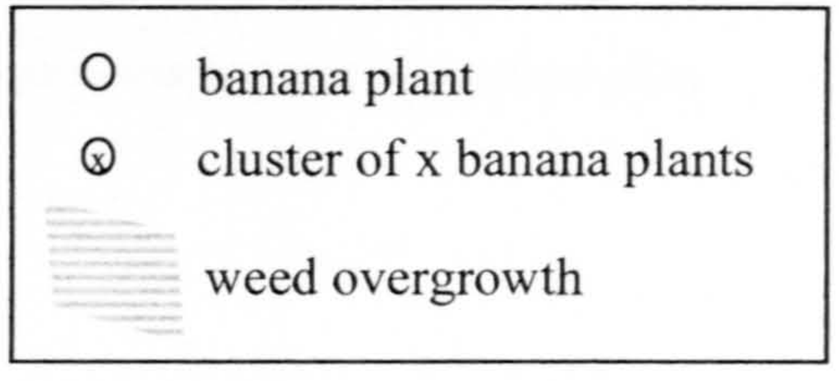
Despite this diversity, most of the respective environments are locally classed as 'old garden'. Furthermore, transitions are fluid on the one hand with 'old village site'—manifesting the particular appearance of clustered old house gardens; and on the other with 'forest'—manifesting the conceptual ambiguity between both environments (cf. p.276). The category of old garden is therefore at once ecologically heterogeneous and blends into that of forest. Yet, this is ecologically heterogeneous in turn, ranging from post-logging regrowth to true oldgrowth, which though may bear the marks of ancestral cultivation (cf. pp.267ff.). Although forest ranks as default condition of the land and the regular form of vegetation (cf. p.267,274), it is therefore at once implicitly acknowledged as anthropogenic, representing in turn but the far end of a range of conceptually continuous anthropogenic environments spanning the entire territory.

The approach to resource appropriation matches this continuity, as collecting within and across young gardens, old gardens, regrowth and oldgrowth proceeds in basically the same sweeping and opportunistic fashion. Garden crops, nurtured perennials, regrowth and oldgrowth species may all be harvested on a single excursion, in a like way. They will equally be procured on demand, their availability ensured through prior plot management and confirmed on repeated and wide-ranging subsistence excursions (cf. pp.261ff.,270f.). What appears as a combination of requisitioning activities is therefore as much a principally uniform approach for appropriating resources dispersed in a single, though variously anthropogenic environment.[375]

Case Study 10: Plot Management Regimes in Krisa—Example I



path

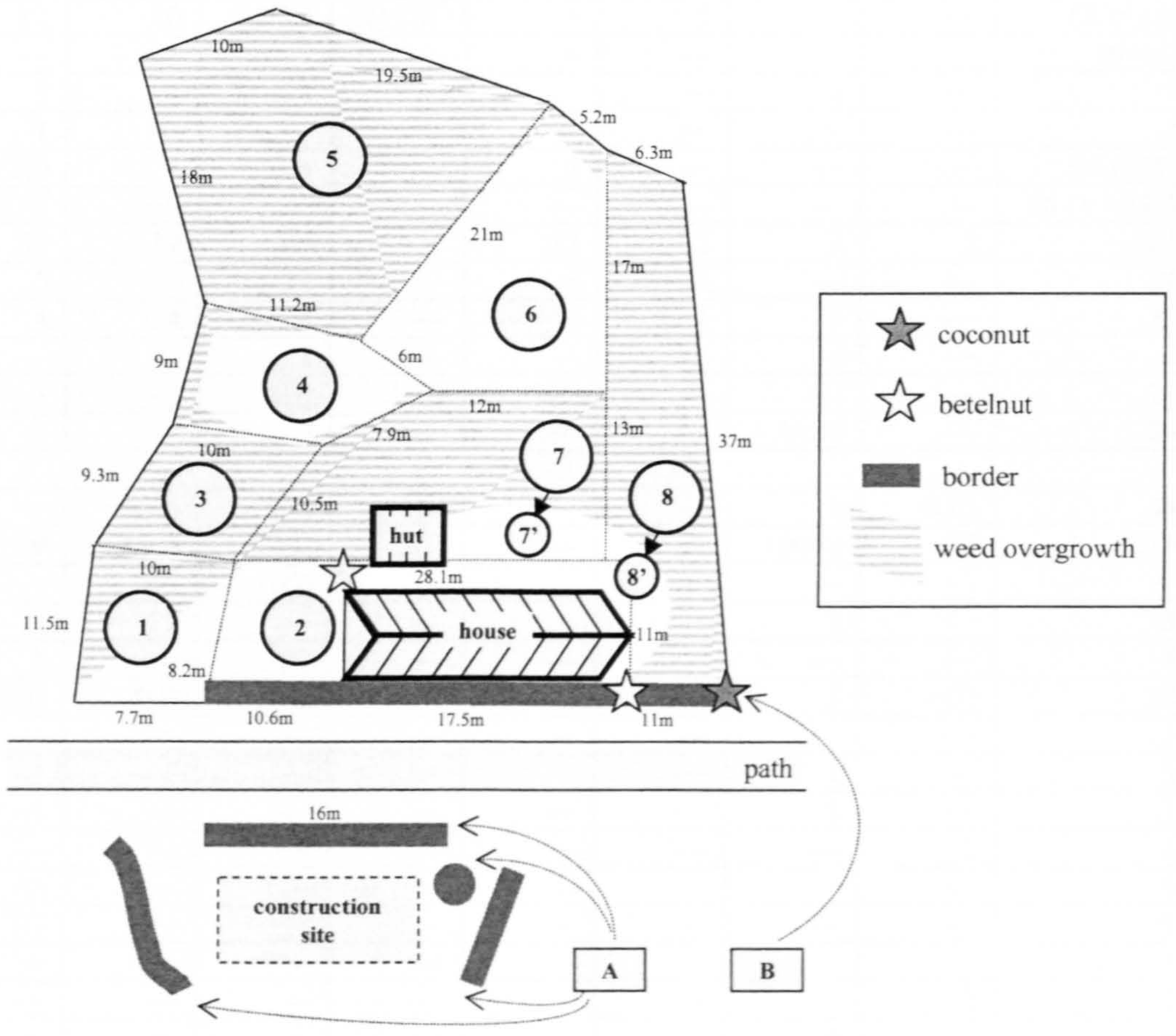


The following plot layout (left) and crop inventory (below) describes a 'nearby garden' (cf. p.280) of a man gardening on alien land (cf. p.289), located about 15 minutes' walk from the outskirts of the village, roughly 550 square metres in size and approximately two years old:

crops (cf. Tables 15, 26)	number of individual plants	**TOTAL**
banana		>31
~ BALES	2+ >1	>3
~ AWIA	1	1
~ DIPI	6+3+3	12
~ SUSUWOU	1	1
~'BUKA'	4+4	8
~'STOP'	2+3	5
unidentified	>1	>1

Case Study 11: Plot Management Regimes in Krisa—Example II

The following plot layout (right) and crop inventory (overleaf) describes the house garden of a large lineally and collaterally extended household, roughly 1,800 square metres in size and approximately one year old:



notes for table next page:

* suckers

† replanted

‡ tubers harvested; number indicating original mounds

§ tubers harvested; vines proliferating and covering part of the section; number indicating original mounds, planted with 1-2 vines each

** tubers harvested; mounds originally covering entire section

†† spontaneous

	number of individual plants in sector (size of plants: I: 0.1-1.0m; II: ~1-5m; III: >5m)												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**7'**	**8**	**8'**	**A**	**B**	**TOTAL**
crops (cf. Table 24)													
banana	6	3	4	2	12	10	16	1(+15)[*]	3	1	—	—	**58 (+15)**
taro	2	1(+4)[†]	5	9	—	—	7	—	6	—	—	—	**30+(4)**
Chinese taro	—	—	—	—	3	—	1	—	—	—	1	—	**5**
greater yam	—	—	—	—	1	—	—	—	—	—	—	—	**1**
cassava	(7)[‡]	(5)[‡]	(8)[‡]	—	(18)	4	1	—	5	—	—	—	**10 (+38)**
sweet potato	(40)[§]	—	(36)[§]	(+++)[**]	(257)[§]	58	—	—	—	—	—	—	**58 (+ >333)**
AIBIKA	—	3	4	5	80	12	—	—	12	2	3	2	**123**
PITPIT	—	—	—	—	5	—	12	—	6	1	—	—	**24**
sugarcane	4	4	1	—	4	4	4	—	6	1	1	—	**29**
pumpkin	—	—	—	—	—	—	2	—	—	—	—	—	**2**
pawpaw	—	2 (I,II)	—	1	3	—	1(I)	1(II)	1(I)	—	2	—	**11**
pineapple	—	2	—	—	1	—	2	—	—	—	1+20	—	**26**
other plants (cf. Appendix 15)													
coconut (2)	3	3(II)	1	1+2(I)	—	4(II)	4(I)	1(I)	—	—	1	4(II)	**24**
betelnut (3)	15	44(I,II)	2(I)	1(I)	3(I)+39	35(I)	37(I)	2(I)	—	—	100+2	35	**315**
TULIP (51)	—	4(I)	2(I)	—	—	—	1(I)	—	—	—	—	—	**7**
BALBAL (52)	—	—	—	—	—	2	—	—	—	—	1	—	**3**
breadfruit (55, 56)	—	1(II)	1[††]	—	1	—	1(I)	—	—	—	—	—	**4**
mango (58)	—	3(I)	1(II)	—	4(I)	4(I)	8+2(II)	1	—	—	3	6(I)	**32**
rambutan	—	1(I)	—	—	—	—	—	—	—	—	—	—	**1**
soursop	—	2(I)	—	—	—	—	—	—	—	—	1	—	**3**
cocoa	—	—	—	—	—	—	—	—	—	—	1	—	**1**
cotton	—	—	—	—	—	—	—	—	—	—	—	1	**1**
SIBEI (42)	—	1	—	—	—	—	—	—	—	—	—	—	**1**
chilli (108)	—	1	—	—	—	—	—	—	—	—	—	—	**1**
betel pepper (115)	—	1	—	—	—	—	—	—	—	—	—	—	**1**
hibiscus (112)	—	—	—	—	—	—	—	—	—	—	—	1	**1**
croton (*Croton* sp.)	—	—	—	—	—	—	—	—	—	—	4	2	**6**
various decorative annual flowers	—	—	—	—	—	—	—	—	—	—	+	+	**+**
various decorative herbs & shrubs, unidentified	—	2	—	—	—	—	1	—	—	—	—	+	**>3**

From Wild Yams to Agriculture

Without doubt, gardening is both vital to perpetuate the present subsistence system in Krisa and deeply embedded in Krisa culture. Ecologically, gardening forms the basis of a long-term subsistence strategy which is meaningfully integrated with extensive short- and long-term mobility of individuals and groups (cf. pp.215ff.,266,271f. and above); with a casual approach to resource appropriation and a tendency for immediate consumption (pp.260ff. and above); with a socio-political system that grants the individual substantial freedom of choice (esp. pp.219ff.,265f.,276 and passim); and with a legal code that emphasises immobile assets, territorial control, and the transformative power of human action on the vegetation (pp.215f.,260ff., 272,274,276,289f.). Economically, the majority of resources rely in one way or another on the preparation of gardens (cf. pp.288ff.). Conceptually, gardening constitutes a primal dimension of subsistence, as evident in the cognitive and legal significance of human-made clearings (pp.274,276); the primary lexeme PILI for the garden (p.274); the degree of lexical differentiation for propagation activities (p.275); and the specific epithet APIANAI for zealous gardeners (p.279).

And yet, the obvious importance of gardening contrasts with its often sporadic performance (pp.273,279,287f.,291); the small size of plots (p.281); the frequently low intensity of maintenance (pp.273,293); the absence of protective measures such as soil retention barriers or fences, even though complaints about landslides and pig damage are common; and the absence of any garden magic besides the application of taboo-signs, whose power, though, is far less than that of taboos on the forest (p.238).[376] More generally, it contrasts with the minor importance of the circumscribed space of the garden itself as opposed to the overwhelming role of the conceptually diffuse and ecologically diverse environment of the forest. Thus, garden produce is secondary to forest produce in importance (cf. pp.230ff.,273); gardens are omitted by hunters, who target only forested areas (cf. p.268); magical practices concentrate on forest resources (cf. p.238); and traditional fertility rituals aimed at the replenishment of game in particular and the forest in general (cf. pp.239f.).

The puzzle resolves with a diachronic perspective, which reveals the functional connection between gardening and a variety of forested environments, obscured though by a fixation on either the one or the other. It thereby highlights at once the role of various plant management schemes, and the variable balance in turn between propagation, maintenance, and regrowth. Much as this slides today across garden types, so it has apparently been sliding over time, moving increasingly towards propagation and maintenance and the respective resources, in a process of successive intensification. Thus, the review of Krisa dietary history (cf. pp.230ff.) suggests that the staple shifted from wild yams, through bananas, to sago over the course of the last several centuries if not millennia; that these starch sources slotted successively into a system defined principally by TULIP and game; and that present diets are in the process of changing towards root crop cultivates, garden greens and coconut. This sequence not only makes sense of the variously sourced data presented earlier, but accords well with a corresponding hypothetical transformation of gardening practices—suggested also by the principles of tropical rainforest subsistence explored in chapter 3—which I will set out in the following. In keeping with the overall perspective of this study, my aim is to model the *mechanics* of change in ecological terms, thus outlining possible, or indeed likely, evolutionary trajectories in regard to management scenarios, rather than speculate about the *forces*—such as demographic or political pressure, nutritional superiority of resources, etc.—which may have driven

the respective processes, beyond those that are patent from my notes and historical documents.[377]

The Krisa trajectory commences with wild yam, the first food of the ancestors. This proliferates upon vegetational disturbance, both according to scientific evidence (cf. pp.40f.) and local testimony: "When you cut a garden, and leave it for a long time, then [the yam] will sprout"[378]. Its prominent use as a staple suggests that naturally occurring clearings may have been insufficient to ensure its abundance. Hence active clearing of forest may have been part of regional land use strategies as far as legend reaches back, possibly several millennia (cf. p.237). Of course, humans may have cleared vegetation primarily for the purpose of establishing camps—then possibly rather transitory and hence clearing comparatively frequent—with the encouragement of yam growth but a welcome side effect. Clearing would at once have enhanced the abundance of the regrowth species TULIP, whose dietary importance may therefore be as ancient as that of yams. Its traditional complementation with game in diet and ritual suggests a similar antiquity for this, supported further by the primordial origins attributed to the respective fertility ritual, ADI (cf. p.239). In fact, the fundamental nature of this ritual suggests that the original significance of game exceeded its present role as a source of protein and fat, serving additionally as a substantial source of calories (cf. p.41), during an era when carbohydrate sources may yet have been comparatively scarce, limited largely to the indirectly encouraged yams. Game occurs primarily in oldgrowth forest, if current hunting practices are indicative (cf. pp.266ff.). However, the principal game animal pig—the antiquity of its role indicated at once taxonomically and spiritually (cf. pp.238f.)—thrives in regrowth (cf. n.343), and would therefore have proliferated upon clearing for yams and TULIP. Since this dynamic may have at once threatened other fauna (cf. pp.268f.), the traditional emphasis on pig may have reflected as much its abundance upon practices aimed primarily at the encouragement of plant resources, as served to control populations.

Considering the ecological characteristics of yams, TULIP, and pig, clearing alone would have been a sufficient form of plant management to ensure their availability as principal foodstuffs during the most ancient era.[379] The subsequent replacement of yams with bananas, though, would have necessitated additional planting and weeding. By this time, bananas must have already had attained an advanced stage of domestication to make them viable as a staple, which suggests that the practices for their management were long established.[380] Incidentally, the same practices may have been applied to TULIP, as well as to other trees and tree palms, taking them increasingly into cultivation and thereby increasing their abundance while potentially accelerating domesticatory processes. Indeed, these practices may have first been developed for woody perennials, and then transferred to non-woody perennials including banana, which but proved more easily domesticable (cf. pp.153ff.).

This sequence is suggested in particular by the argument advanced in chapter 3, that management and use patterns for woody perennials are related to, but more diffuse spatially and temporally than those for the vegeculture–vegecrop configuration, indicating their evolutionary priority in a sequence founded on the utility of secondary vegetation (cf. pp.45,58,65f.,73). More specifically, management of woody perennials may at first have been limited to the cleaning of adventitious juveniles, to support their establishment and growth, and only subsequently involved the planting of propagules, subject to cleaning in turn. After all, cleaning follows a related principle as clearing—the removal of undesirables—while planting introduces a new principle—the addition of desirables (cf. Table 9 [p.140] and p.93). Overall,

therefore, a historical progression seems the most likely from the mere cleaning of woody perennials—presumably coincident with the related practice of clearing forest—to their planting with cleaning upon clearing, to the planting with cleaning of non-woody perennials, likewise upon clearing. This progression would have involved three different modes of intensification: in the most ancient era, the expansion in space of existing management practices (clearing/ cleaning); subsequently, their technical supplementation with a new management practice (planting), thus intensifying treatment for cleared areas and increasingly replacing regrowth and/ or forest species with cultivates as principal resources; and finally the extension of the new practice in time upon increasing involvement of short-lived resources. Correspondingly, residential mobility would have declined, through the increasing attention demanded by individual clearings, i.e. plots, and their complement of resources, i.e. crops (cf. p.294, n.374).

The correspondence between the cultivation of bananas and of woody perennials suggests that the trend towards palm cultivates was already underway on the Krisa plateau *before* the increasing replacement of bananas with sago as a staple. Hence, the cultural pressure which sago-using immigrants from the Pual basin apparently exerted from the middle of the 18th century may have but accelerated a trend towards increasing reliance on sago palm as a resource, reinforcing in turn the ongoing trend towards palm cultivates at large (cf. pp.230,237,244). If this development benefited from the similarity of management practices for both sago and other palm cultivates, it at once shifted the relative importance of their respective management principles, which differ due to the plants' different environments. Thus, garden plots as the habitat of most palm cultivates constitute spatially diffuse and dynamically changing environments in which management is accordingly discontinuous and integrates regrowth. Sago patches as the usual habitat of the sago palm, in contrast, constitute spatially focused and rather permanent environments in which management is accordingly continuous and aims to suppress regrowth (cf. n.371). Increasing emphasis on sago cultivation in sago patches may therefore be regarded as a form of intensification, in terms of concentrating management attention in space while extending it in time. This is besides any additional intensification of sago palm management itself, through concentrating the resource within its environment, and expanding this in space in turn (cf. pp.95ff.). Besides these general attributes of sago palm management, the historical subsistence shift in Krisa may have involved yet one further dimension of intensification, related to the differential requirements of the different sago palm landraces involved. Thus, the comparatively slow growth which apparently characterises the introduced forms (cf. p.237/n.305) would have meant a need for more thorough cleaning to ensure their survival in the suboptimal environment on the Krisa plateau, and thus an extension of management activities in time.

All of these aspects may have supported the increasing emphasis, in historical times, on the cropping phase of gardens in a development towards agricultural forms of land use (cf. p.240 and below). For, agriculture/ intensive horticulture[381], too, entail that management is focused in space and continuous in time; that resources are concentrated within a circumscribed environment; and that this is expanded in space to compensate for resources otherwise provided across time, i.e. in later stages of the plot, or in different environments altogether. More generally, agricultural tendencies would have benefited from the longstanding trend towards perennial cultivates, through its successively increasing subsistence emphasis on the cultivated plot at the expense of other environments; the corresponding increase in the frequency of plot

preparation; and the attendant increase in sedentism to ensure plot and plant maintenance (cf. p.294 and above). After all, agriculture/ intensive horticulture but carry these features to the extreme. The cultural pressure exerted by agriculturally-minded outsiders since the beginning of the colonial era could therefore appear as less a force capable of radically changing the course of local subsistence history than an impetus which but hastens an ongoing process of intensification, analogous to the impetus apparently provided by sago-using immigrants in the 18th century.

The analogy is incomplete, though, in two respects. On the one hand, it implies a merely quantitative modification of existing management patterns, and thus potentially an inevitable development. This assumption ignores that despite some overlapping parameters both forms of land use follow fundamentally different principles. Thus, traditional strategies aim primarily at the long-term generation of perennial resources and regrowth environments, while agriculture aims primarily at the short-term generation of annual crops. Krisa vernacular illustrates this contrast, and the foreignness of the latter principle, through the contrasting concepts denoted respectively by

- the traditional term for garden, PILI, which includes all kinds of maturing environments (cf. pp.273,295),
- the neologism PILI APE-RI (garden/ white man/ [instrumental suffix] = "white man's garden", "non-traditional garden") for intensively cropped plots (Donohue & San Roque 2004:4,55).[382]

The traditional long-term approach, in turn, is meaningfully integrated both with the local cultural substrate, as I have set out in this chapter (p.299), and with the ecological substrate of the tropical rainforest environment, as countless analyses of swidden systems have demonstrated (cf. section 3.4.). In particular, the incorporation of substantial regrowth periods ('fallow') into the cultivation cycle is both economically and ecologically essential, as it generates the majority of resources; assimilates rapid weed overgrowth; minimises erosion; supports floral and faunal diversity; and enhances soil fertility through a variety of mechanisms. Successive elimination of the fallow phase in a shift towards agriculture will therefore erode both local livelihoods and environments. The attendant need to expand cropped areas, in order to generate sufficient resources, reinforces this development, promoting a process which William Clarke and Randolph Thaman (1997) have aptly termed 'agrodeforestation', and which may in the long run prove more devastating than logging (cf. p.272). These dangers, though, receive little attention on the ground. The ecological benefits of swiddening may have successively gained academic recognition since Conklin's (1957[1975]) landmark treatise, but are as yet frequently obscure to laypersons. Awareness that especially for low-intensity swidden systems the balance of economic benefit may lie with the fallow phase rather than the cropping phase is typically low even in academia.

Hence, agriculturally-minded outsiders maintain their vision of nutritional, economic, and indeed moral salvation through agriculture and keep advocating their favoured form of land use in the Vanimo hinterland, continuing a trend set in motion with the beginning of the colonial era. The vehemence of their mission provides the second argument against the sago intensification analogy. For, the current cultural pressure may operate in a context less martial than its 18th-century analogue, yet must be vastly more forceful, considering its backing by the powers of the State, the Church, and modern technology. The resulting combination of coercive authority and apparently superior wisdom has engendered a rapid change in local patterns of land

use, which may not only erode livelihoods and environments by successively eliminating the fallow phase, but may unsettle the very fabric of society by its pace alone. After all, the demands of agriculture agree poorly with the defining characteristics of Krisa culture—of multi-level mobility, casual resource appropriation, immediate consumption, freedom of choice, and immobile assets relating at once to territorial control (cf. p.299). Consequently, agriculture must either fall victim to existing social institutions or radically transform them.

Both processes are apparent in Krisa. On the one hand, the community's recent history is littered with abandoned cash cropping projects introduced by various generations of officials, the first presumably the Vanimo coconut plantation (cf. p.239). Crops remembered as grown large-scale locally include pepper (*Piper nigrum*), chillies (*Capsicum frutescens*), rice (*Oryza sativa*), coffee (*Coffea* sp.) and cabbage (*Brassica oleracea*). Despite regular agronomic success, projects invariably met the fate of employed positions and local enterprises, given up after longer or shorter periods for a range of reasons (cf. p.263), here including poor transport and marketing facilities (cf. p.218).[383] The onset of logging and ensuing cash flow presumably heightened the readiness to quit.[384] Besides, lack of technical support figures as a common explanation for failure locally. This may reflect discomfort with unfamiliar crops as much as with unfamiliar land use patterns.[385] With the latter complication minimised for tree crops, these seem the most promising candidates for commercial cultivation. Still, establishment and maintenance of commercially viable plantations differs significantly from that of subsistence gardens. Farmers require capital to purchase seedlings and hire pruning tools; need to muster substantial and sustained labour for the clearing, planting, and weeding of sufficiently large plots; and need to adjust their subsistence schedules to the ripening of the typically rapidly perishing crop. Hence, various exotic fruit trees—in particular several citrus varieties (*Citrus* spp.), two guava cultivars (*Psidium guajava*), starfruit (*Averrhoa carambola*), and rambutan (*Nephelium lappaceum*)—apparently introduced for commercial purposes as much as for the imagined enrichment of local diets (cf. pp.19f.,240) never generated commercially viably ventures. Today, they lead an inconspicuous existence in Krisa, integrated as minor resources in local subsistence schemes (cf. p.294).[386] The only exception has been cocoa (*Theobroma cacao*), which flourished moderately upon its introduction in the late 1980s, then declined (Kara 1996:12; Leklek 1996:8), but is currently experiencing a renaissance under the guidance of an agronomically and commercially experienced community member (cf. pp.218f.).[387] Its intrinsic suitability to a mobile lifestyle and casual schedules may support this development, as the trees require little attention once established, and their fruit wants fortnightly picking and husking at the most.

Commercial livestock keeping has largely fared similarly as cash cropping. Cattle farming as the most significant venture survived for about a decade and remains manifest in settlement history, but was given up eventually (cf. pp.218f.). Chicken farming is ongoing, but proceeds on a low level and serves principally domestic consumption and the redistribution of cash within the community. In fact, the overall impact of livestock farming, as of agricultural innovations at large, has likely been less economic than ideological. Thus, the apparent correlation between Christianity, agriculture/ livestock farming, and modernity has fostered the emergence of the new syncretic faith whose adherents perceive a functional connection between these elements, considering the two former instrumental for attaining the latter (cf. pp.227,240,273). Cattle farming as an activity emanating from the agricultural mission station at Ossima in the Pual basin, which tangibly blends the Catholic faith

and agricultural forms of land use, may have been one of the prime agents in the formation of this religious ideology (cf. pp.217,218f.). At present, devotees manifest their convictions in particular through zealous gardening and enthusiasm for commercial agricultural schemes.

The agricultural pressure exerted by outsiders since the beginning of the colonial era has clearly left its mark, even though the commitment to agriculture remains as yet fragmented across the community. There are still some who rely on TULIP propagated by their parents (cf. p.291), and many still go for one or several years without preparing any gardens at all (cf. pp.273,279,291). Advanced secondary growth still provides the most important resources besides the four palm cultivates: forest palms, rattans, bamboos, and various trees, including TULIP (cf. Appendix 17). Garden hunting is still not considered worthwhile, even though some types of gardens clearly attract pigs (cf. pp.268,281,282,291). And the visible impact of gardening overall remains low even in local perceptions, manifested in the comparative observation that in the area allocated to Wamena refugees grassland had replaced forest due to the immigrants' intensive gardening activities (cf. nn.223,306).

Yet, gardening has clearly intensified at a brisk pace over the last few generations. Evelyn Cheesman (1941:183) still noted: "If the Krissa men did not spend so much time in hunting they would fare badly. They have some gardens on the lower slopes, but those I saw did not appear to grow good crops." This statement may partly reflect the bias of an agriculturally-minded person, and thus present gardening as more ephemeral than it actually was. However, her further observations that Krisa people "are true forest people and great hunters" (op.cit.:182) and that "the chief business of their lives [is] hunting" (op.cit.:183) seem to genuinely reflect hunting as a considerably more important activity than it is today, even though the respective images continue to nourish local identities. Besides such impressionistic evidence, the decline of hunting is suggested by the respective changes of various relevant parameters (cf. pp.268f.), as well as by the increasing participation of men in the processing of sago (cf. p.264/n.331). Local testimony indicates a commensurate decline in the proportion of forest foods in the diet over the last two generations (cf. p.240). On the other hand, a correlation of comparative ethnographic evidence with mapped vegetation types suggests substantially increased vegetational impact of gardening over the last few decades (cf. n.11). Also, the lack of fences and soil retention barriers despite the frequency of pig damage and landslides (cf. p.299) suggests that protective measures have not kept up with an explosive expansion of gardening.[388] Indeed, the rapid rise of sweet potato to dietary prominence only some two generations from its introduction suggests an increased emphasis on the cropping phase of the garden by definition (cf. pp.230/n.301). If the present trend continues, sweet potato may eventually come to rival banana and sago, even though it assumes only third rank as a staple yet.

The subsistence change in Krisa over the last few generations has been fuelled primarily from Vanimo as the regional hub of modernisation. As this centre has grown, so its influence has expanded, reaching ever more distant communities. Processes which can be traced in Krisa over time are therefore at once projected in space, with its past indicated by communities further south (cf. pp.25f.,220/n.280), and its future by communities at the coast, where root crops have come to assume equal place as the former staple sago (ASWP 3:1506-n.; Thomas 1941-42:165). Allowing for some ecologically motivated variations, the north-south gradient in gardening intensity between the coast and the upper Sepik river (cf. pp.25f.) presumably reflects this dynamic. It thereby lends additional support to the historical

sequence of subsistence phases which I have postulated for Krisa and conversely indicates its regional applicability, while highlighting that the current situation represents but a snapshot in time.

If in local conceptions such transience figures as a permanent attribute of the world (cf. p.228), the trend set in motion with the beginning of the colonial era may yet erode the very foundations in which this world is, literally, rooted. For, as the temporal dimension of subsistence collapses, so do at once the institutions which it requires and supports. In contrast to logging, which constitutes a largely passing phenomenon borne by external agents, agriculture is interwoven with the fabric of society and therefore affects more than the vegetation alone. Beyond even its immediate ecologically and economically erosive effects (cf. p.302), it reduces environmental variability; curtails mobility; diminishes in-situ storage of resources; and threatens territorial demarcation. The impact of modernity and monetary economy aggravate this trend, by severing politics from history; arresting flux; atomising the society; promoting greed, fraud, inequality and poverty; and assailing traditional resources and the associated expertise (cf. pp.222ff.,248,263f.). The transformation of local subsistence which outsiders imagine may therefore eventually take place, but neither will its trajectory be as straightforward as assumed, nor will it come without considerable risk to community and environment.

CHAPTER 6

CONCLUSION

6.1. A Dynamic Model of Tropical Rainforest Subsistence

As the foregoing chapter has shown, the contemporary form of subsistence in Krisa, its variations, and its hypothetical antecedents span the whole range of forms reviewed in chapter 3. Its socio-cultural foundations, in turn, resemble those commonly described for societies identified as hunter-gatherer, exemplified by the features of egalitarianism, sharing and collective land tenure; extensive mobility according to a pattern of alternating concentration and dispersion; conceptual continuity between human and non-human tangible worlds; and coexistence of human and mythical time (Lee & Daly 1999a:4). If the Krisa example thereby illustrates the confusions attaching to concepts of tropical rainforest subsistence, it at once focuses the respective debates, including questions regarding the relationship between technology and society—or mode of subsistence and mode of production (pp.31,196); between tropical rainforest ecology and human foraging behaviour and impact (section 3.3.); between swiddening and agroforestry (sections 3.4. and 3.5.); and between sago palm use and abundance (section 3.6.). In fact, it indicates a dynamic model of tropical rainforest subsistence which can accommodate all of these forms and their hypothetical evolutionary trajectories, without conflicting with the socio-cultural phenomena identified.

This model relies on the recognition that the fundamental element of Krisa subsistence, as of tropical rainforest subsistence at large, is the ***clearing of vegetation***. Most obviously, clearing, viz. the removal of undesirables (pp.138ff.), manifests as the first stage of preparing a swidden plot. This, in turn, constitutes the basis for enhancing the abundance of desirables by three different routes, encapsulated in the three dimensions of gardening recognised in Krisa (p.275) and the corresponding modes of swidden plot development recognised in academia: the planting of garden crops; the planting of woody perennials; and the adventitious establishment of resource-rich regrowth. The two former operations rank conventionally as the hallmarks of, respectively, swiddening and agroforestry/ arboriculture, while the latter process tends to be considered merely incidental. In fact, though, all three rely similarly on prior clearing, which only enables planting much as it encourages regrowth. Besides, clearing (or weeding) manifests as the nurturing of valued plant individuals, planted or adventitious; occurs as incidental canopy opening in the context of resource appropriation and settlement; and finds its template in the inherent instability of rainforest.

These correlations suggest that clearing constitutes the most ancient element of tropical rainforest subsistence. Combined with the considerations I have advanced throughout chapter 3 and the hypothetical evolutionary trajectory I have traced for Krisa subsistence, this leads me to postulate the following incremental sequence for the development of tropical subsistence forms:

1. use of secondary vegetation developing in natural clearings and incidental canopy openings;
2. encouragement of secondary vegetation and valued perennials through deliberate clearing and nurturing;
3. additional propagation of valued perennials in clearings;
4. additional propagation of swidden crops in clearings.

While each step adds a further dimension of plant management, they all ***rely fundamentally on the generation of clearings and use of the resulting fallows, as implied in my concept of 'fallow farming'***. Fallows may remain unmodified (1./ 2.) or be enriched with structurally analogous perennials (3.), but only increasing enrichment of the early pioneer stage results in the cropped plot (4.), which thereby becomes a mere evolutionary adjunct. With increasing substitution of the regrowth and tendency towards immature vegetation, the sequence moves towards increasing concentration of resources, their management and their appropriation, and hence of the expended labour (cf. nn.366,374) in time and space. As long as the cropped plot remains but supplementary for subsistence, though, mobility will remain important, management diffuse and resource appropriation casual. These correlations indicate that socio-cultural features characteristic of so-called hunter-gatherer societies will remain prominent and their transformation occur as gradual as technical change.

Previous studies have variously highlighted, and thereby substantiate, one or several aspects of the suggested model. Practitioners of tropical agroforestry have emphasised the value of a "natural succession analog approach", in which resources are deliberately "placed in the niches otherwise occupied by common early successional species" (Denevan & Padoch 1987, quoting Hart 1980)[389]. Students of tropical subsistence worldwide have described the indirect management of forest resources (Alcorn 1981, Hecht et al. 1988); the planting of 'forest islands' (Posey 1993, Fairhead & Leach 1996); the legal transformation of the landscape through the planting and nurturing of trees (Michon 2005:143,149; Peluso 1996); and the role of the swidden plot as the nucleus for the generation of groves and extensive anthropogenic environments (Huber 1977, 1978; Kennedy & Clarke 2004:1-3 and references quoted). As far as I am aware, there are, however, no studies which have integrated these aspects in the fashion I propose, of the clearing as the universal, central, and most ancient principle of subsistence in tropical rainforest, and the trend, in an evolutionary scenario, towards increasing substitution of the regrowth and ever more immature vegetation. If some archaeologists have suggested models for subsistence system development which converge with the one I propose, they have denied an evolutionary role of perennials (Piperno & Pearsall 1998); have remained vague about the functional and evolutionary relationship between the swidden plot and the management of perennials (Latinis 2000); or have passed over the role of the fallow and the distinction between perennials and garden crops (Groube 1989).

While the described scenarios therefore resonate variously with the one I have sketched out, the relevance of clearing and regrowth has remained largely obscured. Yet, precisely identification of these two aspects as the primal and universal phenomena of tropical subsistence reveals apparently disparate subsistence forms as placed along a continuum, though in a fashion fundamentally different from that conventionally imagined. For, the proposed sequence escapes the categorical conceptual break entailed in existing models which refer principally to cultivation practices and hence need to classify primarily according to their presence or

absence.[390] It therefore escapes at once the attendant need to reconcile the two apparently antagonistic subsistence endeavours of 'foraging' and 'farming' in cases where both obviously overlap (section 4.1.). Rather, it demonstrates once more that 'farming', viz. cultivation, represents not an alternative approach to subsistence but an additional stage in the subsistence process—much as in ecological terms (section 4.6.), so in evolutionary terms. This perspective inverts the common conception of swiddening as prototype of tropical subsistence and product of incorporating a fallow phase into the cultivation cycle, revealing it instead as a late elaboration of the fallow prototype upon incorporation of a cultivation phase into the fallow cycle. Or, as I have phrased the same recognition in chapter 3, "cultivation plots may be a by-product of the desire to generate useful secondary vegetation, diverse biomes, and ecotones in order to enhance existing characteristics of rainforest which make it habitable for humans".

A fallow-based perspective indicates not only the fundamental relatedness of swiddening with other forms of tropical subsistence and emergence from them. It can also account for in-situ domestication of the respective resources, whereas the evolutionary appearance of the cropped plot without antecedents would require the similarly sudden appearance of swidden crop domesticates and hence their prior development elsewhere. For, preparing swidden plots would make sense only once swidden crops have become available, which though would have required long-standing plot preparation in turn, due to the coevolutionary connections involved. Thus, domestication of the vegecrops so prominent for swiddening typically relies on the pre-existence of management schemes which counter the detrimental effects of predation, through artificial propagation and/ or environmental manipulation (cf. pp.155ff.). Defining such management schemes exclusively with reference to contemporary swidden practices therefore produces a chicken-and-egg dilemma.[391] The nurturing and cultivation of woody perennials in managed fallows, however, which I postulate as an antecedent evolutionary stage, would have been a suitable precursor, providing both a template for the practice of artificial propagation and a modified environment conducive to the proliferation of plants with pioneer characteristics. It may thereby have initiated the domestication of short-lived crops; successively intensified upon its advancement; and ultimately resulted in contemporary swidden practices. Morphological modifications of the respective crop progenitors under management which were favourable for humans, such as those reported for African wild yams (Chikwendu & Okezie 1989—cf. n.164), would have accelerated this process by encouraging precisely the management practices which would have acted as selective pressures towards domestication.

The suggestion that tropical vegecrop domesticates originated within a fallow environment is supported by their ecological characteristics, as many are tolerant of weed overgrowth and/ or shade (cf. e.g. Table 24-col.VII,VIII; Nair 1993:94).[392] Particularly suggestive of the postulated transition from the management of a late to an early fallow stage is the large class of perennating plants, including non-woody taxa, which despite their common integration with contemporary swidden regimes have been recognised as semi-cultivates, semi-domesticates, or indeed weedy famine foods, indicating their fundamental independence from artificial propagation and regular survival in advanced secondary vegetation (cf. nn.39,40, pp.82,154).[393] That many of them constitute minor resources at present but are considered to have been used more extensively in the past provides further support for the hypothesized transition from late to early fallow management (cf. e.g. Barrau 1965; Watson 1965; Sillitoe 1983:chpts.2-5 passim vs. 1996:80-tbl.4.1.). Support, in turn, for the

postulated antecedent transition, from unmanaged to managed fallows, comes from the ecological characteristics of many of the woody perennials which continue to provide some of the most important resources for tropical subsistence. Their spontaneous establishment in fallows alone indicates their adaptation to disturbed vegetation (cf. Appendix 17). In particular, the breadfruit (*Artocarpus altilis*) is a typical early colonizer on land exposed through shifting of river courses (Paijmans 1976:59); bamboos occur in oldgrowth forest but tend "to spread and become abundant in secondary forest", rendering them classical indicators of (human) disturbance (ibid.:81); large woody climbers, rattans, and palms establish in late secondary forest (ibid.:80); in fact, rattans typically rely on forest gaps (Johns & Hay 1984:222,229); large arecoid palms "generally require to regenerate in open conditions" (op.cit.:253); and sago palm (*Metroxylon sagu*) proliferates where forest canopy is opened (section 3.6.). Their indirect management through clearing and nurturing would merely have mimicked the processes which encourage their proliferation in the absence of humans, thus strongly suggesting this as the first stage in an incremental sequence of increasing human manipulation. The subsequent commencement of planting, representing a qualitative departure from the previous, may have manifested as much the experimental imitation of non-human or accidental dispersal in the interest of enhancing resource abundance (cf. pp.53,137) as the endeavour to leave a human mark on the landscape by translocating conspicuous plant individuals. Indeed, the widespread function of planted perennials as boundary markers may indicate the original purpose of the practice, which may only subsequently have come to assume an immediate subsistence function, later extended to annual resources.

The proposed evolutionary sequence can therefore meaningfully integrate numerous aspects and phenomena of tropical subsistence which despite their standard recognition empirically have remained theoretically disparate. It can also accommodate a host of ethnographic and archaeological evidence from tropical areas around the world whose evaluation with reference to the foraging–farming duality has created a class of subsistence forms united apparently more by their unorthodoxy than by any functional similarities. Precisely such similarities, however, become obvious with a fallow-based perspective, whose validity they thereby confirm. Thus, we may conceive of the following correlations, with an emphasis on Melanesia but indicating how further evidence can be integrated:

Table 25: Correlating Evolutionary Model and Evidence

broad-spectrum 'hunter-gatherer' subsistence of the first colonists of New Guinea (e.g. Rhoads 1982, Raabe 1990)	stage 1
reliance on forest manipulation and arboreal resources in Pleistocene economies in Island Southeast Asia and New Guinea (e.g. Gosden 1995; Groube 1989; Kennedy & Clarke 2004; Latinis 2000)	stages 1/ 2, commencement of stage 3
prehistoric agroforestry in north New Guinea (e.g. Terrell 2002)	general elaboration of stages 2/ 3
sago palm management (section 3.6.)	specific elaboration of stages 2/ 3
planting of yams in megapode mounds (Dwyer & Minnegal 1990)	commencement of stage 4

contemporary subsistence in the far northwest of PNG (chapters 2, 5)	elaboration of stages 2-4
contemporary 'mixed subsistence' in mid-altitude in PNG (e.g. Dornstreich 1977, Morren 1986), and prehistoric transition 'from hunting to horticulture' in the New Guinea highlands (Watson 1965)	increasing elaboration of stage 4
contemporary and prehistoric arboriculture in Island Melanesia (e.g. Kennedy 2000a, Kirch 1989, Lepofsky 1992, Yen 1974)	(retrograde?) elaboration of stage 3
management of complex agroforests (section 3.5.; also e.g. Peluso 1996)	elaboration of stages 2/ 3 —directly from stage 2 (Michon 2005) or retrograde from stage 4 (Peluso 1996)
'deculturation' of erstwhile swidden cultivators in post-contact Amazonia (e.g. Balée 1992, Posey 1993)	retrograde elaboration of stages 1/ 2
Australian Aboriginal fire-stick farming (e.g. Harlan 1992:22, Yen 1989:57 [both referring to Jones 1969][394])	elaboration of stage 2

The geographical distribution of forms in Melanesia may suggest a process of 'adaptive radiation'—analogous to the biological one (e.g. Campbell & Reece 2002:470f.)—by which a fallow-based antecedent, developed early on, diversified in the process of migration and culture change. The availability of sago palm and breadfruit may have encouraged the longstanding and widespread emphasis on perennials, which in other regions, especially South America, may have been sidestepped in favour of a more rapid development of root cropping. If therefore the specific developmental pattern is unique to Melanesia, I believe that the subsistence principles which underlie it are universal to the humid tropics, and possibly beyond. Their recognition, and the subsequent reanalysis of nonclassifiable subsistence forms suggested by Phillip Guddemi (1992—cf. section 3.1.), will likely confirm his suspicion that forms similar to that in contemporary far northwest Papua New Guinea are far more widespread in space and time.

6.2. Closing the Circle: Paradigms and the Real World

If the ethnography of the foregoing chapter has inspired the dynamic model of tropical rainforest subsistence presented above, it has at once indicated how empirically the tension with conventional models may lead to progressive elimination of the fallow phase and thereby erode the foundations of the system. This destructive dynamic is fuelled by the misconceptions engendered by an agro-centric perspective, which is trained on the cropped plot at the expense of other environments; attuned to short-term rather than long-term strategies, and to direct rather than indirect and unspecific forms of plant management; and informed by an ideology of predation at odds with an integrative approach aimed at the assimilation of successional processes and the extensive transformation of complex vegetational communities. The central role of the fallow for subsistence and its largely anthropogenic character remain thereby invisible, and the respective strategies for resource management and appropriation underrated.

If in the minds of development agents 'fallow farming' becomes accordingly an inefficient form of cultivation, the same level of cultivation turns destructive in the minds of conservationists, who perceive it as threatening apparently pristine environments, oblivious that these are in fact a product of the presumable destruction. Although both sides pursue contrasting aims, their preconceptions constitute but opposite sides of the same coin, arising similarly from the fallacy of equating the cropped plot with human impact and the fallow with its absence. They thereby manifest an agro-centric view of the world which upon a spatial conception of non-human otherness postulates a categorical disjunction between humans and their tangible environment, expressed as the opposition between 'culture' and 'nature' (cf. sections 4.2., 4.4.). If this folk model serves the conceptual purposes of agriculturalists, it fails not only the meaningful description of other forms of subsistence, but in its recasting as scientific dogma lends a spurious authority to the agents of economic development and biological conservation.

James Fairhead and Melissa Leach (1996) have meticulously traced precisely this process in their revaluation of African landscape development, demonstrating how repressive policies have for generations been justified with reference to the notion, as deeply entrenched as flawed, of forest islands in Guinée as the relics of once vastly more extensive vegetation. That this notion resonates strikingly with the mistaken impression of the first Europeans exploring the far northwest of PNG, of vegetable trees as "remnants of the forest" (Schultze-Jena 1914:40—quoted on p.18) is not accidental. Both manifest equally the belief in a fundamental antagonism between humans on the one side and environments beyond the cropped plot on the other, leading to the conviction that the advance of forest constituted a 'natural' process 'despite' human activities (Fairhead & Leach 1996:283). If the root of the error lies in the tendency, in western thought, to separate society and nature (ibid., also op.cit.:5f.,passim), its sanction arises from projecting this separation onto the scientific endeavour and thus erroneously removing human actions and their effects from the remit of ecological inquiry (cf. section 4.3., also n.179). With science a potent instrument of the policy process, the agro-centric error is thus institutionalised:

> "The origins and endurance of such landscape misreading have depended... on the relations of production of scientific knowledge within the powerful economic and institutional structures which apply it." (op.cit.:279)

Hence, the ethnocentric paradigm attains relevance beyond academia, disseminated and translated into practice by the powers in charge, acting to transform the real-world situation it has failed to apprehend. With 'fallow farming' and related phenomena as widespread as indicated, the need to revise the paradigm and thereby reverse this trend becomes yet more urgent.

NOTES

NOTES TO CHAPTER 1

[1] The following overview has benefited substantially from clarifications provided by Christin Kocher Schmid based on her varied field experience and extensive knowledge of ethnographic accounts from PNG.

[2] Edvard Hviding and Tim Bayliss-Smith (2000) allude to precisely this widespread illusion in their Plate 8 (following p.326), which they caption: "A virgin forest?" and explain:

> "An aerial view of northwest Vangunu Island [New Georgia Islands, Solomon Islands] showing unbroken forest... The forest's appearance as "wilderness" is deceptive: it is full of trees such as *Campnosperma* which indicate a history of disturbance. More than a century ago this area supported a large population cultivating swiddens and irrigated taro terraces..."

[3] Possibly the two most publicized studies in regard to subsistence are, respectively, 'Cultivators in the Swamps' by L.M. Serpenti (1977), which refers to mangrove habitat, though across the border in the western part of New Guinea, and 'Oriomo Papuans' by Ryutaro Ohtsuka (1983), which refers to savannah habitat on the Oriomo plateau.

[4] Cf. the parallel observation by George Morren (1986:17) regarding the subsistence role of animals and relevance of hunting in New Guinean societies, which must still be considered valid two decades after it was made:

> "The apparent uniqueness of the Miyanmin case is an artifact of the geographically and ethnographically biased sample available to Bulmer and Arnell in the 1960s... It is loaded in favor of high-altitude core groups of the eastern part of the New Guinea highlands and coastal and centrally organized riverine peoples. For the most part these are groups known for their dependence either on pig husbandry or fishing. It is also true that when these authorities were writing, almost no relevant research had been done on mid-altitude fringe groups such as the Miyanmin anywhere in New Guinea..."

[5] Upland forest typically occurs as remnants in heavily cultivated highland areas, or in the highland fringes. These have been similarly neglected ethnographically as lowland forest and in subsistence terms they seem to represent a transitional zone between both.

[6] Most of the information in the following two paragraphs is taken from Ellis & Klappa (1999) and Kocher Schmid & Klappa (1999:101f.).

[7] An earlier mention of Krisa language by Arthur Capell (1962:38) seems to rely on second-hand information relayed to him by Vanimo missionaries. The reference in Kocher Schmid & Klappa (1999:92) to contact between the protagonist and a linguist relates therefore unlikely to a meeting with Capell in the 1950s, as suggested, but probably to a meeting with Laycock in 1970. In this case, Laycock's presumably tenuous acquaintance with the Krisa vernacular via Capell may also explain the otherwise mysterious advance knowledge by the linguist which so surprised the protagonist.

[8] According to his narrative account, the time must have been after 1982, the year of his marriage and second research trip to the Lakekamu Basin (Beehler 1991:198). According to the Krisa man who hosted Beehler and his wife at the time and assisted in the research, the site of Beehler's stay was the hamlet Ubapo, located inland of Waterstone (Waraston); at the time logging was in its initial stages and had not yet progressed there. That logging cannot have been far advanced is also suggested by Beehler's lack of reference to it, and to the circumstance that he recorded calls of the Harpy-Eagle, a bird which "rarely strays from the seclusion of undisturbed forest" (op.cit.:214).

[9] My designation of research as archaeological follows existing convention (e.g. Renfrew & Bahn 2000). Thus, it comprises classical archaeological research which uses direct evidence of human activity (sites and deposits, e.g. drainage ditches; macro-remains, e.g. stone tools; micro-remains, e.g. starch grains or phytoliths adhering to tools) as well as palaeoecological and palaeobotanical research which uses more indirect evidence of human activity (charcoal deposits; pollen cores; distribution of plant remains, e.g. nuts and wood).

[10] Cf., however, Ellen (1994:221[217]-n.3), who quotes various publications which indicate that "early historical meanings of the term 'fallow' and its cognates in other European languages referred to the several ploughings in orderly succession during the spring and summer in preparation for sowing winter cereals". He continues: "The use of the term to a period of rest is more recent. But while caution is obviously necessary in the analysis of historical European farming, the term is too well entrenched in its modern sense to be dispensed with." In line with his latter observation, I will follow conventional usage and employ 'fallow' for an erstwhile cultivated and subsequently abandoned plot of land.

NOTES TO CHAPTER 2

[11] Interestingly, though, the respective maps of the Australian Topographic Survey (Royal Australian Survey Corps 1970, 1975) class the vegetation around Krisa as 'rainforest', but much of the vegetation in the area of the present mission station of Wasengla as 'medium forest', suggesting greater human impact through more intensive gardening. More intensive gardening is also suggested by contemporaneous ethnographic evidence from the area (Gell 1975). The discrepancy with the quoted comment may reflect a disproportionate intensification of gardening in Krisa since the maps were prepared, a suggestion to which I will return at the end of chapter 5.

[12] Mark Donohue (pers.comm. 2005) has further specified this geographical designation as "the upper Mamberamo area, upriver of the rapids south of Kasonaweja". Hence, he includes the eastern half of the Van-Rees mountains in the region he defines as NCNG. The better part of this region—approximately ¾—is therefore located in Indonesian West Papua.

[13] This and the previous quote resonate strikingly with a statement about subsistence in the Moluccas by 18th century explorer Thomas Forrest, quoted in Ellen (1988:119): "No wonder, then, if agriculture be neglected in a country, where the labour of five men, in felling sago trees, beating the flour, and instantly baking the bread, will maintain a hundred."

[14] Quoted by the authors as Ruthenberg (1980:15).

[15] Inclusive local concepts of garden have been reported beyond Mbo-speaking communities and Krisa (see chapter 5) for example by Roy Ellen (1978:chpt.VII, in press) from Maluku, and by Geneviève Michon (2005:4) for Southeast Asia at large, reflected in her decision to use the term 'garden' interchangeably with 'forest' and 'agroforest' "to render the connotation of the local terms used to designate these systems" (op.cit.:x).

[16] In Krisa and among Mbo-speakers, *Metroxylon sagu* is the sole species used for starch extraction.

[17] In Krisa, there is only one species of palm which is cultivated and receives the specific label LIMBUM. Only by extension does this label, in the phrase WAIL LIMBUM ("wild LIMBUM"), apply generically also to a number of other palms (in particular *Caryota rumphiana* var. *papuana*) which grow spontaneously (cf. Table 18). This clear association between the term LIMBUM, a single species, and deliberate plant management appears however locally specific rather than universal for PNG or indeed the region, as does in turn the range of species to which the term LIMBUM applies by extension generically. Certainly, the representation in Mihalic (1971:122) corresponds closely to the situation in Krisa, with the term in its specific use applied to a single species (though identified—presumably in error—as *Kentyopsis archontophoenix* rather than *Gulubia costata*), and in the phrase WAIL LIMBUM to "the black palm,... a species of *Caryota*", thus at once implying cultivation for the former. Johns & Hay (1984), on the other hand, apply the term, in the spelling 'limbun', to a number of species in the class Arecoideae (op.cit.:252-317), without particular reference to cultivation status, although they note that "the larger species... generally require to regenerate in open conditions" (op.cit.:253). Christin Kocher Schmid has in the APFT Methods work sheet 3 (1999) apparently relied on the designation by Johns & Hay to translate LIMBUM as "arecoid palms"—excluding *Areca*, which carries the specific Tok Pisin term BUAI, but including for example *Rhopaloblaste*, *Cyrtostachys* and *Ptychococcus*. Both in the sense referred to by Mihalic and used in Krisa, though, this translation is too limiting, as it excludes the (principal) 'wild LIMBUM', *Caryota*, a member of the Caryotoideae (Johns & Hay 1984:239-246). On the other hand, the notion of LIMBUM as referring to a single deliberately managed species is likewise too limiting for a universal application. Thus, Christin Kocher Schmid (pers.comm. 2004) reports that Mbo-speakers apply the term to, and deliberately manage, more than one palm species. Under these confusing circumstances, and in order to maintain coherence with the Krisa ethnography in chapter 5, I will keep with Krisa classification throughout.

[18] This is despite the authors' reference to Gell's study and the general listing of bamboo shoots as a potential vegetable (data field 24).

[19] Due to the province-specific system of coding, codes for systems extending across provincial boundaries differ not only, by definition, in regard to the province (e.g. 15 for West Sepik province, 14 for East Sepik province), but typically also in regard to the system itself (in this case 07 for the West Sepik portion, and 02 for the East Sepik portion). Despite the appearance, therefore, codes 1507 and 1402 refer to the same form of land use as defined by the authors of the Working Papers.

NOTES TO CHAPTER 3

[20] Bird-David, N. 1988. "Hunters and gatherers and other people - a re-examination," in *Hunters and Gatherers 1: History, evolution and social change*. Edited by T. Ingold, D. Riches, and J. Woodburn, pp. 17-30. Oxford, Washington, DC: Berg.

Bird-David, N. 1992. Beyond 'the hunting and gathering mode of subsistence': culture-sensitive observations on the Nayaka and other modern hunter-gatherers. *Man (N.S.)* 27:19-44.

[21] Cf. e.g. Hard & Merrill (1992) for a single case study and Kent (1989) for an edited volume on the issue; also Dornstreich (1977:267,267-n.), on the effect of diversified subsistence patterns and a long fallow cycle to promote mobility, thus anticipating an element of my argument; conversely Rindos (1984:172-179,esp.178) on the counterintuitive possibility that historically sedentism may have promoted long-distance foraging expeditions rather than reliance on local, domesticated resources.

[22] Colchester, M. 1984. Rethinking Stone Age Economics: Some Speculations Concerning the Pre-Columbian Yanoama Economy. *Human Ecology* 12:291-314.

[23] Lathrap, D. W. 1968. "The 'hunting economies' of the tropical forest zone of South America," in *Man the Hunter*. Edited by R. B. Lee and I. DeVore. Chicago: Aldine.

[24] Pernetta & Hill (1981:300,302-tbl.5) provide a tabulated synopsis of faunal protein sources used in parts of PNG and the South Pacific, which distinguishes classes of resources and indicates numbers of taxa, but does not specify individual taxa.

[25] Bodenheimer, F. S. 1951. *Insects as Human Food*. The Hague: W. Junk.

[26] Taylor, R. L. 1975. *Butterflies in My Stomach, Or: Insects in Human Nutrition*. Santa Barbara: Woodbridge Press.

[27] French (1986:26) identifies 7 different species of insect which infest various parts of the sago palm, two of them of the genus *Rhynchophorus*: *R. bilineatus*, the black palm weevil, and *R. ferrugineus*, the red palm weevil. Christin Kocher Schmid (pers.comm. 2004) has shared the following communication by Don Sands (pers.comm. 1999), entomologist at CSIRO Brisbane at the time: "Regarding the sago beetle, *Rhynchophorus* is a common weevil but there are other beetle larvae (about 26 spp. including weevil, longicorn and scarab larvae) that are likely to be used as food, known to occur in the trunks of sagos and coconuts."

[28] Barbara Treide (1967), for example, in her literature study of "Wildpflanzen in der Ernährung der Grundbevölkerung Melanesiens" ("Wild plants in the diet of the autochthonous population of Melanesia") observed: "The importance of vegetable protein sources for groups who live predominantly off sago has apparently received insufficient attention." (op.cit.:206, my translation). Similarly, John Pernetta and Lance Hill (1981:296) noted that nutritional assessments based on energy budgets are inadequate not only for their omission of animal protein and other nutrients, but also "because they fail to take account of alternative protein sources, namely plant materials".

[29] I suspect that the regular neglect of leafy greens stems from the inferior role which they are accorded in European cuisines, possibly a concomitant of an agro-pastoral form of subsistence and consequently exaggerated expectations of animals as sources of protein (see also n.191). Hence, the status of leafy greens tends to be viewed as botanical rather than culinary. The attendant neglect by academics is mirrored by laypersons' contempt. Thus, a missionary reported the dietary and nutritional situation in the Vanimo hinterland in the late 1960s as:

> "The staple diet of the Ossima area people was sago... and *leaves*... The nutritional value is very low indeed. The sago would be eaten with meat when it was available, but that was not usually the case... Most of the children and babies, not to mention the adults, were badly undernourished, and the infant mortality rate was far higher than among the coastal village people, who had ample fish to add protein to their diet." (Willy 1996:88, my emphasis)

Fr. Willy fails to mention in this context that "the coastal village people" also had superior access to health facilities (cf. op.cit.:181). Also, he had obviously never seen a Popeye cartoon—which could have convinced him of the nutritional benefits of spinach leaves!

[30] Corresponding to the fermentation of sago starch in Melanesia and Southeast Asia, the fermentation of breadfruit (*Artocarpus altilis*) has been widely reported for Micronesia, Polynesia and Melanesian Outliers (e.g. Yen 1974:258-260,282; Ragone 1991; Stahl 1989:179 and references quoted). According to Diane Ragone (1991:esp.209f.), dietary and economic effects and motivations likewise correspond, or in fact exceed those for sago fermentation. On the other hand, damp storage of palm starch and incubation of grubs has been reported from South America (Wilbert, quoted in Ellen 2004a:91), as has the fermentation of manioc and maize (Stahl 1989:179).

[31] Note, though, that Igor de Garine's assessment may refer to highlands populations. Still, their reduced access to game should be countered by the greater extent of pig husbandry.

[32] Notably, none of the contributors to the debate ever referred to Piperno (1989), and vice versa, except for a reference by Piperno to Milton (1984).

[33] Use of the terms 'foraging/ foragers' in place of 'hunting-gathering/ hunter-gatherers' has been condemned in particular by Tim Ingold (e.g. 2000:10,58f.), on the grounds that the former sanctioned lexically the "'naturalisation' of the activities of hunting and gathering " (op.cit.:59). I entirely agree with Ingold's concerns about the process of 'naturalisation', as will become evident in chapter 4. I do not believe, though, that lexical attribution constitutes a major factor in this process. Indeed, other authorities on hunter-gatherer societies continue to use the terms 'foraging/ forager' (e.g. Lee 1997, Lee & Daly 1999). I have therefore decided to employ both designations interchangeably, mainly in order to keep terminologically with the respective debates I examine and which have variously used either the one or the other.

[34] Note, though, that Whitmore (1990:96) suggests, on grounds of species endemism and richness, that the present extent of the Malesian (cf. p.6) rainforests largely matches their extent during glaciations and that "[t]he main development of seasonal forests in this region is likely to have been on the newly exposed lowlands, and when sea-levels rose again at the next Interglacial these and the physical signs of seasonal climates... were drowned.".

[35] Whitmore, T. C. 1975. *Tropical Rain Forests of the Far East.* Oxford: Clarendon Press.

[36] Johns, R. J. 1986. The instability of the tropical ecosystem in New Guinea. *Blumea* 31:341-371.

[37] Moran (2000:343) defines an ecotone as: "A transitional zone between two distinct biomes; an 'edge' habitat in which species from both biomes are found in a gradation from one biome to another."

[38] David Harris (1973:396) may have indicated the source of the original error when he speculated that the adaptation of yams "to growth under a light tree canopy" suggested their origin in semi-evergreen or deciduous forest. Besides a mistaken equation of light canopy with seasonal leaf fall, students of tropical subsistence may have been misled by the ecology of yams cultivated in the West African yam zone, where seasonality plays indeed an important role (Coursey 1978b:esp.204), and, more generally, by the assumption that tuberous organs served principally the storage of reserves for unfavourable periods rather than perenniality per se, as conversely Hather (1996:esp.545) has demonstrated.

[39] *Coix lachryma-jobi* is a member of the Poaceae family whose seeds are edible raw and which "grows wild and semi cultivated in many areas of P.N.G." (French 1986:137). Correspondingly, Dentan (1991:426) reports that "this cereal thrives best in secondary forest".

[40] *Cordyline terminalis*, also known under the synonym *C. fruticosa*, the Tok Pisin name TANGET, or the Polynesian name 'ti', produces tubers which "were and still are occasionally used as food" in Polynesia, besides several other past and present uses including ritual, magic, medicinal, ornamental, as attire, for fibre, and as boundary marker (Barrau 1965:289; also French 1986:335). *Cycas rumphii* (syn. *C.circinalis*) provides seeds and stem starch which are edible after detoxification, have long been considered an ancient food source in the Pacific, and still constitute famine foods in islands of Western Oceania (Barrau 1965:285; also French 1986:339). Crotons (*Croton* sp.), which have often been mistaken for *Cordyline* in the ethnographic literature (Ehrlich 1989:58f.), are variously used in New Guinea for medicine, magic, ritual, body ornamentation and construction (Powell 1976:138,148,150,162,172), but I have not found any references to their use as a source of dietary starch, as Dentan (1991:426) suggests without elaborating.

[41] For game animals, a similar ambiguity emerges from the debate. General wildlife ecology suggests that agriculture negatively affects game densities (Stearman 1991:248); yet, Dwyer & Minnegal (1991:193,205) quoted several studies which document that forest disturbance through agricultural activities enhances the abundance of game, although they themselves found no such relationship in their field site in lowland New Guinea.

[42] Barnard, A. 1983. Contemporary hunter-gatherers: current theoretical issues in ecology and social organization. *Annual Review of Anthropology* 12:193-214.

[43] Contrary to this designation, which equates the terms 'swiddening' and 'gardening/ horticulture', David Harris (1973:398) has used both terms in a contrasting sense, denoting as 'swiddening' "a long-term fallowing system involving the cultivation of temporary plots for shorter periods than they are fallowed", and as 'gardening/ horticulture' "the long-term cultivation of small areas in the immediate vicinity of the cultivators' settlement", involving fixed plots. In this usage, the concept of tropical 'gardening/ horticulture' approximates even more its temperate-zone template; also, the distinction between plots near the residence and plots further away, often heightened by the differential permanence of the two, tends to be replicated locally, as is the case in Krisa (see chapter 5). Nevertheless, I will neither follow Harris' usage of terms, nor adhere strictly to the distinction he made. Firstly, what he identified as fixed garden plots has meanwhile rather become known as dooryard gardens, house gardens, or home gardens, and I will rather employ these terms when necessary. Secondly, even though these house gardens may locally be recognized as a distinct category, such classification seems to relate to spatial and ideational rather than ecological concepts. Ecologically, I perceive house gardens as but a variant of the swidden plot, a likeness which becomes the more obvious the more frequently residences are shifted, and I explore the multiple variations of the common theme of the swidden plot in chapter 5. This is not to reject the notion, presented in the text below, that the various forms may represent stages within an evolutionary sequence, as proposed by Harris (1973) himself, as well as by Beckerman (1983a).

[44] Similarly, Sillitoe (1996:25) speaks of "Rotating land not crops", without though specifically acknowledging Grigg; there are also earlier publications which employ the image of 'land rotation', such as a report by the United Nations on Agriculture of 1963, as quoted in Clarke (1966:355).

[45] It is interesting to note that in contrast to the complementary English terms of 'slash-and-burn agriculture' and 'shifting cultivation', the French and German renderings combine both aspects, of vegetation removal by fire on the one hand, and shifting of plots on the other, in the designations 'agriculture itinérante sur brûlis' and 'Brandrodungswanderfeldbau'.

[46] Nye, P. H., and D. J. Greenland. 1960. *The soil under shifting cultivation. Technical Bulletin.* Harpenden: Commonwealth Bureau of Soils.

[47] Lathrap, D. W. 1977. "Our Father the Cayman, Our Mother the Gourd: Spinden Revisited, or a Unitary Model for the Emergence of Agriculture in the New World," in *Origins of Agriculture.* Edited by C. A. Reed, pp. 713-751. The Hague and Paris: Mouton.

[48] Note that neither Lathrap (1977) nor Beckerman (1983a) refer to Harris (1973), although they do refer to two other publications by Harris.

[49] Note that Yoshida & Matthews (2002:i) have applied the term vegeculture more loosely, namely "to identify food production systems in which vegetatively propagated energy crops are important". In this meaning, it includes many plants, "especially tree crops, [for which] propagation is not exclusively or necessarily vegetative". As I will demonstrate, there are strong continuities between vegeculture and the management of tree crops, whose detection and analysis rely, however, on precisely the prior distinction between both. I therefore suggest to keep to a definition of vegeculture in its strict sense and will maintain this in the following.

[50] Ellen (1994:215f.) has been more differentiating than most by explicitly stating that "a general distinction is often drawn between vegecultural and seed-cultural agricultural systems, that is in terms of the method of propagation; and between tubers and grains in terms of significant edible parts". Still, he left not only unexplored the implications of this twofold distinction, but conflated both aspects again in the subsequent sentence, by referring to "tuber and grain cultivation". Furthermore, his differentiation into tubers and grains constitutes only a partial differentiation by use, as he acknowledged with reference to other plant parts used, though again in the context of cultivation.

[51] Their sterile fruit makes bananas both a vegecrop and necessitates vegetative propagation (cf. Rindos 1984:145).

[52] Note that the transplanting of seedlings does *not* qualify as vegetative propagation, the seedling having germinated from a seed and thus been reproduced sexually and not clonally as in vegetative reproduction such as suckering.

[53] In fact, Hather (1996:esp.539,540) has pointed out that several of the plants conventionally classed as 'root and tuber crops'—namely from the family *Dioscoreaceae* (e.g. yam), *Araceae* (e.g. taro) and *Zingiberaceae* (e.g. ginger)—must be regarded as perennials which attain their longevity through vegetative propagation of organs formed from stem tissue—tubers, corms and rhizomes, respectively—rather than through secondary woody growth as in dicotyledonous trees or pseudo-woody growth as in palms. This moves the class of vegecrops even closer to the class of 'classical' perennials which I discuss here.

[54] To account for this phenomenon, numerous and partly contradictory hypotheses have been advanced by scholars like David Harris (1972; 1973; 1996) or David Rindos (1984). They involve references to such factors as population increase by various mechanisms; dietary value of crops; and nutrient demand of crops on the substrate. Exploring the arguments in detail, though, would exceed the scope of this study.

[55] Cf. Dornstreich (1977:251-n.) for a concise overview of the problem and further references.

[56] Allan Holmberg (1969[1950]:101), to whom Beckerman referred in another context, explicitly made this point in his ethnography of the Siriono:

> "Labor is not a virtue among the Siriono. They are relatively apathetic to work (*tába tába*), which includes such distasteful tasks as housebuilding, gathering firewood, clearing, planting, and tilling of fields. In quite a different class, however, are such pleasant occupations as hunting (*gwáta gwáta*) and collecting (*déka déka*, "to look for"), which are regarded more as diversions than as work."

[57] This comment notwithstanding, Roy Ellen's (1978) study constitutes an important exception to the prevailing academic division of labour which I have noted. Thus, Ellen integrated an extensive treatment of the swidden cycle with his otherwise geographically oriented study of settlement patterns. In particular, he stated explicitly: "For the Nuaulu, it is possible to isolate the annual agricultural cycle, the long-term swidden cycle represented in the key progression [1st year garden]–[old garden]–[discarded garden covered with secondary growth] and the developmental cycle of domestic groups." (op.cit.:201). He also touched on the phenomenon of successive crop depletion with garden age, as well as on the low incidence of gardening in Nuaulu subsistence—aspects to which I will refer in the following paragraphs in the main text. Contrary to my own attempts below and in this study at large, he did not, however, explore the implications of these circumstances for the long-term survival of crop plants in particular and the role of garden preparation in the overall subsistence system in general. In fact, he remained mystified by the discrepancy between the economic and ecological significance of gardening on the one hand, and the nutritionally secondary role of gardens on the other (op.cit.:169, also 150).

[58] The discrepancy between the number of crops overall (40) and the number of crops listed separately as propagated by seeds or vegetatively (13 + 3 + 24 + 3 = 43) stems from the double mention of three of them as propagated by either method; only one of them, the mentioned perennial, survives into the post-abandonment stage.

[59] Ellen, R. F. 1973. Nuaulu Settlement and Ecology: The Environmental Relations of an Eastern Indonesian Community. Ph.D. dissertation, University of London.

[60] Cf. Roy Ellen's (1978:153) observations that "[w]eeding is a task which is generally neglected in most Nuaulu plots" and that "[t]he Nuaulu regard the weeding of gardens as an unnecessary burden" (op.cit.:253-n.26[27]).

[61] This statement, and the general assertion that weeding constitutes a lesser component of swiddening, seem to be contradicted by Rappaport's (1971) observations regarding energy inputs into Tsembaga Maring swidden cultivation. As his diagram (op.cit.:120f.) and further comments (op.cit.:120f.-caption,122) show, not only do the energy requirements for "planting and weeding until end of harvest" together exceed by more than twofold the combined values for "clearing underbrush" and "clearing trees", but does the energy required for weeding alone exceed that for any other activity. This somewhat unorthodox situation may reflect the intensive nature of Tsembaga Maring swidden cultivation, which "provides 99 percent of the everyday Tsembaga diet" (op.cit.:118). This makes it slightly unrepresentative of more typical swiddening regimes which leave a large proportion of dietary (and other) needs to be met by food plants other than garden crops and by game animals, which in turn thrive in forested areas and indeed swidden fallows (see main text below).

[62] With unmodified systems which receive no fertilizer input, population density is considered viable below 10-60 people per square kilometre (Geertz 1963:26; Harris 1972:248; Whitmore 1990:134 [all relying on various authors]). Ellen (1994:218) claims that swiddening may "support population densities of more than sixty persons per square kilometre", without though providing references in support of this statement.

[63] According to Emilio Moran (1996:535), weed overgrowth as the principal cause for plot abandonment was first suggested by Robert Carneiro (1957)*. Moran traced the previous position which emphasized soil exhaustion, and its connection with the protein debate (cf. section 3.2. and p.58), to an argument by Betty Meggers (1954; 1970)†, which suggested that "soils rather than protein... were most likely to serve as a limiting factor to the development of complex polities", since

"the poor soils of Amazonia could not support cultivation by means other than slash-and-burn techniques and that this doomed the populations to politically acephalous societies and to materially simple conditions" (Moran 1996:535).

* Carneiro, R. L. 1957. Subsistence and Social Structure: An Ecological Study of the Kuikuru. Ph.D. dissertation, University of Michigan.

† Meggers, B. 1954. Environmental Limitation of the Development of Culture. *American Anthropologist* 56:801-824.

Meggers, B. 1970. *Amazonia: man and culture in a counterfeit paradise.* Chicago: Aldine.

[64] For example, Clarke (1976:250 [relying on a further source]) noted that in Papua New Guinea "the planting of nitrogen-fixing *Casuarina* spp. is fairly widespread"; similarly, Sillitoe (1983:133) reported that Wola people plant *Casuarina oligodon* seedlings in their gardens, which "continue to grow following abandonment,... helping, the Wola point out, to restore the fertility of the area quickly so that they can garden it again"; the Agricultural Systems Working Papers (ASWP:chpt.2) devote their data field 34 to the practice of "Planted Tree Fallow", as a sub-category of "Soil Fertility Maintenance Techniques", referring to species such as *Casuarina oligodon* or *Parasponia* spp. (cf. p.21); Whitmore (1990:137f.) cited the planting of *Casuarina oligodon* in New Guinea as one of a few examples for fallow improvement worldwide.

[65] For examples among references quoted earlier in this section see Conklin (1957:78ff.-tbl.9,86f.); Ellen (1978:165,171-177); Grigg (1974:58); Kocher Schmid (1991:71 [bamboo (var. spp.)], 180 [nut pandans (*Pandanus* spp.)], 184 [betel palms (*Areca* spp.)]; 1998:114); Sillitoe (1983:73-75 [fig (*Ficus wassa*)], 75-77 [highland breadfruit (*Ficus dammaropsis*)], 103-111 [karuga screw-pine (*Pandanus brosimus, P. julianetti*)], 112f. [marita screw-pine (*Pandanus conoideus*)], 131-133 [paper mulberry (*Brussonetia papyrifera*)]); Vasey (1981:23); Vickers (1983:39). The Agricultural Systems Working Papers, though not devoting a special data field to the practice, list numerous tree crops in their data fields 21-27 (ASWP:chpt.2; cf. p.22), and correspondingly with the crop inventories of individual systems (cf. esp. Table 1).

[66] See references quoted in Bahuchet (2000:46); in Beckerman (1983a:7); and in Dwyer & Minnegal (1991:193,205; cf. n.41).

[67] Treacy, J. M. 1982. Bora Indian agroforestry: An alternative to deforestation. *Cultural Survival Quarterly* 6:15-16.

[68] Posey, D. A. 1982. Keepers of the forest. *Garden* 6:18-24.—(Note that the citation provided in Sponsel (1986) may be incorrect, as the same details are also given for another article by Posey.)

[69] Denevan, W. M., J. M. Treacy, and J. B. Alcorn. 1984. "Indigenous Agroforestry in the Peruvian Amazon: The Example of Bora Utilization of Swidden Fallows," in *Change in the Amazon Basin.* Edited by J. Hemming. Manchester: University of Manchester.

[70] In a subsequent publication (Michon 2005:67), the authors took a firmer stance regarding the last aspect, stating explicitly that the concept of intermediate systems should not imply temporary evolution. Although temporary evolution was in fact one of their main concerns (op.cit.:chpt.VI), this related to the emergence of such systems, not to any potential transformations, in particular not into modern plantations. In fact, the authors regarded the developmental trajectories of either as divergent, emphasising that intermediate systems should be regarded as "an alternative rather than a transition towards modernity" (op.cit.:166, also 162-166). This perspective indicates an important conceptual distinction to which I will return below.

[71] Note that Whitmore (1990:118-122) has analogously described monocyclic and polycyclic systems of silviculture, which though he related mainly to timber production.

[72] These correlations qualify Roy Ellen's (1978:186) assertion that whereas the swidden constitutes "a system... which maintains the existing natural ecological structure (e.g. Geertz 1963:16-17)", the transition from old garden to grove meant "not only... a breaking out from the swidden cycle" but "a fundamental change in the ecological structure of the domesticated environment, largely achieved through a reduction in the diversity per hectare", and that therefore a trend towards increasing management of groves represented in some respects "a more significant change than that from reliance on non-domesticated resources to swiddening". Ellen's observations on diversity may apply in terms of plants actively propagated (but cf. op.cit.:165—quoted on p.62), while his references to Geertz' forest mimicry hypothesis, and his exclusion of groves from the swidden cycle may have been in line with contemporary thinking, which though has meanwhile become contested (cf. pp.52f.,64). However, the perenniality of resources propagated in groves, combined with the diversity of the spontaneous component, clearly renders groves rather than swiddens closer equivalents of forests in ecological terms.

[73] Kang, B. T., and G. F, Wilson. 1987. "The development of alley cropping as a promising agroforestry technology," in *Agroforestry: A Decade of Development*. Edited by H. A. Steppler and P. K. R. Nair, pp. 227-243. Nairobi: ICRAF.

[74] Ellen's (1978:186—cf. n.72) reflections on the apparent transition in Nuaulu economy from a swidden system towards one dominated by groves seems to rely on a similar assumption as prevalent in institutional agroforestry, that full-blown swiddening must precede the development of agroforestry systems.

[75] Note, though, that woodiness by itself does not guarantee equal suitability for these purposes, nor necessarily suitability at all (see e.g. Johnson 1982:415f.).

[76] This bias towards food in studies on swiddening is mirrored in the field of institutional agroforestry by a bias towards—listed in the sequence of perceived importance—species with soil-improving qualities; fuelwood and fodder; fruit trees; and a residual category of 'other woody perennials' (e.g. Nair 1993:172-178).

[77] Correspondingly, Roy Ellen (1978:173) observed: "The set of activities and body of knowledge directed towards the establishment and maintenance of such a permanent or semi-permanent association in areas previously dominated by other associations, may be termed Nuaulu silviculture (cf. Rappaport 1968:55), *though the Nuaulu themselves have no separate term for this set of interrelated activities*." (my emphasis). More recently, Ellen (in press) has devoted an entire article to the fuzziness of Nuaulu environmental categories.

[78] The five genera found in the Indo-Pacific region are *Metroxylon*, *Arenga*, *Caryota*, *Eugeissonia* and *Corypha*, the three in South- and Mesoamerica *Mauritia*, *Roystonea* and *Arecastrum*, all listed in diminishing order of importance (Ruddle et al. 1978:5-9).

[79] Thaman (1993:246) notes that *Metroxylon* in Samoa may be an aboriginal introduction.

[80] According to Powell (1976:112), *M.sagu* boles reach 10-18 metres.

[81] For reasons which I detail in chapter 4 (cf. n.141) I use the term 'landrace' throughout to identify a phenomenon which in the literature is variously labelled with either this term or as 'variety' or 'cultivar'.

[82] Michiel Flach (1997:57) suggests that for commercial starch extraction trunks should be harvested "when the inflorescence first begins to form in its growing point". But he also observes: "During fruit formation, there are still some functional leaves and starch accumulation proceeds, albeit at a decreasing rate." (op.cit.:26). In an earlier publication (1983), he indicated that starch content alone is not necessarily the only parameter which determines the optimal cutting time in a local situation: "In the lowest part of the trunk, the number of vascular bundles increases, and the bundles also become harder. This may explain why the traditional processor waits until most of the starch from the lowest part of the trunk has been shifted in preparation of flowering to the upper part before he harvests the trunk." (op.cit.:45). That is, in different contexts, different criteria may find application, which include starch content, speed of starch accumulation and ease of felling.

[83] Note, however, that Ruddle et al. (1978:22) cite one study which reports the trampling method from the Fly river area in PNG.

[84] The term commonly used is 'trough', which though denotes a "container" (Collins Cobuild English Dictionary 1995:1792). Since the purpose of this part of the sago washing apparatus, though, is not to contain water, but to channel it, I prefer the term 'gutter', which refers precisely to this function (op.cit.:751).

[85] For example, Rhys Jones and Betty Meehan (1989:123f.) have described leaching procedures applied by Gidjingali people (Australia) for detoxifying yams and cycad nuts. In the same volume, Ann Stahl (1989:175-178) has provided a detailed inventory of the various purposes, applications and nutritional effects of leaching and soaking, which besides detoxification and its converse, the precipitation of starch, can also serve the softening of plant tissue and fermentation. With a yet wider perspective that encompasses also non-food uses, David Harris (1977:213 [referring to several authors]) has perceived an evolutionary sequence of macerating plant parts to extract their fibres for cordage, using the leached toxins as stupefacients for fish, and consuming the detoxified parts as food.

[86] This figure tallies with that given by Johnson (1977*—quoted in Ellen 2004a:73), of between 28 and 302 kg as the range of yields from 11 different locations. Occasionally, though, higher amounts are quoted in the literature. Flach (1997:24) mentions that in New Guinea "yields usually vary from 150 to 400 kg of dry starch per harvested trunk"; his tables, though, which refer to localised studies (op.cit.:42-tbl.9,10), list figures not exceeding 337 kg. Barrau (1959:155) mentions up to 408 kg (900 lbs) for naturally sterile palms. Persoon (1992:192) even reports from Siberut, Indonesia: "A single trunk may contain 400-600 kg of starch." This amount seems excessive, but as the phrasing implies may refer to total starch content rather than actual yield.

* Johnson, D. 1977. "Distribution of sago making in the Old World," in *The equatorial swamp as a natural resource [Sago-76: papers of the first international sago symposium]*. Edited by T. Koonlin, pp. 65-75. Kuala Lumpur: Kemajuan kanji.

[87] Although the reference is to "*Metroxylon* spp.", it is likely that the species is more specifically *M.sagu* in most if not all cases, rather than any of the species native to the Pacific islands, because 1) most the locations given are either mainland New Guinea or west of *M.sagu*'s native range; 2) Table 1 (op.cit.:4) lists the distribution for "*M.*spp." as Papua New Guinea and Irian Jaya; 3) the designation of "*M.*spp." rather than *M.sagu* may reflect the state of taxonomy before *M.rumphii* and *M.squarrosum* were recognised as synonyms for *M.sagu*.

[88] Presumably, wet storage *under* water excludes both oxygen, which prevents rotting, and lactic acid bacteria, which prevents fermentation. The slow disintegration of the starch may be caused by plant enzymes still present.

[89] In fact, Rhoads' subsequent use of the term, in the context of prehistoric sago palm management, strongly suggests a reference to planting, when he infers the absence of prehistoric sago palm cultivation from the apparent absence of prehistoric sago palm introduction into northern Australia (see p.97 in the main text below).

[90] Tuzin, D. 1977. Reflections of being in Arapesh water symbolism. *Ethos* 5:195-223.

[91] Regarding the presumable retreat of rainforest, Rhoads (1982:25) is in agreement with Johns (1990:136), who stated that "during the periods of major glacial advance, large areas now covered with luxuriant rain forest, supported a dry, parched, savannah vegetation"; both authors similarly relied on Nix & Kalma (1972)*. In contrast, Whitmore (1990:96) has suggested that the extent of rainforest in Malesia has remained largely constant (cf. n.34). Despite these disagreements regarding the absolute extent of rainforest, all authors agree that the exposed shelves were covered in different vegetation. The validity of Rhoads' argument remains therefore unaffected.

* Nix, H. A., and J. D. Kalma. 1972. "Climate as a dominant control in the biogeography of northern Australia and New Guinea," in *Bridge and Barrier, Publication BG*. Edited by D. Walker, pp. 61-91. Canberra: Department of Biogeography A.N.U.

[92] Barth, F. 1971. Tribes and intertribal relations in the Fly headwaters. *Oceania* 41:171-191.

Barth, F. 1975. *Ritual and Knowledge among the Baktaman of New Guinea*. Oslo, New Haven.

Morren, G. E. B. 1979. Seasonality among the Miyanmin: wild pigs, movement, and dual kinship organization. *Mankind* 12:1-12.

[93] Raabe (1990:180) presented Rhoads' (1982) argument as based on the assumption that the New Guinea lowlands were settled by coastal sago users, apparently indicating a contrast with her own argument. I believe that Rhoads made no such claim and that therefore the contrast is imaginary. Rather, Rhoads stated:

> "Since people must have come to Sahul by sea their prior adaptation to riverine or coastal environments seems plausible. The plant resources occurring in areas near the northwestern coast probably differed little from those known in the immigrants' homelands (Powell 1976). These foods probably included sago, mangrove, nipa and *Saccharum* spp. Fish and shellfish found in the new territories would also be familiar." (op.cit.:25)

He thereby rather indicated a diverse subsistence base, consonant with that claimed by Raabe, even though he made it less explicit that sago need not have been a staple at the time of immigration.

NOTES TO CHAPTER 4

[94] In regard to the distinction between "non-domesticated" and "domesticated" sago palms, the same provisos apply as raised earlier in a more general context (cf. p.102). Thus, it appears that Ellen blended a metaphorical with a literal understanding of domestication, and thereby two principally distinct concepts. Besides, the differentiation of sago palms into "non-domesticated" and "domesticated" in literal terms is problematic anyway, as it appears that there is no separation of palm populations into wild type and domesticate (see p.158).

[95] In fact, Obrist relied on an earlier work of Dornstreich's (1974)*, but the inventory of techniques she quoted remains the same nonetheless.

* Dornstreich, M. 1974. *An ecological study of Gadio Enga (New Guinea) subsistence*: Ann Arbor, University Microfilms.

[96] On the value of Rindos' (1984) contribution cf. in particular the foreword by Robert Dunnell (op.cit.:x).

[97] Williams, R. 1976. *Keywords: A Vocabulary of Culture and Society*. London: Fontana.

[98] Corresponding to the three "cognitive axes" (1996c:104) which Roy Ellen identified, Tim Ingold (1994:21 [referring to Williams 1976—cf. n.97]) identified two of the several meanings of nature as "essential quality" and "material world", implicitly subsuming under the latter the meaning of 'otherness' in form of its opposition to culture. In contrast to Ellen, though, Ingold used both in reference to humans ('human nature') rather than to the world apart from them ('non-human nature'). I will refer to this ambivalence regarding 'human nature' in sections 4.3. and 4.4.

More generally, there are certainly innumerable ways to slice the subject, which for obvious reasons has also been a central concern in philosophy and environmental studies (cf. e.g. Collingwood 1945; Soper 1995; Williams 1973). There always seems, however, to be an at least partial resonance with Ellen's cognitive axes and consequently with the approach I apply in the following, which may confirm their relevance. In any case, I feel that they are particularly suited to my purpose of locating the relative positions of anthropology and science in the study of subsistence.

[99] von Uexküll, J. 1982. "The theory of meaning," in *Bedeutungslehre*, *Semiotica*. Edited by T. von Uexküll, pp. 25-82.

[100] Gibson, J. J. 1979. *The ecological approach to visual perception*. Boston: Houghton Mifflin.

[101] I want to follow Ingold (2000:6f.) regarding implications, justifications and reservations entailed in using the concepts of 'Western' and 'modern', in particular regarding the problem that it obscures the diversity of thought in the Western tradition, which though unites in a shared allegiance to "disciplined, rational inquiry".

[102] More specifically, nature is a product of culture in the abstract sense. Besides, it is contingent on culture in the specific sense. On the distinction between abstract and specific culture see note 104, below.

[103] If this phrase resonates with the title of a review article by Arturo Escobar (1993), the correspondence is not accidental. As the contributors to the reviewed volume (Fox 1991)* insisted, anthropology needs to acknowledge that its practitioners are bound by politics beyond those involved in producing the text, from which they cannot extricate themselves. These pertain to the history of anthropology itself; the processes involved in becoming an anthropologist; and the practice of doing anthropology. In particular, the authors pointed out how one of the constitutive notions of

anthropology, of representer and represented, as a manifestation of the contrast between self and other and an instance of reflexivity, conflicts with actual processes of engagement and interaction, that is with the relationships which formed the discipline, form the practitioners, and underlie their fieldwork experience. In Ingold's (2000:4f.) idiom, they would regard anthropology, the anthropologist, and anthropological experience "as a singular locus of creative growth within a continually unfolding field of relationships", and urge awareness about this. But if the reflexivity of Escobar's title refers to that which post-modernist anthropology claimed for its approach to textual representation, and which the volume by Fox aimed to transcend by pointing out the wider limitations of anthropological practice, the same reflexivity of course motivates, once again, this very innovation. Much as therefore Ingold's project remains ultimately reflexive, so does Fox' and Escobar's.

* Fox, R. Editor. 1991. *Recapturing Anthropology: Working in the Present.* Santa Fe, NM: School of American Research Press.

[104] I believe there to be a genuine difference between the conceptions of culture in the specific and culture in the abstract sense. The one refers to the set of behaviours and beliefs (both being inherently connected, as pointed out earlier) which characterise individual social groups; it is inherently plural. The other refers to an exclusively human attribute defined hierarchically vis-à-vis the concept of nature; it is principally singular, though varies empirically with the respective culture in the specific sense. It is therefore in some sense true that abstract culture emerges from specific culture, though in a productive rather than reflexive way. Ingold (2000:41), however, seems to suggest the latter when he takes the double mention of the term 'culture' in the statement by Carol MacCormack (1980:6)*, that "[n]either the concept of nature nor that of culture is 'given', and they cannot be free from the biases of the [European] culture in which the concepts were constructed" as evidence that the same logical paradox which obtains with the concept of nature likewise obtains with its twin concept of culture. The paradox indeed obtains, due to the inherent dilemma of reflexivity, but I do not believe that the quote demonstrates this. Rather, it seems to refer, first, to abstract culture as conceived within Western thought, and second, to Western thought as an instance of specific culture. There is no representational relationship between the both—unless Western thought were to be considered the sole manifestation of the (abstract) cultural propensity for (specific) culture, so to speak, i.e. of cultured humanity. Yet, such representation would be required to demonstrate the logical paradox. The situation therefore resembles more that with the various conceptions of nature overall, rather than the particular one with the conception of nature as external reality.

* MacCormack, C. 1980. "Nature, culture and gender: a critique," in *Nature, Culture and Gender.* Edited by C. MacCormack and M. Strathern. Cambridge: Cambridge University Press.

[105] This scenario therefore treats reality as a relational concept rather than an absolute one, and thereby converges with the approaches of both classical ecology and Ingold's sentient ecology, which emphasise the relationships between organisms and/ or persons (see section 4.3.).

[106] Ingold (2000) seems to disregard these contingencies in the exploration of natural laws and consequently seems to object to the notion of natural laws as such. Thus, he asserts in regard to Darwinian theory that the concept of natural selection was "but the reflection of scientific reason in the mirror of nature" (op.cit.:4) and observes that

> "...as biologists gaze into the mirror of nature, what they see—reflected back in the morphology and behaviour of organisms—is their own reason. Accordingly, they are inclined to impute the principles of their science to the organisms themselves, as though each embodied a formal specification, programme or building plan, a *bio-logos*, given independently and in advance of its development in the world..." (op.cit.:19).

While Ingold thereby usefully points out how the separation of form and process in Western scholarly thinking recurs in our conceptions of life, I believe he overstretches the point and thereby undermines his argument. After all, the logical consequences of his assertions would be (1) to claim that science does not discover natural laws but invent them; (2) that even if science could discover nothing more than the workings of the Western mind, the same would have to be granted for all other lifeworlds; hence e.g. the experience of the Cree hunter in his encounter with the hunted caribou, which Ingold uses for instruction (op.cit.:13f.), would similarly have to be considered but a reflection of the Cree hunter's experience of life: if biologists see their own reason reflected, then the Cree hunter may see his

own sociality reflected. Returning to the contingencies of scientific insights, I would hold, contra Ingold, that the—justified—"'developmentalist' critique of neo-Darwinian biology and the 'ecological' critique of mainstream cognitive psychology" (op.cit.:4), which he quotes in support of his argument, are critiques which point out the insufficiency of conventional models but not the incapacity of science to deliver more appropriate ones.

[107] Polysemous concepts of nature and attendant conceptual confusions are not limited to the Western scholarly tradition. As Roy Ellen (1996c:112-114) has demonstrated, "boundary problems and contradictions" abound in Nuaulu conceptions of nature. Conflations among the various cognitive axes which underlie the various conceptions of nature may therefore be a universal phenomenon.

[108] Ellen (1996:12) provides a prime example of such twofold conflation, when he states: "The first [assumption in professional scientific discourse] is that nature really exists out there in the world in a positivist sense, and that science offers us a realistic model of how it is different from culture." Thus, he refers, first, to nature the external reality ('Nature III'); then, implicitly, to nature the physico-biological realm ('Nature IV'), the only form of nature with which science can legitimately be concerned, but which it is alleged to confuse with the former in its positivist aspirations; and finally to nature the opposite of culture ('Nature II'), of which science will allegedly provide a model. While in purely scientific terms both conflations are inadmissible, in scientific discourse certainly the former conflation is widely practised, as I have indicated. The latter conflation, though, I consider more a cultural construction of anthropologists than a genuine feature of scientific discourse; after all, a concern with the nature–culture duality is the domain of anthropology or the humanities, but not of science (see main text below). (Indeed, Ellen subsumed anthropology with science earlier in the same paragraph.) Besides, any attempt to explore the differences inhering in this duality seems a questionable undertaking anyway, since the duality refers to two hierarchically related, and hence principally incomparable concepts.

[109] Cf. Ingold (2000:99), who quotes Irving Hallowell (1960:28)* as stating: "The concept of the 'natural' is not present in Ojibwa thought", and continues (op.cit.:.424-n.11): "Since the Ojibwa have no concept of the natural, Hallowell maintains, they also lack any notion of the supernatural... Hallowell's point... is that the experience of other-than-human persons is one of superior power, rather than one of a reality that is superior to nature."

* Hallowell, A. I. 1960. "Ojibwa ontology, behavior and world view," in *Culture in history: essays in honor of Paul Radin*. Edited by S. Diamond, pp. 19-52. New York: Columbia University Press.

[110] From the text which precedes the quote, it seems that Ellen regards both post-modern constructionism and evolutionary ecology as instances of what he describes as the third approach. If both converge in their rejection of "the objectivist, adaptionist version of ecological anthropology" (op.cit.:19), they clearly differ, though, in their purpose of study: the former is concerned, in true anthropological fashion, with conceptions, the latter, in true scientific fashion, with the object of the conception itself. The latter should therefore come under the first approach, not the third.

[111] Anthropology therefore finds itself in the paradoxical situation of examining the conceptions which have given rise to it in the first place, thus performing the ultimate act of reflexivity. Compare Escobar (1993:382—cf. n.103), who paraphrased one of the contributors to the reviewed volume as: "Contrary to common belief, anthropology did not 'invent' the savage or the primitive... but emerged in a symbolic field that had been in place long before the nineteenth century. Since the Renaissance this symbolic field was organized to allow for the construction of the West in relation to a Janus-faced Other; one side was the savage, the other the West itself, but as possibility, as Utopia. Between the 'state of nature' and the 'ideal state', the Savage and Utopia emerged as complementary slots, mediated by the figure of Order."

[112] Of course, I do not mean to imply the absurd idea that men and mice exhibited equal ecological *patterns*, but that they are equally subject to uniform ecological *principles*.

[113] The confusion may have been promoted by use of the ecosystem concept. Emilio Moran (1990:3) defined:

> "The term ecosystem generally refers to the structural and functional interrelationships among living organisms and the physical environment within which they exist."

Regarding application of the concept in archaeology, Karl Butzer, writing in the same volume (1990:93), clarified:

> "Transfer of the concept to the social sciences requires several explicit restrictions. It is not a concrete unit of analysis but a dynamic perspective that facilitates the articulation of complex, interdependent relationships, characterized by positive and negative feedbacks, and variable equilibrium properties..."

It furthermore requires acknowledging the important role of information, technology, and social organization for human ecosystems, and the steering function of human cognition; thereby

> "we are not creating a dichotomy between human beings and nature, but rather singling out one human component—the mentalistic process—from the energetic [and, one may add, material] processes of the system" (op.cit.:93f.).

These specifications make it "possible to accept the definition that *human ecosystems* represent the interlocking of social systems with ecosystems" (op.cit.:94, original emphasis) and render the ecosystem concept a focus which "serves to draw attention to the systemic interactions among cultural, biological and physical factors or processes" (ibid.). For Butzer, therefore, "[t]he value of the human ecosystem as a framework for archaeological research is explicitly conceptual" (ibid.). In the words of Michael Jochim, another contributor to the volume (1990:75):

> "The ecosystem concept has been useful to archaeologists primarily as an heuristic device, encouraging us to think in terms of the systemic interrelationships among cultural and natural factors."

Butzer and Jochim thereby hint at two dilemmas which adoption of the ecosystem concept in anthropology may have introduced to the study of human subsistence:

1. a reductionistic conception of the human ecosystem, by conflating "the mentalistic process" with material and energetic processes (I will deal with this error in more detail in the main text below).

2. the mistaking of "structural and functional interrelationships" for "a concrete unit of analysis", i.e. the "trap of making ecosystems coterminous with biogeographical units or sites" (Moran 1990:12). This error reproduces that of confusing the concept of 'ecology' with that of 'environment' (or nature IV with nature I), against which e.g. Ellen (1982:90) cautions, but which he subsequently commits himself, by referring to "activities which materially affect ecology" (op.cit.:223). As explained in section 4.2. (p.116), this error remains benign within the natural sciences, but becomes consequential once the observer enters as an object of study itself/ themselves, i.e. in the social sciences.

Comparison of Butzer and Jochim's language with that used by Ellen (1982) suggests furthermore

3. a confusion of the concepts of 'ecosystem' and 'ecology'. The utility of the former as a framework for exploring interrelationships is thereby equated with a similar utility of the latter. Yet, the former refers to an, if ambiguously bounded (cf. Moran 1990:21ff.; and, in the same volume, Ellen 1990:1991-227), entity (though not to "a *concrete unit* of analysis", see point 2.): "a complex level of organization above the levels of cell, tissue, organ, organism, population and community" (Moran 1990:6). The latter, in contrast, refers to the ontological domain of which the former is part, or, conversely, the principles which apply in its organisation. While the former may therefore be legitimately conceived as a focus which trains various investigative concerns, the latter refers specifically to one of these; it is non-negotiable in anthropological terms, like the concepts with which science operates. Ecology can therefore serve as a *dimension* of analysis, but not as *framework*.

[114] This paradox may be not so much specifically Western as universally human, as Ellen (1996c:113f.) has suggested upon an examination of comparable non-Western concepts, especially among the Nuaulu. It becomes particularly acute, though, when it intrudes on scientific inquiry.

[115] Or, more precisely, in its academic version. Pet-owners and advocates of animal rights, in contrast, tend to attribute some form of personhood, respectively, to their pets or the animals they aim to represent (cf. also Ingold 2000:90f.).

[116] Leenhardt, M. 1975. Preface to *The Notebooks on Primitive Mentality, Lucien Levy-Bruhl.*" Oxford: Blackwell.

Agamben, G. 1993. *Infancy and history: the destruction of experience.* London: Verso.

[117] I continue to use the term 'hunter-gatherer' interchangeably with the term 'forager', as I did in chapter 3 (cf. n.33).

[118] Rosaldo, M. Z., and J. Collier. n.d. "Politics and Gender in 'Simple' Societies." MS to appear in *Sexual Meanings.* Edited by S. Ortner and H. Whitehead. Cambridge, London, New York, New Rochelle, Melbourne, Sydney: Cambridge University Press.

—the quoted passage occurred subsequently in slightly changed form on pp.276f. of the published article:

Collier, J. T., and M. Z. Rosaldo. 1981. "Politics and gender in simple societies," in *Sexual Meanings. The Cultural Construction of Gender and Sexuality.* Edited by S. B. Ortner and H. Whitehead, pp. 275-329.

[119] Conception of the tangible environment as non-human other, and the corresponding asymmetry in the conception of human–environment relations may appear historically contingent rather than ecologically determined. Thus, Ingold (2000:81) quotes Vernant (1983:254)* on the notions prevalent in classical Greece:

> "As a grower of crops... the farmer was not seen to act upon nature, let alone to transform it to human ends. Work on the land was more a matter of falling into line with an overarching order, at once natural and divinely ordained, within which the finalities of human existence were themselves encompassed."

Yet, the 'nature' in this quote likely refers to the imaginary nature the external reality (Nature III) or the physico-biological realm (Nature IV) rather than nature the tangible environment (Nature I) conceived as non-human other (Nature II). In its implicit comparison with the modern conception, the quote may therefore illustrate the degree of modern hubris, which has extended the environmentally transformative capacity of humans to reality and/ or natural laws, but does not necessarily challenge my argument that seed cultural systems readily engender a spatial conception of otherness.

* Vernant, J. P. 1983. *Myth and thought among the Greeks.* London: Routledge & Kegan Paul.

[120] Note a corresponding negative definition in the past for swiddening (Geertz 1963:15), which highlights the pervasive agro-centrism of conventional academic approaches for conceptualising subsistence.

[121] By denying the 'biological *relevance*' of human desires, intentions, motivations, etc., I do of course not mean to imply the absurd idea that these had no biological *consequences*. Without doubt, such consequences, whether intended or unintended, are universally evident, most patently in the global environmental crisis. They are, however, mediated by behaviour, which alone is accessible to biological inquiry (cf. p.126). Its ideational basis, in contrast, remains outside the remit of biological inquiry and thus bar biological relevance. In other words: ideational phenomena are nonexistent for the purpose of biological analysis.

[122] While I focus here on the human relationship with plants rather than animals, the three concepts may likewise apply to human–animal relationships, and are frequently used that way, the label of cultivation then being typically substituted with that of husbandry. Of course, the biological differences between plants and animals—including in particular the latter's food requirements, mobility and social

capacities, and the ease with which humans can select mating partners—manifest in different activities directed at them. I believe, though, that the basic patterns of interaction remain by and large the same, although exploring the parallels would exceed the scope of this study. I will, however, refer to the respective publications where appropriate.

[123] The scheme I present in the following was inspired by discussions with Christin Kocher Schmid regarding the format in which to organise ethnobotanical data. Our early versions involved the classification of plants—princpally trees—into several utilitarian categories and an extensive catalogue of human activities directed at them, in particular measures of indirect encouragement. Various revisions of the scheme, and the theoretical considerations set out in the present chapter led me to successively distil the current version which I believe represents the 'primary colours' of human plant management.

[124] With a perspective beyond subsistence benefits, there are of course additional scenarios, relating to the increased abundance of neutrals, undesirables, or untouchables, which may proliferate upon the removal of a respectively different class, or indeed of desirables (through appropriation). The underlying principles, though, remain the same as the ones discussed in the text regarding the proliferation of desirables. A case in point is the example provided by Christin Kocher Schmid (2004; cf. also the third example in Table 8), of species considered spiritually dangerous but ultimately useful, whose avoidance can lead to their increased abundance and must therefore be regarded as a management measure. What is ecologically effective in these cases, though, is not avoidance per se of the untouchables, but its complementation with the removal of another utilitarian class (as through the clearing of undesirables or harvesting of desirables), which shifts the balance between both, thus corresponding to the management practice of retention. Furthermore, the ultimate utility of these untouchables eventually shifts them to the class of desirables, thus placing them with the scenarios described in the text.

[125] Following A.K. Chase (1989:esp.42f.,46), we may introduce a further dimension to plant management, namely its spatial and temporal variations, which will subsequently allow more fine-grained analysis of domesticatory processes.

[126] Jones, R. 1969. Fire-stick farming. *Australian Natural History* 16:224-228.

[127] Unfortunately, the term management does imply a deliberate component. I have adopted it nevertheless, since it has already become widely used for complex or borderline cases (cf. e.g. Townsend 1990 or Rhoads 1982, as quoted in section 3.6.), and since there seems to be no comparatively appropriate term which at once suits clearly deliberate scenarios. Ellen (1994), for example, uses both 'regulating' and 'modification'. The former, however, has similar connotations of deliberateness as management, implies more systematic though less complex scenarios, and would poorly fit phenomena like fixed-field agriculture. The latter lacks an implicit reference to the utilitarian aspect of subsistence, besides suggesting, erroneously, the possibility of unmodified conditions.

[128] Thus, Nina Etkin (1994:3), for example, parenthesised cultivation as "sowing in prepared beds".

[129] By this term I refer to Darwinian evolutionary theory which holds that taxa evolve through selection on variation:

> "Natural selection is based on differential success in reproduction, made possible because of heritable variation among the individuals of any population and the tendency for a population to produce many more offspring than the environment can support. Natural selection results in adaptation, the presence in living things of heritable traits well suited to the local environment." (Campbell & Reece 2002:443).

Corresponding to my caveat, Campbell & Reece (op.cit.:445) note:

> "One obstacle to understanding evolution is the common misconception that individual organisms evolve, in the Darwinian sense, during their lifetimes. In fact, natural selection *does* act on individuals; their characteristics affect their chances of survival and their reproductive success. But the evolutionary impact

> of this natural selection is only apparent in tracking how a *population* of organisms changes over time." (original emphases).

[130] Mark Blumler and Roger Byrne (1991: 26-n.8) go so far as to claim that they "are aware of only one proven example of domestication-as-coevolution: the evolution of lactose-tolerance in groups that practiced milking." While this may be the single most striking example of human genetic change as adaptation to domesticates, it is not necessarily an instance of coevolution in the strict sense which the authors allege to advocate. After all, this would require a corresponding genetic change in the milk-providing animal. Certainly, genetic factors contribute to the increase in duration and degree of lactation in the respective females (cf. e.g. Harris 1977:229). However, the faculty per se of continued milk production in mammals is principally a function of appropriate stimulation (ibid.) rather than of domesticatory processes, as demonstrated palpably by the example of human wet-nurses.

[131] In fact, Rindos implicitly employed the more comprehensive notion of coevolution advocated by John Odling-Smee (1994), who argued that biological inheritance follows two processes, not just one: the first is internal and involves the transmission of genes; the second is external and involves the transmission of "ancestrally chosen and modified environments" (op.cit.:176f). More specifically,

> "This second inheritance system... is partly directed by autonomous events... which lie outside the influence of organisms.... However, it is also partly directed by the non-random, environmentally perturbing actions of phenotypes, including actions which are not directly determined by genes, but which could be co-determined by other phenotypically based processes, including human culture." (op.cit.:177f.)

Odling-Smee referred to these actions as 'niche construction' (op.cit.:178), for which humans exhibit "an unprecedented potency" (op.cit.:192)—presumably due to unparalleled behavioural flexibility. This explains the circumstance that the coevolution between humans and other taxa has been marked by genetic change predominantly on the side of the latter and behavioural change on the side of the former.

[132] Biologists may apply slightly different labels to the described relationships, but their concepts correspond to those outlined. Thus, Campbell & Reece (2002:540) offer the following definition:

> "Symbiosis... is the term used to describe ecological relationships between organisms of different species that are in direct contact.... There are three categories of symbiotic relationships: mutualism, commensalism, and parasitism. In mutualism, both symbiotic organisms benefit..., in commensalism, one organism receives benefits while neither harming nor helping the other in any significant way. In parasitism, one symbiotic organism, called a parasite in this case, benefits at the expense of the host."

Clearly, Rindos' understanding of symbiosis conforms to Campbell & Reece's more narrow notion of mutualism, which they define—corroborating, and in the last sentence expanding, Rindos' argument, as detailed in the text below—as

> "an interspecific interaction that benefits both species. Mutualistic relationships sometimes require the coevolution of adaptations in both participating species. Changes in either species are likely to affect the survival and reproduction of the other.... Many mutualistic relationships may have evolved from predator–prey or host–parasite interactions. Most angiosperm plants, for example, have adaptations that attract animals that function in pollination or seed dispersal. Any plants that could derive some benefit by sacrificing such organic materials as nectar rather than pollen or seeds would increase their reproductive success." (op.cit.:1180f.)

[133] In regard to animals, Diamond (2002:702) identified as the six main obstacles to domestication "a diet not easily supplied by humans (hence no domestic anteaters), slow growth rate and long birth spacing (for example, elephants and gorillas), nasty disposition (grizzly bears and rhinoceroses), reluctance to breed in captivity (pandas and cheetahs), lack of follow-the-leader dominance hierarchies (bighorn sheep and antelope), and tendency to panic in enclosures or when faced with predators (gazelles and deer, except reindeer)".

[134] Harris may have erred, though, regarding the type of conditions, claiming environmental seasonality as the decisive parameter, while more recent explanations emphasise forest gap dynamics and plant perenniality (cf. pp.40f.).

[135] Schwanitz, F. 1966. *The origin of cultivated plants*. Cambridge: Harvard University Press.

[136] It should be emphasised that there may be advantageous phenotypes which though derive their particular characteristics from environmental influences alone, without genetic fixation. Only with the latter, though, can traits manifest in the offspring and thus continue to participate in the iterative process of selection on variation which is the central tenet of Darwinian evolutionary theory.

[137] According to Campbell & Reece (2002:457): "Darwinian fitness is the contribution an individual makes to the gene pool of the next generation relative to the contributions of other individuals."

[138] Rindos (1984) identified both respectively as 'incidental domestication' (op.cit.:138-140,153-158) and 'specialised domestication' (op.cit.:138-140,158-164). He equated the former largely with dispersal, although other mechanisms are conceivable (see p.155). He also considered the former conceptually and developmentally prior to the latter, which may stem from his bias towards temperate-zone grain crop agriculture. I believe, however, that both denote merely two principally independent, alternative mechanisms, which may occur in any sequence or combination. This notion finds support from examples which Rindos himself adduces, of corresponding cases involving non-human animal agents (e.g. op.cit.:101-106,109-111).

[139] Thus, Harlan (1992:64) has taken the observation that "some 35-40,000 yr of landscape domestication [i.e. management] in Australia has not resulted in domesticated plants" as evidence to assert: "Plants are clearly *not* domesticated before agriculture." Yet, the absence of fully domesticated taxa does not exclude the possibility of intermediate forms, which may very well exist in Australia, as they do extensively in Melanesia (see main text below). In fact, Rindos (1984:161f.) supplies examples from the literature which document precisely that, as does e.g. Yen (1985:317). Besides, any Australian evidence would not rule out the *potential* for domestication without cultivation, with supporting evidence elsewhere—the only claim which Rindos makes. Harlan argues however, erroneously, for a categorical distinction between domesticatory and non-domesticatory conditions:

> "As long as human activity is confined to harvesting, any genetic effect on wild populations is likely to be negligible." (op.cit.:117)

Yet, this would mean that humans exist in an ecological vacuum before they commence more extensive forms of management (presumably exceeding the Australian version, which though is poorly characterised as pure harvesting). After all, symbiotic relationships, of which the domesticatory one represents but a particular instance, are a universal ecological phenomenon.

Blumler & Byrne (1991), who subscribe to a similar view, supply in fact the counterargument in their note 11, which though they present as counterevidence to Rindos' thesis, thereby curiously contradicting themselves twice. Thus, they state:

> "Rindos's (1984:130) suggestion that carob (*Ceratonia siliqua*) and tamarind (*Tamarindus indica*) pods became indehiscent [i.e. non-shattering] as a result of interactions with humans is absurd: these plants belong to phyletic groups in which indehiscence is common and precedes humans by many millions of years... In fact, it is possible that indehiscence in woody legumes evolved originally as an adaptation for dinosaur dispersal!" (op.cit.:27-n.11)

If the discovery (which the authors do not explicitly state) of pre-human indehiscence in carob and tamarind did indeed disprove Rindos' suggestion that the trait in the two taxa was induced by human domestication, it does not invalidate the fundamental possibility of it arising through the same circumstances in other taxa. In fact, the reference to a dispersal relationship with dinosaurs proves precisely this point. For, if indehiscence can evolve as an adaptation to dinosaur dispersal, then it can equally evolve as an adaptation to human dispersal. There is nothing that makes dinosaurs exceed humans in their capacity to act as dispersal agents; in fact, the reverse is probably true.

[140] There seems to be little agreement on the use of either the term 'progenitor' or the term 'wildtype'. The former seems more common with agronomically, the latter with biologically oriented writers (cf. respectively Harlan 1992:e.g.113 vs. Matthews 1995:esp.107; 1996:esp.118f.-tbl.1). Neither tend to make a distinction, though, between genotypes that precede human involvement with the taxon, and genotypes occurring in parallel to domesticates. Theoretically, though, there exists a difference

between both, and I suggest to represent this with the selective use of terms. Thus, wildtype should denote the genotype which coexists with the domesticate. Progenitor, in contrast, should denote the genotype which *precedes both*. That this is not necessarily identical to the wild type is evident from the potential of diversifying selection to split the original genotype into two new ones (cf. Figure 5 and Skelton 1993:371). Certainly, the rapid evolution of some domesticates rather suggests a process of budding, in which the original gene pool remains relatively unchanged (ibid.). Not all domesticates conform to this scenario, though, and in any case there remains a conceptual difference, which is well represented by the distinct lexical connotations of the two terms.

[141] A corresponding term is 'cultivars' (cf. e.g. Ellen 1988:125). I will avoid using it in the context of domestication, for its obfuscating connotations. Thus, it implies cultivation, which though is not a necessary precondition for the process of domestication and hence the emergence of landraces, as set out earlier. In contrast, the term 'landraces' corresponds to the term 'races' which is used analogously with domesticated animals, thus highlighting the common principles by which both have emerged. The corresponding terms used in biology are 'varieties' for plants and 'breeds' for animals (e.g. Skelton 1993:964f.). Since these tend to imply scientifically classifiable strains, though, their application in an ethnobiological context is not recommended (cf. Sillitoe 1983:5-n.8). The term 'cultigen', finally, refers to "a species that has arisen in cultivation" (Johns & Hay 1984:250), i.e. a domesticate without corresponding wildtype. Again, the implication of cultivation should discourage universal use of this term.

[142] Although Rindos (1984:esp.chpt.3) argued cogently for the imaginary role of intent in domestication, and in one way or other provided all the arguments to which I refer here, he did not systematically and explicitly distinguish between consciousness and intent *in their relation to* the distinction between selection and evolution, and in particular to the further distinction between human acts and their demographic relevance. This omission may account for the lack of clarity among several of the authors referring to him, and in particular for Blumler & Byrne's (1991) misapprehension and polemical dismissal of his stance.

[143] Even in the case of genetically modified organisms (GMOs), the expression of traits is not immediately accessible to human manipulation: what gets modified is the genotype, not the phenotype; selection, however, acts on the latter, hence the indirect relationship between evolution and selection remains. Besides, there is the continued potential for the modification not resulting in the desired trait. The development of GMOs therefore conforms fundamentally to the principles of conventional breeding, if employing more invasive and manipulative methods.

[144] Through pollination or mating, both conforming to the activity of translocation. The respective condition, conceived as 'reproductive control' (also used are phrases such as 'intervention in reproductive systems' or 'selective breeding'), is frequently considered the hallmark, or indeed equivalent, of domestication (e.g. Ellen 1994:211; Harris 1996:442,443,452; Harris & Hillman 1989:4,6; Yen 1991b:566). This belief may owe much to the prominent, since effortless, role which the selection of mating partners plays in the domestication of animals (cf. n.122). It is however a misconception, by which once again human behaviour (the translocation of organisms/ genetic material for mating or pollination), which *may* constitute a selective force, is confused with its demographic effects (the increase in reproductive success for individuals with particular traits), and hence human acts with the evolution of taxa.

[145] Mendelian genetics permit probabilistic assessments in the expression of traits, since they rely on "two laws, segregation and independent assortment" of "alternative forms of genes (hereditary 'particles')" (Campbell & Reece 2002:255). These laws typically apply in cases where traits are determined by single genes, their alternative forms naturally located on different, if corresponding, chromosomes. The classical case is Gregor Mendel's own study, which assessed the heritability of various characters in pea plants (ibid., op.cit.:247-254). Yet, there are situations where several genes contribute to the expression of a trait, as just mentioned in the text. As long as the involved genes occur

on separate chromosomes, Mendelian laws apply. If, however, they are located on one and the same chromosome, segregation becomes impossible, and so does therefore probabilistic assessment.

[146] Simmonds, N. 1979. *Principles of crop improvement*. London: Longmans.

[147] Accordingly, Rindos (1984:123) noted:

> "No plant species is, per se, a weed, and without information about the relationship [with people] it will often be impossible to classify a particular species. One of the dangers in the reconstruction of prehistoric subsist[e]nce systems is the assumption that 'weed' contaminants of a grain crop were, indeed, weeds."

[148] A similar situation as with weeds recurs in the animal kingdom: both the house mouse (*Mus musculus* ssp.) and the house sparrow (*Passer domesticus*) have been demonstrated to show morphological changes characteristic for domesticates (Leach 2003:356f. and references quoted). Since their "relationships with humans fall outside useful subservience but meet some of the distinguishing criteria", there has been a trend to classify them as commensals (ibid.). This designation (applied with the appropriate coevolutionary perspective by Leach, though not by all quoted authors) seems commensurate with conventional biological understanding (cf. n.132), according to which the respective relationships might in fact verge on parasitism. Correspondingly, weeds may well be similarly classified. If Rindos (1984:92) therefore refused to regard them as "as parasites on agricultural systems", he may have overshot his aim of pointing out the parallel development of crops and weeds.

The argument that all taxa are similarly exposed to the respective selective pressures and human schemes therefore principally irrelevant receives further support from the observation that domesticatory processes operate on humans themselves, resulting in such changes as declines in metabolic efficiency (Diamond 2002:706), body size, and robusticity (Leach 2003). Certainly, human self-domestication renders the concept of *coevolution* somewhat inappropriate, involving but a single taxon. Yet, it can thereby highlight how taxa can become their own agents through self-induced selective pressures, i.e. niche construction (cf. n.131).

The confusion which arises when scholars adhere to an intentionalistic framework, disregarding the universal applicability of evolutionary principles (to crops, weeds and humans) and thus at once essentialising the human species as immutable in time, becomes patent in Harlan's (1992:87) reflections on the involved concepts:

> "Since ecological behavior is the chief criterion for calling something a weed it would be logical to include animal species as well as plants in that category. The house sparrow, the starling, the statuary pigeon, the common brown sewer rat, the house mouse, the fruit fly (*Drosophila melanogaster*), and rabbits in Australia and New Zealand are excellent examples of animal weeds. Indeed, *Homo sapiens* is perhaps the weediest of all species, and the more he dominates the landscape, the more he seems to thrive. If we confine the concept of weeds to species adapted to human disturbance, then man is by definition the first and primary weed under whose influence all other weeds have evolved. One might argue that man is a domesticated animal rather than a weed. But man existed a very long time before he domesticated any other species; he has never seriously or consistently attempted to improve the race by selection or breeding as he has with other domesticates; and if we apply the test of unwantedness, the current alarm over the population explosion would appear to place man more in the category of weeds than domesticated animals. If man does succeed in controlling his own population size, we shall have an example of a weed becoming domesticated."

[149] In a similar vein, Rindos (1984:86) observed that

> "people invented agriculture, just as they invented chocolate mousse, atom bombs, and pornography. Such statements are totally true and absolutely trivial. Inventions are merely the events, behaviors, and material objects associated with human activity. This tells us nothing we did not already know."

In particular, it tells us nothing about the *process* which has led to the respective events. After all, both are not equivalent.

[150] The notion of intent, as manifested in the artificiality of process and product, is subliminally present even in scientific textbooks. Thus, Skelton (1993:964f.) explains:

> "A breed is a distinct, self-perpetuating strain of organisms *produced artificially*, whether by selection, hybridization or gene manipulation. The term variety is used for the same concept in plants... Most of the

> distinctive features of breeds and varieties... *are those desired by people and are not necessarily adaptive....*" (my emphases).

In fact, the "distinctive features of breeds and varieties" are supremely adaptive, namely to particular forms of human management. While their selection may have followed human desire, this has not lifted the involved processes above the workings of evolutionary principles. The same conflict, between intent and principles, becomes palpable when Campbell & Reece (2002:797) entitle a section: "Neolithic humans created new plant varieties by artificial selection", and continue: "the wheat groups we rely on... are the result of natural hybridization".

The same tension not only confuses scientific understanding, but deflects attention from scientific problems. Thus, Rindos (1984:2) observed:

> "Natural scientists have ignored... the mechanistic processes that might underlie agricultural evolution because... if crops and agricultural systems are ultimately derived from individual or cultural choice or decision making, they are beyond the ken of the evolutionary biologist."

Similarly, taxonomists take a hesitant stance towards domesticates, which "are, somehow, *not* the real thing" (Ellen 1996:15).

[151] *Canarium* comprises nut-bearing trees which are prominent in the archaeological record for their well-preserving hard shells (cf. Yen 1990:262).

[152] In the context of genetic instability, the aspects of indistinguishability from and absence of a wildtype represent ultimately but two sides of the same coin, although Yen's (1985:323) exposition creates the impression that they were distinct, thus generating an apparent contradiction. Thus, Yen first cites the "lack of an obvious wild analogue" as one of the criteria suggesting selective pressure without full domestication, while in the subsequent paragraph citing as criterion for the same condition that the candidate for domesticate can taxonomically be classified with the candidate for wildtype.

[153] Harris (1977:206f.) anticipated some aspects of my subsequently elaborated argument in his review of subsistence forms which did or did not lead towards agriculture. He noted that "in contrast to the harvesting of the seeds of grasses and forbs, [the harvesting of tree nuts] does not appear to have functioned as a pathway towards domestication and food production", which he attributed to the time required for a tree to reach maturity and the circumstance that trees are typically cross-pollinators, while herbs self-pollinators.

Regarding the criterion of pollination, Harris seems to have mistaken, though, the particular attributes of contemporary domesticates for general attributes of their respective life form and thus have confused ultimate and proximate causes of domesticability, or possibly even cause and effect of domestication. After all, most flowering plants employ various mechanisms against self-fertilization to maintain the benefits of sexual reproduction (Campbell & Reece 2002:788f.). The circumstance that many "agricultural" plants are (also) self-fertile (op.cit.:789) indicates the importance of self-fertility in the process of domestication—through its effect of stabilising populations—but not a universal tendency of their life-form towards this trait. In fact, Harris' argument is most famously qualified by the coconut palm as a woody perennial which is both cross- and self-pollinating (Yen 1985:323).

Furthermore, the conspicuous occurrence of self-fertility with domesticates may indicate that the trait itself has been a function of the domesticatory process, rather than vice versa. Thus, self-fertile variants would have been preferably selected by humans for the uniformity of their offspring (or, more accurately, selection of such offspring would at once have selected for the trait of self-fertilization in the parent plant). This scenario is further suggested by the ultimately self-defeating character of self-fertility, which may initially promote domestication but may in the long run lead to a deterioration of the crop through inbreeding depression (Campbell & Reece 2002:789) and to stagnation of the domesticatory process upon lack of new variants (ibid.).

[154] Other mechanisms may of course operate simultaneously. Diamond's (2002:702) suggestion, however, that the toxicity of acorns, which in contrast to that of almonds is controlled not by a single dominant gene but is polygenic, prevented their domestication seems unconvincing. Toxicity may prevent use altogether; but if it does not, as evidently in the case of oaks, there is no reason why it should prevent domestication. After all, domestication need not manifest in loss of toxicity, as bitter manioc famously demonstrates.

[155] Rindos' use of the past participle arises presumably from his idea that dispersal historically preceded environmental manipulation as a domesticatory mechanism (cf. n.138), and that therefore resources had already achieved a degree of domestication before they were further protected.

[156] According to Rindos (1984:112-n.6):

> "Propagules are of two types: sexual and asexual. The first are composed of the seed(s), and any associated accessory structures; the second are vegetative structures, such as tubers, corms, and bulbs. In evolutionary terms, the important distinction between them is that sexual propagules will produce plants that differ from both parents to the extent to which cross-fertilization and combination of traits has taken place, whereas asexual propagules perfectly reproduce the characteristics of the mother plant."

I believe that Rindos employed the notion of 'perfect reproduction' in a genetic sense, referring to the plants' (ideal) genotypes, since obviously asexually reproduced organisms (clones) differ from one another and the mother plant to the extent that they have morphologically (and potentially genetically, through somatic mutation) changed under environmental influences.

[157] Ellen (1994:211) observed in regard to the corresponding scenario for animals:

> "The distinction between hunting and herding..., and between predation and symbiosis..., are rendered most problematic in cases where it is common for domestic stock to interbreed freely with wild or feral animals..."

The problem is precisely the contingent character of domestication, which ranges indeed from pure predation to full symbiosis, and which is therefore unsuitable as a criterion by which to distinguish subsistence forms into, for example, hunting and herding, or, more generally, foraging and farming.

Yen (1991b) has devoted an entire article to exploring the various shades of reproductive control practised in New Guinea, singling out pig management schemes as exemplary. Thus, he traced a sequence of increasing human involvement in the reproductive cycle—following altitude—from none with hunting, through rearing of female piglets with or without occasional matings with wild boars, to full-blown breeding (op.cit.:esp.560-562). Unfortunately, he referred to these schemes as 'domestication' in general, and to semi-breeding schemes as 'semi-domestication' in particular, a perspective which he reinforced by stating that "the degree of control indicates the degree of domestication" (op.cit.:566). In fact, he transcended even this definition, by calling the rearing of young cassowaries, which apparently never breed in captivity, 'domestication' (op.cit.:560,562; also 1985:324). Whether referring to the raising of animals, or indeed to reproductive control, any such schemes concern however human behaviour, while domestication concerns the potential evolutionary effects of such behaviour, as I have pointed out earlier (p.151, n.144). If Yen's casual use of concepts therefore contributes to the pervasive confusion regarding the mechanisms of domestication, his evidence indicates that management schemes for both plants and animals in Melanesia span a wider range than commonly considered, and in particular include very relaxed regimes.

[158] The latter two must certainly be classed in this category, although Rindos omitted them, again presumably for his bias towards temperate-zone agriculture in which they play a negligible role (cf. n.138).

[159] Hather (1996:539f.) noted that there are several strategies by which plants may attain longevity: secondary, woody growth is the commonest, but is limited to the dicotyledons; monocotyledons may instead undergo pseudo-woody growth, as with palms, or vegetative propagation through tubers, corms or rhizomes, as, respectively, with *Dioscoreaceae*, *Araceae* and *Zingiberaceae* (cf. n.53). I believe that vegetative propagation through suckering should be added as a perennating mechanism. Suckering plants relevant for tropical subsistence include in particular bananas (*Musa* spp.); clumping palms such as *Metroxylon sagu* (cf. section 3.6.), which at once exhibits pseudo-woody growth; and some dicotyledonous trees such as breadfruit (*Artocarpus* spp.; e.g. Yen 1974:260,275), which at once exhibit secondary woody growth.

[160] While Rindos (1984:150f.) implied scenarios (a) and (c), he omitted (b), presumably as a consequence of neglecting the respective plant structures (cf. n.158). Scenario (b) seems likely where

unconstrained reproduction leads to crowding, such as with certain suckering plants, in particular *Metroxylon sagu* (but also possibly with *Colocasia* corms and *Dioscorea* tubers, cf. Hather [1996:543-fig.28.4., 544-fig.28.6.]).

[161] Rindos (1984:145-n.3) clarified: "Flowers, although botanically a sexual organ, are vegetative organs in relation to the dispersal of the plant; seedless fruits, because they contain no propagule, are likewise vegetative organs."

[162] That is, referring to domestication in its biological sense, as applied so far. Metaphorical use of the concept, in the sense of cultivation or association with the human sphere (see below), is however common, as demonstrated for example by Tuzin (1992:105—quoted on p.95), or by Ellen (1982:128,167; cf. p.102, n.94). Ellen (2004a) seems to be using the concept uncritically, referring once (op.cit.:76) to domestication in the context of *M.sagu*'s diffusion, although not to morphogenetic change in the taxon; elsewhere (op.cit.:89), his phrase "palms are domesticated or used for their fruit, cabbage, leaves..." demonstrates that his concept of domestication is distinct from use, hence non-biological. Similarly, he refers to the concept of coevolution between humans and *M.sagu* (op.cit.:75,95), but the context makes clear that the scenario under investigation is technical, not biological.

A singular exception to this common non-biological notion of sago palm domestication is Yen (1990) who casually mentions *Metroxylon* among other New Guinea domesticates (op.cit.:261f.), and equally casually notes: "The *Metroxylon* sago palm perhaps demonstrates best the development of domesticated taxa of the wide Melanesian–Polynesian border region that discriminates the New Guinea region of origin and the Polynesian region of agricultural diffusion." (op.cit.:269). He confirms his use of the biological concept of domestication by stating that in New Guinea selection was aimed at tillering and starch production, while further east at leaf production—corresponding to the differential characteristics of *Metroxylon* species and differential use of their products in the respective regions (cf. pp.86f.). It remains unclear to me whether he meant to imply that selective pressure by humans split the genus *Metroxylon* at large into the contemporary species, or that it but modified their progenitors (cf. p.148). It also remains unclear to me whether he was aware of the contrast, and indeed conflict, of his view with the conventional one, in particular since he has elsewhere (1989, 1991b) used the concept of domestication in various non-biological meanings (cf. p.160, n.157). In any case, the circumstance that he did not follow his assertions with any further exploration of the topic is puzzling in view of the challenge it poses to conventional views of New Guinea subsistence prehistory (cf. Klappa n.d. [forthcoming]).

[163] I have referred to Flach (1983) and Rhoads (1982) in more detail in section 3.6. Besides the supportive effect of plain predation, conforming to domesticatory scenario (b) described in the text above, the additional propagation with human aid, which *M.sagu* often experiences, conforms at once to domesticatory scenario (a).

[164] Even the spectacular morphological modifications which Chikwendu & Okezie (1989) reported for African wild yams under cultivation constitute but instances of phenotypic plasticity under management, not the development of a human–yam symbiosis, which would require increased reproductive success for the taxon as a whole. However, such expression of phenotypes favourable to humans, which may to some extent arise incidentally in the context of other management activities, may subsequently have encouraged management schemes promoting true domestication. I will return to this issue in chapter 6.

[165] Note in contrast Ruthenberg's (1971) "Farming Systems in the Tropics".

[166] Note that Spriggs (1996) uses the term in a more limited sense than Spriggs (1993), though still in reference to swidden gardening.

[167] The reference to fixed fields is not uncommon in dictionary definitions, occurring e.g. explicitly in Barnard & Spencer (1996:595) and obliquely in Seymour-Smith (1986:7), where reference is to fields, and in Shipton (1997:9) and Messer (1997:196), where reference is to sedentism and permanent cultivation, respectively.

[168] Rindos (1984:255) defined agriculture explicitly as "only a *level* or *type* of behaviour" (original emphases) rather than "a set of specified actions or practices". In the context of his coevolutionary analysis, this is clearly an advantageous approach; in the context of subsistence studies more generally, though, such a generalised definition at odds with the lexical connotations of the term is likely to generate more confusion that light.

[169] The subtle pervasiveness of such conceptions in academic texts is demonstrated for example by Harris' (1977) representation of farming as default condition of subsistence, evident in his characterisation of non-agricultural forms as "failure" of their respective practitioners to "develop agriculture" (op.cit.:198) or "move toward the cultivation and domestication of locally gathered food plants" (op.cit.:219), or of the harvesting of tree-nuts as a developmental "cul-de-sac" (op.cit.:208).

[170] Particular aspects which are missing from this taxonomy are for example parameters related to the historical dimension of plant management (cf. n.175).

[171] Note that Harris is careful to point out that his model "is not unidirectional and deterministic" (1989:16ff.; similarly 1996:444). This is different, though, from it being unilineal, as confirmed by the explicit reference to a time axis in his Figures 1.1. (1989:17) and 15.1. (1996:445).

[172] This latter relationship lies ultimately at the basis of Rindos' (1984) theory on the origins of agriculture. Thus, he regarded agriculture as "a direct outgrowth of the processes already existing under domestication" (op.cit.:266), that is as the result of the dynamics and positive feedback mechanisms entailed in the increasingly obligate symbioses between humans and their resources (op.cit.:esp.chpts.5,6).

[173] Yen (1985:321) could therefore correctly, if somewhat nonchalantly, suggest that "a list of species whose histories probably included domestication may be derived from field records of cultivation".

[174] The metaphor of "genetic response" is frequently employed in evolutionary discourse, but may confuse an understanding of actual processes. In evolutionary terms, the only real effect of human action is demographic, in that it changes the distribution of traits in a population. What 'responds', therefore, is *not* one or more plants, i.e. biological entities, but only *the average genotype of a population*, i.e. a statistical entity (cf. p.145).

[175] Peter Matthews (1995:107, 1996:118-120) has in the context of his own research in Oceania identified a further level of complexity, arising from the historical dimension of plant management beyond its effects on individual plants. Thus, he distinguished four, rather than just two variables for describing a plant's status, namely

- present habitat—alternatives: 'wild', 'cultivated';
- genotype—alternatives: 'natural (wildtype)', 'modified by human activity';
- cultivation history—alternatives: 'progenitors never cultivated', 'progenitors cultivated';
- dispersal history—alternatives: 'completely natural', 'dispersed by humans within natural range', 'dispersed by humans beyond natural range'.

If the former two refer to functions of management and domestication, respectively, whose various combination I indicate in the text, the latter two refer additionally to the effects of management over time, with their respective impacts on the former two variables in turn.

Analogous to my argument, Matthews observed: "To interpret the distributions of plants used by humans, we need to avoid biases that come from our present dependence on agriculture." (1996:118). Accordingly, he emphasised that his four variables are, like my two, principally independent, and arranged them in a matrix listing all possible combinations (1996:118f.-tbl.1 [note that the fourth category conforms to Rindos' 'incidental domestication' (cf. nn.138,139), although Matthews himself commented: "There is no common, specific term for this possibility." (op.cit.:120)]). Although he did not point it out, the alternatives which he provided for each variable represent of course but opposing poles of what, again, are ultimately continuous parameters.

[176] Occasionally, authors have used the two concepts interchangeably, in the sense of resource appropriation. Ellen (1982), for example, speaks at one point of "the procurement of non-domesticated resources...[vs.] the procurement of domesticated resources" (op.cit.:128—for the complete quote cf. pp.101f.) and at another—if imprecise in thermodynamic terms—of "energy produced by food-collecting populations" (op.cit.:97). More common, though, is use of the concepts analogously to foraging and farming (e.g. Harris 1989:13; Ingold 1979:281).

[177] For him, an amalgam of agriculture, cultivation and domestication (cf. pp.137f.).

[178] Engels, F. 1934. *Dialectics of Nature*. Moscow: Progress.

[179] The critical aspect in the following discussion—as in much of this chapter at large—is the transferability or otherwise of concepts from one epistemological domain to the other. Thus, there is no question that humans have dramatically and radically transformed their environment, have demonstrated supreme creativity in this, and have done so decidedly with intent. However, such assertions are meaningful only within their respective terms of reference. In this case, these terms may be economic, technological, aesthetic, etc.—all addressing processes which involve the transition from resources/ raw materials to goods/ artefacts ranging from machines to anthropogenic landscapes. This transition, in turn, is defined not only by a material rearrangement of the respective entities' component elements, but by the emergence of new entities upon the ideational processes involved (in particular through ascription of commercial, utilitarian, aesthetic, etc. value and attribution of meaning). In ecological terms, however, the transition in question is that from some substrate into the resources themselves upon purely material and energetic processes; ideational concerns remain without consideration, as much in regard to the motivations driving human behaviour as in regard to the valuation of its effects (cf. pp.126,150,163; n.121). Hence, the above assertions become irrelevant, true as they may be within other terms of reference.

Expressed in more general terms, one and the same situation may be conceptualised very differently depending on the respective explanatory framework. If the sameness of the situation suggests, erroneously, that concepts could be transferred across frameworks, this operation can easily distort perceptions. The underlying confusions may seem trivial and restored perceptions banal, yet the distortions can impact significantly on representations, an effect which may in fact be exploited politically. I attempt to demonstrate such impact in the following in regard to the notion that resource organisms were accessible to human creation—a notion which may appear preposterous at face value, yet permeates the entire field of subsistence studies. Its political gain is a feeling of superiority for the presumed creators ('farmers') over alleged non-creators ('foragers'), which has throughout history justified interventions which nowadays come in the guise of 'development'. A related case in point is the common concept of 'oil producing countries'—entailing a notion of production appropriate in an economic context, though implicitly extending to a geological context, in which the concept of 'oil extracting countries' would be more appropriate. The implied image of a regenerating resource serves to lull the public into a sense of economic and military safety and to buttress the neo-classical economic model which attributes value to environmentally erosive activities. These explications shall demonstrate that it is desirable to examine carefully such hidden shifts of domain, if not in the interest of intellectual rigour alone, so of tracing and exposing their political implications.

[180] Indeed, even the notion that objects could be made is contestable, as Ingold (2000:chpt.5) has shown. Thus, the idea, implicit in the manufacture analogy, that an extrinsic design provided by human reason was to be imprinted on a pre-existing substrate provided by nature (op.cit.:80,85) finds little support beyond modern thinking (op.cit.:80-86). Ingold has therefore suggested to regard objects, like organisms, as emerging only "within the relational contexts of the mutual involvement of people and their environments" (op.cit.:88).

On the other hand, the distinction between organisms and objects, as one between entities which exhibit life processes and are thus considered animate and others which do not, is less clear-cut than it seems. This uncertainty applies even within the current Western paradigm, as the tenets of natural science itself indicate some fundamental ambiguity about the definition of life—what, for

example, about viruses, "obligate intracellular parasites" (Campbell & Reece 2002:330), which "are in the semantic fog between life and nonlife" (op.cit.:339)? It also applies in a cross-cultural context. Thus, Ingold (2000:chpt.6) has adduced ethnographic examples of ontologies which not only infer personhood for non-human beings and, indeed, for what we would consider inanimate things, but which defy any such neat classification altogether (op.cit.:esp.96f.). He concluded that, contrary to Western ontology, which apprehends life as a *property of objects*, in these examples life appears as a *property of the context* within which objects are positioned, as well as a *process* for those engaged in it (op.cit.:97).

Our conventional distinction between objects and organisms may therefore unravel with potential shifts in our ontology, sensu Ingold, towards a relational lifeworld, a perceived shared animacy and a developmental view of both object and organism alike. Whether or not we agree on the exact demarcation between objects and organisms, and on the foundations for their existence, we do however sense a categorical difference between some things and others, recognising their dissimilar modes of creation, as illustrated in the quote which follows in the text.

[181] Vernant, J. P. 1983. *Myth and thought among the Greeks*. London: Routledge & Kegan Paul.

[182] More precisely, killing is a necessary concomitant of subsistence in regard to uses such as food, fuel, construction, etc. There are certainly other uses, such as transport or traction, which require life organisms. Still, the categorical distinction, which I want to demonstrate in the following, between the productive capacities of humans and those of the utilised organisms, remains, and is best demonstrated by reference to the switch between the animate and the inanimate.

[183] Intriguingly, this concealment tends to complement a notion, near universal in cultivator societies, which links (human) death to cultivation practices. Thus, Harlan (1992:44-46) quotes several myths in which crops emerge from corpses or graves to illustrate a wider phenomenon:

> "There are hundreds of tales on the same theme with an essentially world-wide distribution. Someone or something must die for crops to appear and grow. In many tales death came for the first time with agriculture." (op.cit.:45)

The Judaeo-Christian myth of Eden fits the mould, as ejection from paradise means at once the loss of access to the tree of life and the commencement of agricultural toil.

The contrast between the theme conveyed in these myths and the simultaneous denial that resource organisms get killed seems to indicate that the act of planting has a symbolic quality which aims at transcending death, thereby generating the illusion that it was itself creative, a quality which though can only manifest upon the recognition of death itself. This indicates that cultivation touches profound spiritual concerns. It may, therefore, be in the realm of depth psychology rather than ecology that we will find the discontinuities that distinguish some subsistence forms from others. To explore these issues, though, would exceed the scope of this study.

[184] This observation applies indiscriminately of the kind of organism in question. For Ingold (1979:281), it was important to point out that "economic production... is common to both animals and men". I would maintain that it is, indeed, common to all organisms, including plants. Certainly, the relationship is more palpable with heterotrophic organisms, whose need for organic matter manifests as actual food-getting and feeding activities which are easily recognised as appropriation. If autotrophic organisms require but inorganic matter and sunlight, though, they need to likewise absorb these first, in a process which corresponds to appropriation.

[185] The act of feeding most vividly represents the transition between ecological and economic production, and constitutes its principal instance in regard to non-human animals. With humans, however, there are numerous acts which in their thermodynamic, ecological and economic effects correspond to feeding, but which fulfil other than dietary utilitarian functions. They all involve killing (harvesting) the organism, but then using its stored energy or organic matter for purposes such as fuel, fertilization or construction. In these cases, the alternation between ecological and economic production terminates with the latter, without involving a further step of ecological production in humans.

[186] I suspect that Ellen (1982:91) might have been unaware of the curious literal meaning of his assertion, hence that he might have meant the attribute of 'non-genetically' to refer not to the generation of resource organisms but to the respective human management activities, implying in turn that humans, in contrast to other animals, were 'not genetically programmed' to perform these. If this is what he meant, it is however not conveyed by the wording he used. Furthermore, though, the respective assertion that all animals save humans went about their subsistence business blindly following genetically encoded instincts would be biologically naive to the extreme, contradicted not only by learning in animals, but conversely also by the fact that the human capacity for "organized social activity" is itself genetically encoded.

[187] As indicated in n.182, this scenario is typical, though not universal. It is particularly prevalent with human–plant relationships, where appropriation of assimilated energy (for food, fuel, etc.) and materials (for construction etc.) regularly entails killing of the organism (or its propagules). With human-animal relationships, in contrast, assimilation and appropriation often occur both in parallel and in temporal sequence. Thus, many livestock animals may provide energy and materials both during their lifetime (in form of milk, blood, eggs, traction, transport, etc.) and after their death (in form of meat, hides, feathers, etc.). Accurately, of course, a comparable situation obtains with plants which figure as resources through the support they provide for other resource organisms, as in the case of companion or shade plants. These considerations demonstrate that assimilation and appropriation are not alternative conditions, but complementary ones, which stems from their grounding in different explanatory frameworks, namely ecology and economy.

[188] Thus, e.g. Terrell et al. (2003:351f.) suggest a scheme for organising data on plant management which relates resources to a range of behaviours from pure harvesting to pure environmental manipulation, with intermediate forms in between. Although they phrase the contrast between both extremes in terms of skills rather than activities, the effect is the same: the implication that harvesting(-skills) did not matter in cases of environmental manipulation, and thus neglect of one stage of the subsistence process.

[189] Besides the notorious "calorific obsession" (Moran 1990:17f.) of studies in human ecology in the 1960s, '70s and '80s, which by implication entailed a corresponding obsession with food (also e.g. Ellen 1982:95-122), the equation of subsistence with the generation of foodstuffs is explicit in such concepts as "food-collecting populations" as synonym for hunter-gatherers (Ellen 1994:200); "food procurement/ production" as synonyms for foraging/ farming (e.g. Harris 1989:passim; cf. p.167); the exclusive reference to food as the target of subsistence activities (e.g. Dornstreich 1977, Obrist 1990—cf. p.104); the limitation of resources to food-providing plants (e.g. ASWP:chpt.2—cf. p.21); or indeed the limitation of co-evolutionary relationships to feeding scenarios (e.g. Rindos 1984:191-193). Occasional exceptions tend to occur in the form of afterthoughts or addenda rather than theoretically or methodologically integrated into the respective studies, and with a view of non-food resources as supplementary rather than integral to subsistence, thus confirming the rule. They include for example the classification of resource plants with non-food uses in a residual category of "inedibles" (e.g. Sillitoe 1983—cf. pp.79f.); 1½ pages in Ellen (1978:75f.) on "sources of non-edible forest products"; one paragraph in Ellen (1982:174) on the importance of considering also non-food resources in the analysis of subsistence; one paragraph in Ichikawa (1996:471) on the importance of non-food resources in Mbuti subsistence; and a footnote in Rindos (1984:144-n.2 [referring to several sources]) on the principal evolutionary equality of food- and non-food resources.

[190] This importance, and the resulting bias, may be further accentuated by a lexical emphasis on edibility in the host society. Thus, Prance et al. (1995[1987]:158f.) observed for Amazonian Indian groups:

> "In fact, only one category may be considered to be readily recognized by the Indians themselves, as demonstrated in the indigenous lexicons. This category is 'edible'... No single or short set of terms covers the semantic range of 'construction material', as here defined, in any of these languages. Rather, house beams, posts, ridgepoles, thatching material, canoe-building material, and the like, are all individually named."

As the authors continue, the same applies for 'technology', 'remedy', or 'commerce'.

[191] Thus, their own experience with the utility of environmental resources, that is living organisms, tends to be limited to food, and to a minor extent to (herbal) medicine, fibre for clothing and data carriers (paper), and timber for furniture and construction. If these resources are often made unrecognisable through multiple stages of processing, the remainder of uses tends to be met by mineral and fossil resources (stone and brick for construction, metal and synthetics for artefacts, mineral fertilisation, fossil or nuclear fuels). Indeed, food constitutes the only subsistence need which truly continues to require organisms—as long as we have not found a way to synthetically mass-produce matter from mineral or fossil sources which we are fit to assimilate.

Furthermore, a principally agro-pastoral orientation may exaggerate expectations of animal use and correspondingly diminish expectations of plant use (analogous to the neglect of vegetal foodstuffs, in particular leafy greens as sources of protein [cf. n.29]), causing ethnobotanical inattention to material culture, not offset by a corresponding attention in ethnozoological studies, which tend to focus on cognitive rather than material issues. Yet, even people classically identified as hunter-gatherers, for whom animal resources figure prominently, meet material needs predominantly from plant resources. Thus, Mitsuo Ichikawa (1996:471) has observed for the Mbuti Pygmies: "The use of plants for material culture deserves special mention... Their material culture is... characterized by plant products which are abundant in the forest."

[192] John Pernetta and Lance Hill (1981:esp.293-298) have, however, anticipated this methodological approach in a position paper. Thus, they argued that building materials as well as knowledge of artefacts and their manufacture constitute essential parameters for the survival of rural communities in Papua New Guinea, and therefore need to be considered for any realistic evaluation of livelihoods; and that attention to these parameters reveals that subsistence is insufficiently described by reference to cultivation practices alone, since the respective resources originate from non-agricultural habitats.

[193] These correlations apply with qualifications to shelter as an aspect of material culture. Some parts of the construction may require highly specific resources, such as for thatch, walling, flooring, posts and ridgebeams; other parts may be sufficiently met by unspecific resources, such as for beams and rafters, a circumstance to which I have referred in the context of discussing perennials in chapter 3 (pp.57,77, n.75).

[194] Thus, the food bias has commonly led to a view which contrasts 'food uses' with 'other uses', thereby artificially collapsing a whole spectrum of uses into a single category. Sillitoe (1983:chpts.2-6) additionally inflated the food category, by classifying food resources into 'tubers', 'greens', 'shoots' and 'stems' and 'fruits', all of which he equally contrasted with 'inedibles' (cf. pp.79f.). Conklin (1957:74) maintained a more balanced representation, contrasting food with various other uses, one of them being 'technological', which in turn, though, comprises numerous distinct uses, namely "firemaking, cooking, and... the construction of tools, containers, house and agricultural equipment, hunting and fishing equipment, clothing, structures, musical instruments, and other manufactures." Ellen (1982:212-tbl.9.1.) similarly subsumed 'artifacts' under 'other economic uses', which he contrasted with 'food', 'medicinal' and 'social and mystical' uses.

[195] Note, however, that artefact collections may easily be biased towards or against particular classes of objects, especially when objects are purpose-made and therefore their function as vehicles of personal and/ or cultural expression is heightened. My own collection from Krisa demonstrates this effect, as local artisans conceived the collection as a means to re-enact the material life of the past. This proved beneficial for the purpose of this study, since it permitted access to a wider range of resources than would have been possible in a wholly contemporary scenario, where many materials and objects have been replaced with commercial ware. In other circumstances, though, the opposite may apply, when the interests of artisans and researcher diverge.

[196] There are, to my knowledge, no studies which either propose or apply a similarly comprehensive assessment and quantification. Ellen (1982:216) quotes Hays (1974)* as having employed an index

derived from numbers of uses, while he himself proposed to measure significance for specific uses. He did suggest: "General measures of degree of significance may be calculated by bringing together a number of separate indices", without though going into more detail theoretically or empirically. Prance et al. (1995[1987]:159f.,162-169-tbl.1) identify resources with their uses and distinguish but two alternative conditions, 'major/ minor (food, item of technology, commerce, etc.)', to which they assign the values 1.0 and 0.5, respectively, accommodating multiple uses through addition of values. If their scheme approximates mine in its approach, it differs both in the number of variables examined (they conflate significance of use with significance of resource), the range of variation considered (they distinguish between only two values), and the scope of relative importance overall (which they represent through addition, without additional multiplication). The resulting, comparatively 'flat' quantification may suit the authors' purpose of exploring the contribution of one particular environment (terra firme forest) to the resource base. It is less appropriate for throwing into stark relief the relative importance of various environments in the overall subsistence system, as I am undertaking to do.

* Hays, T. 1974. Mauna: explorations in Ndumba ethnobotany. Ph.D. dissertation, University of Washington.

[197] Two studies which illustrate this last point in contrasting ways are Sillitoe (2002) and Kocher Schmid (2004; n.d. [forthcoming]). Sillitoe argues (op.cit.:52) that "energy accounting is as admissible as any other currently available technique" for assessing hunting returns, and proceeds accordingly (op.cit.:52-59), concluding that the extremely low energy cost-benefit ratio of contemporary Wola hunting (op.cit.:56) combined with the limited collection of 'wild' plant foods (op.cit.:59-62) to rule out past reliance on 'hunting-gathering' in the New Guinea highlands. Thereby, he not only falls victim to a presentist bias, which he anticipates without though supplying any more convincing counterargument than his own convictions (op.cit.:69). He also continues to subscribe to the "calorific obsession" of the past (cf. n.189), two decades after the recognition that nutritional sufficiency depends on more than energy (cf. p.41), and in contradiction of at least one of the sources he cites in support of his argument (Ellen 1996b:599,620), which in fact highlights the contrast between "the sometimes spectacular calorific inefficiency" of hunting and its potentially crucial contribution to protein supply and important role as a social lubricant. Kocher Schmid, on the other hand, appreciates the limited but essential use of tropical hardwoods for durable ceremonial objects, which allows her to apprehend an otherwise invisible aspect of local land use.

[198] Evidence for this problem abounds in Johns & Hay (1984), a publication which describes members of the palm family in New Guinea. For example, the authors note for the genus *Corypha*:

> "1 species in New Guinea, *probably C.elata* Roxb." (op.cit.:199, my emphasis).

In Figure 118 (op.cit.:307), they show

> "An undescribed species of *Ptychosperma*",

whereas under the genus *Nengella*, they list 19 described species, then qualify:

> "Although 19 species have been described, it is likely that there are really far fewer. The material in [the National Herbarium in] Lae suggests 3 [!] species in Papua New Guinea. One widespread and common species... is very variable, and may account for a number of the names in the above list..." (op.cit.:291)

For the genus *Orania*, they observe:

> "The genus has recently been revised for New Guinea... Unfortunately 3 of the 4 new species described are known only from single collections, and except for a few rather obscure photographs, they are not illustrated, so some difficulty may be experienced in fitting names to further collections with any degree of certainty." (op.cit.:295)

[199] Celia Ehrlich (1989) has devoted an entire article to the dilemma of obscure—and consequently obscuring—identifications and the problems caused for subsequent research. In conclusion, she recommended suitably: "Ethnographers could make their writings more useful *by including several kinds of information about plants*—descriptions as well as English common, native and pidgin names." (op.cit.:61, my emphasis).

[200] This circumstance may be equally obscured by conceiving of subsistence as 'food production' (cf. pp.168ff.), or indeed by equating subsistence with sustenance (cf. Ellen 1982:91—quoted on p.171), as by a preoccupation with technology, limited to equipment (Ellen 1994:197,200).

[201] Recall that processing comes with incidental effects which enhance proliferation of the plant (cf. sections 3.6., 4.5.).

[202] This point is illustrated, for example, by Moran (1996:539), who concludes that the finding of an elaborate study from Amazonia, that substantial differences exist between resource frequencies in old fallows and 'natural' forest, "*suggests* human-induced alteration of forest composition" (my emphasis). Although the study may, admittedly have served purposes other than determining human management schemes, all it can accomplish in this respect is to suggest, rather than document, "human-induced alteration", which though could be achieved by observing, and inquiring about, the very management activities suspected.

[203] The study by Denevan & Padoch (1987) demonstrates not only the perceived necessity of plot surveys, but furthermore their privileged treatment in the event of scarce resources. Thus, the authors note (op.cit.5):

> "The original objective of the field research project was to study the swidden fallows in an indigenous Amazon village..., including the description of managed fallows, the process of transition from swidden to fallow, the management of useful fallow plants, and ethnobotany. Within limited time and resources, all this was not possible and the actual focus of the research was on determining the characteristics of managed fallow vegetation. Fallows of different ages were mapped and the natural and managed vegetation was described. Vegetation sampling was done along transects (young fallows) or in quadrats (older fallows), and plants were identified, measured, and counted. Relative abundance or dominance of useful species was determined. Some idea was thus obtained as to the changing composition of useful plants over time in managed fallows. However, the plots were not resampled later to determine changes in specific fields over time, nor was more than one field in each age category sampled for comparisons; both of these methodologies were desirable but not feasible."

[204] Analogous to my observation in n.196, there are, to my knowledge, no studies which either propose or apply a similar approach to quantification. Terrell et al. (2003:351-357) suggest a vaguely similar exercise which they term 'provisions spreadsheet', correlating resources and actions directed at them. Their scheme suffers however from the limitations identified in n.188, besides lacking a systematic means of quantification. Hviding & Bayliss-Smith (2000:55ff.-fig.3.2) present an extensive inventory of resource species and their uses, grouped according to local environmental categories, which would therefore require rearranging according to either of the former parameters, besides prior ranking of uses and resources, to permit the quantification I suggest.

[205] Clearly, this division represents positive discontinuities of human existence which are similarly recognized in the Marxist model of the mode of production (cf. e.g. Hann 1996; Roseberry 1997; Seymour-Smith:194-196). Thus, the concept of resource base parallels that of forces of production; the concept of socio-cultural matrix that of relations of production plus the superstructure which builds on them; the concept of subsistence behaviour that of labour, both articulating the respective two others. Similarly, students of subsistence have repeatedly undertaken analytical separations which resemble mine to a greater or lesser extent. To my knowledge, though, my format has no precise precedent. Thus, it is generally acknowledged in hunter-gatherer studies that assessing the ways in which people interact with resources is insufficient to ascertain their hunter-gatherer status, and that this needs to be complemented with assessments of social organisation and cosmology (cf. Lee & Daly 1999:3—quoted on p.43). This scheme, however, is biased against my spheres (1) and (2), which it subsumes as a combination of appropriative behaviour and resource status, in favour of (3), which it differentiates into social and cosmological aspects. Ellen (1988:125) does differentiate three spheres corresponding to mine, though limiting them to coevolutionary trajectories for (1), protection for (2), and social control for (3). Chase (1989:42) has provided a scheme very similar to mine, distinguishing "dynamic processes involved in changing the morphology, distribution, and genetics of certain species", "plant exploitation practices" and "rationalization of action". Like most authors, though, he disregards aspects connected with use, thus eliminating half of the phenomena integral to subsistence; furthermore, he

explores subsistence ultimately from an anthropological perspective alone, thus disregarding its ecological dimension (cf. pp.160f.).

[206] Note that I use the term 'schedule' in a purely commonsense meaning, as referring to the spatial and temporal organisation of activities (cf. n.125). This is distinct from 'scheduling', which in human ecology has been understood as the implementation of some actions out of a range of potential ones (Cook 1973:44; Ellen 1982:226), loosely corresponding to the more recent concept of 'optimal foraging strategy'.

NOTES TO CHAPTER 5

[207] The 'ethnographic present' refers to the years 1997–1999.

[208] Unless otherwise specified, topographic data are taken from the Territory of Papua and New Guinea 1:100,000 Topographic Survey, Sheets 7192 [Vanimo] and 7191 [Bewani] (Edition I) Series T 683 (Royal Australian Survey Corps 1970[1985], 1975).

[209] For the spelling, cf. Conventions-n.§.

[210] Preliminary classification in the past recognised Krisa language together with three others as "Krisa group"; the languages of the Vanimo west coast as "Vanimo group"; both in turn as "Sko phylum-level stock"; and "Kilmeri" (Kilimeri or Mbo) and "Ninggera" (Ningera) as "Bewani group, Border stock, Trans-New-Guinea phylum" (Moseley & Asher 1994:map35).

Classification has been revised on the basis of recent linguistic research in the region. Linguists Mark Donohue, Lila San Roque and Melissa Crowther now recognise a family "Macro-Skou", which comprises "I'saka" (Krisa) as an isolate representing the earliest split from the proto-family, the languages of the Vanimo west coast and numerous others; Mbo as unrelated to these; and Ningera as a variety of Mbo (Donohue & Crowther n.d.:n.2.; Donohue & San Roque 2004:6f.,108; San Roque 2001:28-fig.2.2). They argue that the vernacular spoken in Krisa should be called I'saka following local practice (Donohue & San Roque 2004:1, also 6-n.3; San Roque 2001:28-n.3). As far as I am aware, however, the name I'saka is less inclusive than the name Krisa (see main text below). For this reason, and in order to avoid inflation of names used, I will keep to the latter.

Also, I will maintain a four-fold distinction between Krisa, Mbo, Ningera and the languages of the Vanimo west coast, and the respective socio-cultural groups. This best represents local understanding of linguistic and political relationships. Thus, Krisa people recognise their language as unique, closely related and mutually intelligible with Ningera (cf. Cheesman 1941:182; also Ketan 1992), and very different from both Mbo and the coastal languages, while recognising the closest and historically deepest social and political ties with Mbo-speakers, some ancestral connections with Ningera speakers, and only recent connections with the coastal communities.

Appendix 8 provides an overview of the various representations. The discrepancy between linguistic and local understanding may relate to a blurring of language boundaries through extensive linguistic exchange upon even recent contact, a phenomenon which Donohue & Crowther (n.d.) have observed as common for the region.

[211] Donohue & Crowther (n.d.:5) note: "The cause of this movement is not known, and cannot be guessed at—natural disaster, social change, extravagant leadership, are just some of the possibilities." Considering the intrinsic instability of socio-political formations in the region, of which I will present aspects under the following headings, and the extent of the event's impact, I assume a cause beyond human agency, thus favouring the authors' first suggestion. In fact, the region is seismically active, as demonstrated by frequent tremors and sporadic earthquakes of variously destructive impact, reported in local accounts and official documents (e.g. AA n.d.:78). Geological instability manifested most recently in the tragic events of 17th July 1998, when a gigantic tsunami devastated Sissano lagoon (about 100 kilometres east along the coast from Vanimo), causing the deaths of several thousand people and in its wake the need to resettle survivors displaced through submersion of their land, which in turn led to land disputes with other resident populations (cf. San Roque 2001:39). It seems plausible to assume a similarly devastating event, its inland analogue maybe the collapse of a mountainside, as the trigger for major relocations with corresponding conflicts, resulting in further relocations and thereby setting off a wave of migrations.

[212] The letters A-J stand for recognised groups, which in the community are identified by individual names, mostly idionyms, but occasionally drawn from the toponym of a past occupation site or the personal name of the founder or first immigrant. I use the letter code for two reasons. Firstly, an inventory of 12 individual names would add little information but much confusion. Secondly, and more importantly, it might invest the respective accounts with undue authority. Certainly, insiders may be able to match the codes to actual groups, an operation which though I do not want to sanction by fixing

it in writing. After all, my version of history is necessarily partial, decontextualised and synthetic, which conflicts with the purpose of oral history to supply the principal legitimation for territorial claims, a highly delicate subject anyway throughout PNG. I therefore want to avoid any suggestion that my records could serve to supplement or replace living accounts. They are to be taken as purely illustrative, not authoritative.

[213] For converting genealogical into calendrical information, I assume

1. a generation period of 30 years. This comparatively large average seems justified considering in particular the formerly widespread practice of polygyny, which led to men fathering children well into advanced age, and the possibility of younger children attaining genealogical significance despite a preference for the firstborn.
2. generation +1 to refer to young or middle-aged adults during 1997-99. "Four generations ago/ before the present" (4 gbp) therefore refers to the current young adults' (+1) great-grandfathers or current elders' (+2) grandfathers. The beginning of that generation (creation, birth) is calculated as 4 x 30 ybp = 120 ybp; an event during that generation's lifetime (marriage, heroic act, etc.) as (4 – 1) x 30 ybp = 90 ybp; an event late in that generation's lifetime as (4 – 2) x 30 ybp = 60 ybp.
3. the year 2000 as reference point to calculate years AD.

[214] Substantial time depth of migrations and composite character of communities are also reported from elsewhere in the region (Deklin 1979:31,33 [Wanimo]; Simet 1992:52-55,63 [Ningera]; Thomas 1941-42:166 [Manimo/ Wanimo]). Migration routes described, or implied, in these accounts accord reasonably well with those suggested by linguistic research.

[215] In particular Mt.Sini, one of the northern peaks of the Bewani Mountains, is of significance for seven different groups (Ketan 1992:passim; Simet & 1992:Annex Four), suggesting their past proximity to the assumed epicentre of the Bewani expansion.

[216] Reports of immigration from the interior accord with the claim that cultural introductions originated from the Pual basin. Both assertions are in turn supported by Ningera oral history (Simet 1992:63), and, more generally, by the migration routes reconstructed upon linguistic research (Donohue & Crowther n.d.:5). Overall, they agree with the hypothesised destabilisation originating in the Bewani mountains (cf. n.211), which would have expelled populations radially, or, considering topography, north- and southwards away from the range. Donohue & Crowther (op.cit.:4) stated that "we do not yet have evidence for a southward expansion, though this too appears likely to have taken place". Alfred Gell (1975:5), though, may have made some pertinent observations when he noted that before administrative pacification Umeda people had been threatened by Walsa groups from the north—i.e. from the direction of the Bewani mountains (cf. Maps 5 and 6).

[217] My dating differs slightly from that given by Christin Kocher Schmid (1850-75). This follows from my different approximation of generation periods (30 instead of 25 years) combined with the consideration that migration to the new site took place only when the warrior had turned old (hence about 2 generations from his birth). It seems to fit with the migration histories of the other clans.

[218] This scenario of chain migration is reported in oral accounts from the neighbouring Wanimo people at the coast, where community formation in the early 18th century involved that new arrivals, immigrating from the west, gravitated towards existing settlements in which their language was spoken (Thomas 1941-42:166). Of course, it is possible that K.H. Thomas reported as historical fact a mythical theme similar to that in Krisa. On the other hand, the respective scenario is suggested by the linguistic considerations of Arthur Capell (1962:38), who noted: "Here is met a phenomenon that occurs also in other parts of New Guinea: the use of a language by a single village... Krisa is another. This process seems to be due in large measure to the migration of villages under stress of war of other causes."

[219] A similar correspondence between community formation and adoption of the modern name has been reported by Jacob Simet (1992:52f.) for the neighbouring Ningera people. Assuming a like scenario for Krisa is therefore plausible and supported by my notes. Still, it is possible that adoption of the modern name occurred only with the shifting of the village to its present site in the late 1930s, and was like the move itself stimulated by Australian officials (see main text below).

The name was clearly in use, though, a few years later (Cheesman 1941, 1949, 1958—she uses the spelling "Krissa"), thus predating any noticeable spread of Tok Pisin and attendant corruption of local names in the Vanimo hinterland (cf. Cheesman 1941:182; PR 30-31/6). This suggests that it was an autochthonous creation rather than an invention or adaptation by outsiders, whatever the circumstances of its adoption.

Its precise origins, though, are unclear, and various attempts by myself and others to elicit its meaning and etymology have remained inconclusive. San Roque (2001:28-n.3; also Donohue & San Roque 2004:6-n.3) reports a local opinion, of which I recorded a related version, suggesting connection of the village with someone named Chris, which I cannot substantiate and find unconvincing. Joseph Ketan (1992:22) provides several phrases in the vernacular, which though bear no resemblance to the name Krisa, and which on re-examination by Roger Kara (1996:19f.) turned out apparently meaningless fusions from several languages.

[220] With a pan-New Guinean perspective, the fighting entailed in these processes may seem trivial. Thus, Donohue and Crowther (n.d.:3) observe that "due to the inaccessible nature of the terrain, inter-group warfare has not featured prominently in NCNG [i.e. north-central New Guinea]. The edges have seen extensive fighting, but in the NCNG zone warfare is limited to uncoordinated raiding." While warfare may therefore not have been institutionalised, the pronounced instability in the region must have led to numerous hostile encounters. In fact, the notion of "uncoordinated raiding" underlines the volatility of inter-group relations, which must have been given direction by the migration routes and attendant population pressures exerted in the wake of the Bewani expansion (cf. nn.211,216).

[221] If village formation constituted a decisive step in Krisa history, it may have been remarkable more for the apparent permanence of occupation and attendant political consolidation, in turn a function of security concerns combined with extraordinary leadership, than for the residential pattern itself, which seems to have been common in the region. Thus, there is evidence that nucleated settlements approximating villages occurred in pre-colonial times among Mbo-speakers (Kocher Schmid 2000a:5). They were located in sites where the territories of several groups converged, often coinciding with the intersection of several ridges (cf. also Gell 1975:26). Dwellings would be built on the respective group's ridge; a communal men's ceremonial house on the intersection. These residential clusters would be occupied intermittently, mainly for ritual purposes (cf. op.cit.:28), although the administration later tried to convert them to permanently settled villages. Yeble, the site of the first Krisa village, seems to approximate the condition of converging territories, according to the distribution of group territories recorded by Ketan (1992:7-map2). The major difference to other communities in the region may have been that comparative permanence of settlement was achieved already in pre-colonial times following heightened immigration pressure towards the plateau.

[222] The coastal communities had abandoned warfare already by the 1930s (Thomas 1941-42:167; also Simet 1992:63).

[223] Since West Papua was taken over by Indonesia in 1962, and became officially part of Indonesia as Irian Jaya province in 1969, there had been a low-level flow of immigrants into what was until 1975 the Australian Territory of Papua and New Guinea and thereafter the Independent State of Papua New Guinea. In 1984, the steady trickle swelled to an exodus of around 11,000 people, who were emigrating in the wake of multiple violent incidents. The refugees were accommodated in several camps in Western and Sandaun Provinces, the northernmost Blackwater near Ningera. By mid-year, this was filled with around 1,000 people. The PNG government, favouring repatriation, returned a number of them to Irian Jaya the same year, an exercise which was surrounded by some suspicion. (May 1986:Preface; Smith & Hewison 1986:200-217; cf. also Willy 1996:228-240)

This event seems to have triggered the escape of two men who took refuge in Krisa and subsequently got more of their compatriots to join. Today, some of them live in Krisa temporarily, and possibly illegally in terms of international regulations, while others have been wholly assimilated. They are locally called 'Wamena people', probably in reference to the centre of the unrests, rather than their actual origin. According to local estimates, they number about 80 individuals. They have settled in their own hamlet and continue to practise their own, intensive, form of swidden cultivation in its vicinity. Since they figure little in Krisa affairs, I have left them out of this study.

[224] Previous researchers in Krisa and/ or the region have consistently expressed their doubts at the appropriateness of applying the term 'clan'. Their hesitations stem from

- exaggerated expectations regarding clan structure and function, based on experience with PNG highlands and islands societies (cf. Kara 1996:34,46; Ketan 1992:11,12 and passim);
- inability to trace common descent, arising from the tendency to focus on the most obvious contemporary groupings rather than on distinct oral traditions which would identify these as amalgams (cf. Kara 1996:28; Ketan 1992:15 and passim);
- inability to establish a consistent pattern of socio-political organisation, arising from the tendency to confuse historical with mythical ancestors, and hence lineages with clans, in the absence of detailed genealogies (this confusion is evident in the array of group categories used by Ketan [1992], and has also been reported by Christin Kocher Schmid regarding various surveys among Mbo-speakers [pers.comm. 2003]);
- inability to define principles of recruitment, arising from the confusion of (atypical) matrilateral filiation and (typical) political association/ economic access through females with the standard of patrilateral filiation (cf. Kara 1996:28,41f.), that is, of the exception with the rule, and of alliance formation/ usufruct with landholdership.

[225] By 'landholdership', I refer to customary tenure, which continues to apply to about 97 % of all land in PNG (Eaton c1980:38; Filer & Sekhran 1998:30). It relies on oral chronicles to demarcate boundaries and legitimise access to land, mediated through corporate groups. According to Peter Eaton (ibid.): "Absolute ownership of the land is vested in the group or clan who retain controls over its use and transfer.... Boundaries to customary land are generally natural features and knowledge of them is passed on orally from one generation to another."

The term 'landholdership' is not unfamiliar in PNG (cf. e.g. Eaton [ibid.], who uses the common phrase "land... is... held"; or Ketan [1992:passim], who speaks of "landholding alliances"). I consider it much preferable to the often used 'landownership', because the two terms refer to different concepts, of which only the former adequately represents customary tenure. Thus, ownership refers to the *immediate* possession of entities by persons and the rights attached to it. Upon the owner's death, possession and rights pass accordingly to the respective eligible persons (heirs). Holdership, in contrast, refers to the *mediated* possession of entities, the respective rights attaching principally to the medium—here the landholding corporation of the clan—and extending to (other) persons only through their relationship with it—here in the form of clan membership. An individual's death therefore changes nothing in terms of either rights or possessed entity: all surviving eligible persons continue to exercise their holdership. In the case of customary tenure, therefore, neither land rights nor land can be inherited, but only clan membership, contrary to widespread but sloppy usage of terms.

The difference between both concepts is epitomised by the contrast between property, which describes owned entities, and tenancy—etymologically and semantically related to tenure—which applies to non-property. Tok Pisin may not distinguish between ownership and holdership, the expression "PAPA BILONG..." ("father of...") designating equally holdership and ownership. Yet, the connotation contained in the metaphor of the parent, as well as in actual usage, is that of looking after the entity—or indeed after one's rights to it—rather than that of possession and transferability as contained in the notion of property.

[226] "STORI BILONG MIPELA: MAN I SAVE PAIT NA KISIM GRAUN, MERI NOGAT—MERI I SAVE SENIS."

[227] TETE appears the Krisa, DIRI the Mbo vernacular term. The concept is translated locally into Tok Pisin as MASALAI, which though outside Krisa denotes more generally "forest spirit" (cf. Mihalic 1971:131). Donohue & San Roque (2004:110) provide a contrasting translation, which according to my detailed records is incorrect. Thus, they list TETE in the semantic field 'Human and kin terms', and indicate its meaning as "PPP, CCC". My records though identify the respective kin types—plus further ascending generations considered human—as DIBISAI (a term not listed by Donohue & San Roque), while noting TETE as applying (1) only to ascending generations; (2) only to non-human ancestors, i.e. generations beyond the DIBISAI.

[228] Achievement is the decisive parameter for leadership, and I present relevant attributes in more detail on pp.226ff. Birth is a secondary parameter which contributes indirectly to achievement, as demographic reasons tend to predispose elder children for leadership. Thus, elder children typically grow up with both parents alive and are therefore more likely to acquire the foundations of historical knowledge, which is integral to achievement. Their younger siblings, in contrast, often grow up partially or wholly orphaned, which tends to leave them historically ignorant. Krisa kin terminology reflects the importance of seniority by highlighting the elder of two, or the eldest among all siblings, with the label BA, which contrasts with the generic term for sibling, PU.

The role of birth for leadership is largely invisible without detailed genealogical information, which contrasts with the high visibility of achievement, in particular as manifested in public activities and oratorical displays. Roger Kara (1996:38) has thereby been led to assume these as the sole parameters for leadership. On the other hand, a survey among Mbo-speakers found inherited ('acquired') leadership alongside achieved leadership, both principles being variously emphasised in the different communities (Siuta Sam 1998:13f.). I suspect, though, that the Mbo system of leadership corresponds to that in Krisa. Thus, the reference to inheritance probably misrepresents the role of birth as heredity, while documented differences among communities probably manifest the differences among individual cases of leadership and/ or varying bias of the numerous researchers involved.

[229] Thus, people may on the one hand refer to clan X as "leader Z" and may accordingly talk of X's land as "Z's land", much as he himself may talk of "my land". On the other hand, his name may be used interchangeably with that of an ancestor, of whom he himself may talk in the first person (as may sometimes other clanmembers). The resulting apparently anachronistic statements may account for the curious contemporaneous bias in Ketan's (1992) study, by which he alleges that many of the Krisa groups joined only recently, or indeed within the lifetime of the current paramount leader (op.cit.:9,23, 25f.), while these events happened in the 19th century the latest.

[230] The respective thresholds of five and (approximately) eight generations presumably arise from the principles of oral transmission in combination with the length of human lifespans. Thus, members of three generations are typically alive simultaneously, which gives the +3 generation first-hand experience of the +5 generation, rendering the latter part of living memory and hence manifestly human. Beyond the +5 generation, though, accounts become increasingly second-hand; beyond the +7 generation third-hand, removing their protagonists from the human realm.

[231] The covert character of the concept of the clan obtains also among Mbo-speakers and has caused much frustration for previous researchers in the region (Kara 1996:28; Ketan 1992:11). Mbo-speakers commonly suffix the individual names of clans with NIRI/ DIRI (pers.comm. Christin Kocher Schmid 1999), which though denotes but the clan's founding spirit ancestor (see n.227) rather than the socio-political formation itself. In contrast, the Ningera vernacular does label groups, subgroups, leaders and their assemblies with specific terms (Simet 1992:53f.).

[232] An agnate is defined as "someone related through the male line" (e.g. Barnard & Spencer 1996:595).

[233] Clan exogamy is very strictly observed. There seems to be only one instance at present in which it has been contravened, and this is the sole case, recent or historical, which I recorded.

[234] "MI NO INAP GO BEK LONG GRAUN BILONG MAMA BILONG MI, MI MAS I GO BEK LONG GRAUN BILONG PAPA BILONG MI—EM I BLUT BILONG MI STRET!"

[235] Illegitimate birth of children is frequent. Thus, it is an almost standard pattern that a woman's first child has been fathered by a man other than her subsequent husband; likewise, that after separation (which may occur with increased frequency nowadays [see p.225, n.286]) or upon widowhood a woman conceives in an illicit, possibly even adulterous, relationship. Such occurrences attract little criticism and seem to represent a traditional pattern. The relaxed attitude of the mother's kin and/ or any future spouse reflects that an illegitimate child represents a windfall gain in members for the respective clan. This benefit relies, of course, on the ultimately unchallenged position of marriage, which only enables patriliny by establishing male control over female reproduction.

[236] Mbo- and Ningera-speakers practise a broadly similar form of marriage as Krisa people; so do possibly people on the Vanimo coast (see n.241).

[237] Thus, describing someone as 'HAPKAS KRISA' identifies their mother as a Krisa woman, their father as a man from another community.

[238] The case reported by Ketan concerns the takeover of an Ossima clan by two men from Krisa and Awol respectively, who were thereby returning to their mothers' native clan; that reported by Simet concerns the takeover of one Ningera clan by another "through a greatgrandfather's mother".

[239] The terms for husband and wife, in contrast, differ from the generic gender terms, although they carry some resonance with them, the husband being called INI, the wife BUA (cf. Table 13). If these designations are confirmed by Donohue & San Roque (2004:110), the terms they provide in regard to opposite-sex siblings are misleadingly incomplete. Thus, they list "man" as DAKA, B as MINI, and Z as BUPU. According to my own records, the generic gender term for "man" is clearly MINI, while DAKA rather assumes the demonstrative meaning of "someone"; in its use for siblings, MINI applies only to $B_{f.s.}$, much as BUPU applies only to $Z_{m.s.}$

[240] This interpretation is supported by a myth from the Mbo-speaking community of Isi, recorded by Vakaloloma Siuta Sam (1999), whose presentation and analysis here would however exceed the scope of this study. Note that Juillerat (1996[1986]:313) reports correspondingly from the Yafar, whose marriage practices resemble those in Krisa (see n.241), that "certain texts [i.e. narratives recorded by the ethnographer] even attribute the origin of sister exchange to the rejection of incest", with particular reference to a myth in which a son, instructed by his father to marry his sister and refusing to do so, receives the comment: "All right, go away and exchange your sister for a wife" (op.cit.:283). In the same vein, Juillerat comments elsewhere (op.cit.:342): "The pivotal point of brother–sister complementarity... is marriage by exchange as the ideal form of matrimony... Being a means of transforming a sister... into a wife..."

[241] Contrary to conventional anthropological understanding (cf. e.g. Barnard & Good 1984:95-97; Maybury-Lewis 1996; Seymour-Smith 1986:18f.), therefore, Krisa sister exchange does *not* result in double cross-cousin marriage, nor indeed in any other form of cross-cousin marriage. Rather, it results in the definition of exogamous groups beyond those defined through clan membership, hence relates to marriage *pro*scriptions, not *pre*scriptions (see pp.210,212).

Broadly similar forms of marriage by sister exchange as in Krisa, described in more detail in the text below, seem to occur throughout the wider region. Christin Kocher Schmid (pers.comm. 1999) reports the same form with minor variations from Mbo-speaking communities. Patrol reports (PR 48-49/6, 49-50/13, 53-54/2) indicate that it occurs also further south, at least up to the Bewani mountains. Descriptions of inheritance rules and alliance patterns by Ketan (1992:13,15) for populations in the Vanimo hinterland and by Simet (1992:53) for Ningera suggest the same, as do my own records of

intermarriage and ensuing alliance patterns between Krisa and the respective communities. I suspect similar principles for the communities at the Vanimo coast (see n.255).

Further to the south, both Alfred Gell (1975:27,37-80) and Bernard Juillerat (1996[1986]:esp.289-345) have reported marriage systems for, respectively, Umeda and Yafar societies, which are based on sister exchange (cf. n.240) and seem to involve similar inter-group dynamics as in Krisa. An immediate comparison with the Krisa system is problematic and would exceed the scope of this study, as both authors apply perspectives different from my own as well as from each other. Eventually, however, it will be interesting to undertake an evaluation of the respective data from a single analytical angle.

More generally, the emphasis on both cross-siblingship and marriage by sibling exchange, which is central to the respective systems of marriage, kinship and alliance, seems prevalent in PNG and indeed Oceania at large. This is suggested by the respective Tok Pisin phrases alone. Thus, the original designations of the terms BRADA ("brother") and SUSA ("sister") are, respectively, as 'same-sex sibling' and 'opposite-sex sibling' (cf. Mihalic 1971:75[in the spelling BRATA],186), although in their modern usage they have come to assume the meanings of their English templates (cf. Mihalic 1971:76). The term SENIS, in turn, denotes among others the swapping of a cross-sex sibling in marriage for a spouse (cf. Mihalic 1971:172). On an academic level, in particular a volume edited by Mac Marshall (1983) has highlighted the importance of cross-siblingship in Oceania, the editor noting that "[i]deally, marriage takes the form of sibling exchange" (op.cit.:11), while at the same time pointing out that "[a]s a topic in its own right siblingship has received relatively little attention in the published literature for Oceania" (op.cit.:7). Since the field of kinship has not been my principal concern in this study, I am unaware if further comprehensive works have been published since. What I am rather sure about is that in the field of subsistence studies there have as yet been no explicit attempts to relate the respective form of marriage and its ensuing patterns of alliance to group migrations, territoriality, and long-term systems of land use, which though is what I will undertake in the following.

[242] The equivalent Tok Pisin term ANKOL ("uncle") therefore encompasses uncles, nephews and nieces, easily causing confusion in an English context (cf. Table 13). Interestingly, Gell (1975:233) documented a similarly self-reciprocal term, used, if only as a nickname, between MB and ZS in Umeda, namely 'penis(-sheath)', which thereby resonates at once with the Krisa label PE for maternal cross-cousins.

[243] Again, Donohue & San Roque (2004:111) provide contrasting designations and kin types, which according to my detailed records are incorrect (cf. n.239). Thus, they list FZ and MB as WINI and FZH, MBW as ONGNI (ONI in my own spelling, the addition of "NG" presumably representing the nasalisation of "O"). According to my own records, WINI can apply only to females, ONI only to males; both designate principally FZ and MB respectively; and ONI may by extension apply to FZH, which though is not a common designation, while MBW tends to remain unlabelled altogether.

[244] "BRADA SINGAUT LONG EM LONG SALIM SUSA I KAM."

[245] By 'clan-sister' I mean any agnatically (cf. n.232) related female of the same genealogical level as ego.

[246] "BRADA O KANDERE I HOLIM YU, NA YU GO LONG BRADA O KANDRE BILONG EM." — I am most grateful to Rebecca Dukala for this apparently self-evident statement, which served as one of the keys to enlighten me on the mysteries of Krisa sister exchange.

[247] Of course, the more distant a relation, the more likely it is up to interpretation. Occasionally, therefore, kinship of a groom with his bride seems to exceed that with his exchange bride, the division into kin and non-kin performed ex-post to justify a desirable union.

[248] Among Mbo-speakers, matriparallel cousins do fall under the incest taboo, which corresponds to other evidence that with them the tendency towards matrilateral filiation is yet more pronounced than

in Krisa (pers.comm. Christin Kocher Schmid 2001). Note that Juillerat (1996[1986]:301-item 6,305-fig.31) describes precisely the same prohibition.

[249] Polygynous marriages were common in the past, in particular for leaders. Oral accounts indicate two to three wives as typical for Krisa and four to five as typical for Mbo-speakers (cf. PR 49-50/13, 53-54/2). Polygyny has however become rare under the influence of missionary teachings, which condemn it as an errant ancestral practice. Still, a few men in Krisa do at present sustain marriages to two wives, who though always live far apart and usually harbour animosities against each other. More commonly, men nowadays remarry upon separation, which though may never be wholly completed, the resulting situation thus corresponding to a polygynous one. Women remarry rather upon widowhood only, thus likewise reflecting the traditional pattern, but may engage in illicit affairs upon separation (cf. n.235).

Genealogies confirm the tendency for multiple unions for the five generations for which marriages remain documented. Besides polygynous marriages for males, they regularly show two to three successive marriages for females. Oral accounts occasionally indicate marriages even past a woman's reproductive age, possibly yet more frequent than remains documented, since lack of descendants easily eliminates individuals from the genealogical record.

[250] The incest taboo for uterine siblings is notwithstanding their structural resemblance to matriparallel cousins (cf. p.211).

[251] Reasons for this practice may range from pragmatism, i.e. taking advantage of eligible males in the sole appropriate clan, to cultural preference, manifesting a possibly universal psychological inclination towards siblings and/ or a political strategy to artificially reduce choice in the interest of expansion (see main text below). Note Juillerat's (1996[1986]:340) observation that sororal polygyny constituted "a sort of polygynous ideal" among the Yafar.

[252] The pattern is widely documented in government and missionary accounts (PR 44-45/6, 48-49/6, 49-50/13, 53-54/2, 57-58/5; Willy 1996:64). A recent survey of the Mbo-speaking villages Isi 1 and 2 confirms the excess of males (Isi 1: 65 %; Isi 2: 52 %) (Kameata et al. 1997:11). Similar imbalances have been reported by Gell (1975:27,54) and by Juillerat (1996[1986]:xxvii, 290) for Umeda and Yafar societies, respectively. I have not yet sufficiently analysed my own census data to confirm or refute a similar situation for Krisa. It is, however, likely, as is, in turn, its connection with subsistence. Thus, Carole Jenkins and Catherine Milton (1993) have argued that "[w]here hunting is highly emphasized, sex biases may systematically disadvantage females" (op.cit.:291), in order to curb population growth. Mechanisms are an as yet unexplained excessive sex imbalance among live births (op.cit.:289) and its subsequent increase through active infanticide and systematic underfeeding of female children (op.cit.:289f.), the latter resulting in poor immunity, exacerbating malnutrition in turn (op.cit.:291), and ultimately leading to increased maternal mortality (implied, op.cit.:289, 292), which in turn reduces the survival chances for newborns (op.cit.:289). Their study referred to the Hagahai people, described as a Papua New Guinea highland fringe society of "forest-based... hunter-horticulturalists" (op.cit.:281,282) who rely principally on starchy vegetables from gardens, although they do not necessarily prepare gardens every year and also utilise numerous forest plants including semi-domesticates (op.cit.:284f.). The Hagahai form of subsistence therefore seems to involve rather more intensive cultivation than that practised in the Vanimo hinterland, which if anything makes the argument yet more pertinent to the situation there.

[253] The levirate is defined as "marriage or 'inheritance' of a woman as a wife by her late husband's brother" (e.g. Barnard & Spencer 1996:611), here meant to include unions upon separation. The prohibition of the levirate is categorically observed in Krisa; I have recorded no cases in which it was contravened, whether in a legal or illicit union. Christin Kocher Schmid (pers.comm. 2000) reports that Mbo-speakers in fact express dread at the thought of leviratic unions. Juillerat (1996[1986]:322f.), in contrast, reports the levirate as an, if rather undesirable, possibility among Yafar people.

[254] Krisa people repeatedly indicated that the preferences of the prospective partners had been paramount also in the past, although love-matches seem to have increased during the last decades,

concomitant with an increase in monetary compensation (see p.224, n.286). During the same period, also the age difference between partners in a first marriage seems to have levelled out. Until the 1960s, brides tended to be in their mid-teens, grooms in their early twenties, while both are nowadays often in their late teens.

[255] I suspect that similar relationships might underlie the phenomenon of 'inherited friendships' observed by John Terrell and Robert Welsch (e.g. Welsch & Terrell 1994:394-396; Terrell 2002:210f.) among the communities of the northern PNG coast (cf. n.241). As Terrell (op.cit.:210) explains,

> "the social institution that binds people in different communities on the coast together even though they may speak utterly different and unrelated languages is the custom of having friendships between individuals and families that have been handed down from one generation to the next".

The consequences are strikingly similar to the situation between Krisa people and their Mbo-speaking neighbours, if on an infinitely larger scale:

> "The vast network of human relationships maintained in this way extends for many hundreds of kilometers along this coastline and some distance inland. It is largely through these friendships that people on the coast and nearby islands share so much in common despite the fact that along the 700 km of coastline between Jayapura in modern Irian Jaya [West Papua] and Madang in Papua New Guinea, people speak a total of 60 different languages belonging to 24 different language families." (op.cit.:211)

This correspondence suggests to me that the reported 'friendships'—the concept presumably implied through common use of the Tok Pisin term FREN ("friend") for social relations with non-agnatic kin—actually describe recognised consanguinity between matrilaterally related individuals and groups, generations after the original marriage transaction, which would at once account for their heritable quality. Indeed, Welsch & Terrell (op.cit.:395) confirm: "In most cases, the ties in question are defined in kinship terms", but discount the significance of such labels by qualifying them "—as fictive relationships between brothers, uncles, or cousins—as indeed nearly all relationships within villages are glossed and framed." Hence, they conceive of the relationships as "extensions or projections of intravillage relationships onto important social and economic relations beyond the village" (ibid.) and conclude: "Only occasionally do these ties seem to mark actual kin relationships, though in this respect there is some variation along the coast." (ibid.)

Contrary to these assertions, I suspect that actual kin relationships are precisely what underlies these ties, the attached kin terms fictive only insofar as they represent classificatory extensions of the respective prototypes (cf. p.208, Figure 11). Unfortunately, this scenario must remain speculative, as I lack actual information on the marriage practices of the communities involved, including those on the Vanimo coast; a reference by Thomas (1941-42:178-180) is inconclusive. (Note that Terrell and Welsch tend to refer summarily to the north coast, specified in above quote as bounded by Jayapura in the west and Madang in the east, which is the region covered by their statistical analysis of material culture [Welsch, Terrell & Nadolski 1992; Welsch & Terrell 1994], although their systematic ethnographic research, which must have provided the empirical evidence for their concept of 'inherited friendships', seems more specifically limited to the Aitape district [Terrell 2002:195].) I recorded a single comment, in Krisa, of coastal people compensating for brides with pigs, possibly supported by a vague reference in PR 49-50/13. If this was the case, it may however be a recent innovation or occur additionally to sister exchange (cf. the exchange of shell valuables which accompanied Krisa sister exchange in the past—see p.224). In any case, though, it would not preclude the development of alliances based on creditor–debtor relationships as a function of recognising the asymmetry of the brother–sister dyad as central for kin relationships. This principle may similarly operate among the communities of the northern PNG coast, rendering matrilateral relatedness and the relationship between cross-cousins elemental for political interaction in form of the 'inherited friendships' which Terrell and Welsch observed. The analogy of these, in turn, with the "intergenerational responsibilities that are so essential to agroforestry as an economic institution on the coast", which Terrell (2002:211) perceived, would then describe precisely the mechanisms of territorial control and historical legitimacy, mediated by vegetational markers, which I have traced for the Vanimo hinterland (see pp.215ff.,272; cf. also n.241).

[256] The same applies to the ONI-ONI relationship, which though tends to assume a lesser profile across than within communities. This may follow from the predominantly personal character of intra-community associations, favouring relationships of a parent-child type, as opposed to the

predominantly political character of inter-community associations, favouring relationships of at once cooperating and competing peers.

[257] Use of the term BISNIS for paternal cross-cousins and their agnates may be specific to the region. Thus, Mihalic (1971:72) notes its designation in contrast as "clan, tribe".

[258] Note that this case differs from those previously described (cf. pp.207,212). If the former involved takeover by *descendants* of female clanmembers (i.e. SAI moving into the vacant clan of their extinct PE), the present case seems to have relied on an incorporation by the *agnates* of outmarried females (i.e. PE moving into the vacant clan of their extinct SAI).

[259] Genealogies suggest the same, although the respective data are unreliable, since inmarriages will more likely be remembered than outmarriages.

[260] A further factor which may have slowed down the immigration of Mbo-speakers is their residential concentration on the Pual floodplains following administration and mission influence (pers.comm. Christin Kocher Schmid 1999), in particular via the promotion of large-scale agricultural projects (Kocher Schmid 2001:7). While residential clusters formerly *south* of the Pual have in the last several decades been shifted towards the river, indicating the continuing northward migration of Mbo-speakers, the same thrust has not generally continued *beyond* the river (but cf. n.261).

[261] Thus, patrol reports up to the early 1960s locate Airu at a site variously described slightly west or slightly east of Ossima, but in any case south of the Pual river (PR 55-56/4, 57-58/5, 60-61/1, 61-62/7). The map by the Royal Australian Survey Corps (1985[1970]) correspondingly marks its location at the confluence of the Pual and Puwani rivers, but additionally a residential cluster 'New-Airu' north of the Pual river. Current information from Krisa presents the old site as abandoned, which is supported by the most recent map of the area (National Mapping Bureau of Papua New Guinea 1998).

[262] Cf. Juillerat (1996[1986]:290) who commented, somewhat analogously, though without going into any further detail or indicating consequences for migration patterns: "This situation [the lack of available women] has obliged the Yafar to build the widest possible network of marriage exchanges, that is to seek wives in all neighbouring tribes, including the Punda, who do not even speak the same language. It also seems to have encouraged marriage by exchange."

[263] The village-like nucleated settlements reported for Mbo-speaking communities (cf. n.221) would not have required such negotiation—each clan having been limited to its own territory—but only an agreement regarding residential convergence. The same may have applied for the first Krisa village at Yeble, and possibly for the original second village at Desawa, for which residences were reportedly arranged by clan—a pattern which survives to some extent in the present village core. On the other hand, the prominence of the first village's founder, and his presumable position as first village chief (cf. p.202) do indeed suggest that at the eve of the clans' relocation to Yeble negotiations took place under his guidance, not only for collective migration, but also for collective permission to settle. Similar negotiations would again have taken place at the eve of the relocation to Desawa. In any case, they must have taken place between then and now—possibly triggered by the need to establish school and aid post buildings outside the village core—as the larger present village at Desawa offers free access to all, the landholding clan having opened this part of its territory for collective access.

[264] I will in the following keep the gloss "camp" as translation for KEM, even though this has the unfortunate connotation of temporary encampment rather than dwelling place. However, alternative terms are either unsuitable or already occupied with a different meaning:

- "hamlet" refers to a small residential cluster—a KEM may be a hamlet, but may also just be a single residence;

- "shelter" refers to a temporary and/ or open construction—a KEM may consist of a shelter, but also of one or several houses;
- "settlement"—SETELMEN in Tok Pisin—has the connotation of squatter settlement, i.e. the illegal occupation of government land, and is therefore clearly opposed to KEM in Krisa, which denotes the legal occupation of customary land, the respective designation providing at once classificatory support for territorial claims (see n.271 below).

[265] The vernacular classes PLES and KEM collectively as I ("dwelling place"), which may reflect the absence of actual villages in the past (cf. nn.221,263).

[266] Recall, though, that *Cordyline* is in fact an ancient Oceanic food plant (cf. n.40), hence has the potential to satisfy both purposes.

[267] Engraving of initials into the bark of trees, or attaching the remains of a meal to a branch is a common pursuit of boys and young men on outings into infrequently visited areas on their own territory, and may serve a comparable purpose of leaving the mark of human presence in the environment.

[268] "KIRAP GEN...: WOKIM GADEN, PLANIM SAKSAK, KISIM GRAUN GEN".

[269] The mid-1980s mark the turning point towards large-scale timber extraction rather than the actual commencement of logging operations. Prior to this date, logging was carried out by WeSDeCo, the publicly operated West Sepik Development Corporation. Operations must have been proceeding already in the mid-1970s, since Allen (1976:327) noted: "A large sawmill exports sawn timber to overseas and international ports..." Part of the timber may have of course been extracted from town land, not from customary land within the Timber Rights Purchase area. In any case, operations must have been of a moderate scale, since over five years later they had not yet advanced to Ubapo, a Krisa camp inland from Waraston (cf. n.8). With the involvement of overseas companies in the mid-1980s, though, large-scale timber extraction commenced, and was completed on Krisa land within about a decade.

[270] The disputes keep occupying Krisa leaders with frequent meetings in town, threatened legal action and the search for lawyers. They represent a significant aspect of community life, documented by the circumstance that about 4 % of all my incidental notes refer to them.

[271] According to the official line in Krisa, Pasi is located on traditional Krisa territory. This position is reinforced by people's insistence that Pasi's status as KEM must under no circumstance be confused with that of SETELMEN (cf. n.264). Oral accounts, though, do mention acquisition of land. Correspondingly, Ningera people claim that the land was theirs, a version supported further by written documents, which though at once suggest willing cession (Simet 1992:Annex Four; PR 57-58/5). In any case, Ningera people have raised few objections to continued Krisa occupation of the site, which though may change if ever this were to become financially valuable.

[272] The 1997-98 El Niño drought therefore posed a particular threat to human survival in those regions of PNG where sago constitutes a major staple. As its impact in the Vanimo hinterland was however comparatively benign (cf. n.359), this region largely escaped the deprivation it might have otherwise experienced.

[273] In the early 1940s, fibre skirts for women and penis gourds for men were still the standard attire in Krisa (cf. Cheesman 1941:182). Fabric had been introduced, but modern clothing became more common only from the end of the Pacific war in the mid-1940s. Some women seem to have worn the traditional fibre skirt into the 1960s; the last man dedicated to wearing the penis gourd is said to have

died in the early 1970s. Modern bedding may have become the norm only after modern clothing; the widespread adoption of modern utensils such as plastic or enamel plates, dishes and cups seems to have accompanied the logging boom of the late 1980s.

[274] In the Mbo-speaking communities, an inadequate or deteriorating water situation is one of the most frequently mentioned reasons for the shifting of hamlets (pers.comm. Christin Kocher Schmid 2000; also Kameata et al. 1997:3).

[275] If alcohol- and drug abuse, thuggery and crime are indeed rife among squatters, their non-local origins and illegal settling add to the perceived threats and may serve to justify hostility by landholders and government (cf. McNeil 2002).

[276] Logging in the region proceeds as selective logging, which in contrast to clearfelling removes only large individuals of certain species.

[277] Kameata et al. (1997:3f.) have described a similar pattern among Mbo-speakers, of residences moving in unison with logging operations.

[278] Kameata et al. (1997:3) have similarly mentioned sorcery as one of the causes for migration among Mbo-speakers. Beehler (1991:212) reports that in the Bewani area, south of the Mbo-speaking communities, reasons given for village relocations often "relate to the desire to escape from evil spirits".

[279] Kameata et al. (1997:3) have similarly mentioned disputes as one of the causes for migration among Mbo-speakers.

[280] Among communities further in the interior, at the southern slopes of the Bewani mountains, the same phenomenon continued into the early 1960s (Willy 1996:62,63,105).

[281] The respective watercourses north of the Krisa watershed, where drainage is to the sea, are principally Wasu and Usipi creeks; to its south, where drainage is to the Pual river, principally Wia creek. The latter runs through several clan territories (Ketan 1992:7-map2), thus permitting access for a large part of the community and suggesting that in the past the clans were similarly vying for water as for an elevated spot on the plateau (cf. n.221).

[282] Indeed, coastal people, who have become far more sedentised than their Krisa neighbours, are now explicitly regarding their former camps near the beach as retreats akin to holiday chalets (pers.comm. Alan McNeil 1999). For the contrast between the 'burden' of a migratory lifestyle perceived by outsiders and the local appreciation of it, cf. Kocher Schmid (2005).

[283] Bruce Beehler (1991:212) anticipated this part of the argument for the Bewani area, south of the Mbo-speaking communities:

> "It is not uncommon for villages to be resituated every decade or so. The reasons given often relate to the desire to escape from evil spirits that come to dominate the area, but this more likely can be translated into the diminished quality of the environment brought about by human exploitation. There is probably a reduction in crop productivity and also increased sanitation problems that can create periodic outbreaks of a host of diseases, the most palpable of the evil spirits."

Beehler missed, though, that people not only remove resources, but also promote them (cf. p.19). In fact, sites are abandoned as much for the threats noted by Beehler, as to protect newly established resources in the old site and promote further ones in a new site. That is, people do not merely follow available resources, but at once leave resources in their wake. Thus, Christin Kocher Schmid (pers.comm. 2000) reports that Mbo-speakers explicitly identify the increase in fallow areas containing

valuable resources, and hence the decrease in areas suitable for garden preparation in the vicinity of a settlement site, as an incentive for residential shift, which occurs about every ten years. The pattern in which Krisa people established successive hamlets in the process of their coastal migration (cf. p.216) conforms to this scenario, even through it proceeded in an accelerated fashion due to the legal issues involved. Beehler (ibid.) did allude to the long-term effects of this dynamic when he continued:

> "Much of the habitable lowland areas have been colonized at one time or another during the last millennium. Much of what looks like 'virgin' rainforest is probably old secondary growth."

He missed, though, that precisely the resulting anthropogenic environments are replete with resources, and that the survival of long-lived plants among these attracts renewed occupation as much as does the recovery of vegetation and reduction of microbial load.

[284] Examples of community disintegration may be recorded in the stories of dispersal from both Mt. Dale and Mt.Sau (cf. p.201). Thus, the mythical dispersal from Dale of the present Krisa clans may recreate a historical dispersal, if of a different set of clans. The historical dispersal from Sau apparently involved less clan D1 alone (cf. Table 12) than an entire community of which it was part, as suggested by accounts of intermarriage and other indications of the group's collective character. The mythical reference to Mt.Sini by seven different groups in the region (cf. n.215) may likewise indicate their connection with an erstwhile community in that area. Community disintegration was certainly also a concomitant of the initial stages of the Bewani expansion, and possibly even its cause, although natural disaster seems more likely in this regard (cf. n.211). Examples of migrations and unifications are recorded in the oral histories of the Krisa clans as well as of other groups in the region (cf. n.214).

[285] At the time of this Patrol Report, Krisa was yet the only community in the Vanimo hinterland where brideprice was an acceptable means of compensation. Today, brideprice is common also among Mbo-speakers. Juillerat (1996[1986]:321) has similarly reported increasing importance of bridewealth (brideprice) payments among Yafar people.

[286] That separation was less common in the past is partly speculative, based on the evaluation of life histories and genealogies, and on the retrospective contrast with the projected effects of brideprice compensation and freedom of partner choice. There are strong indications, though, that love-matches result much more frequently in broken marriages than unions encouraged by the relatives, the more so in the context of outstanding brideprice.

[287] Considering these socio-political impacts of logging which Ketan describes here, his claims at another place (op.cit.:9,23,25f.), that many of the Krisa groups joined only recently, may therefore represent as much an instance of (virtual) group fragmentation, by which locals presented clan integrations as contemporary in order to safeguard territorial claims, as a misunderstanding on Ketan's part (cf. n.229).

Regarding the change of land use options, Ketan (1992:15) claims that the rights to forest resources had formerly lain with the communities at large and only been transferred down to the level of clans with logging. This seems unlikely in view of the composite character of communities, and of the elemental function of the clans as socio-political units. However, rights may well have been handled more flexibly, and this could be what Ketan is actually referring to. Thus, actions which are today limited to the land of one's own clan may formerly have been permitted also on the land of clans to which one maintained kin connections. Indeed, data from Mbo-speaking communities suggest this scenario (pers.comm. Christin Kocher Schmid 2000). The contrast, though, may as well result from genuine cultural differences, considering in particular that part of the communities were themselves undergoing logging at the time of the research and therefore differences in the handling of resource rights should have been pronounced.

[288] Thus, Krisa territory falls within the Vanimo District; the Kilimeri and Vanimo East Coast Census Divisions; the Bewani and Vanimo Local Government Councils (since 1997 Bewani–Wutung Rural Local Level Government [Independent State of Papua New Guinea 1997; cf. Filer 1998:76-80]); the Bewani and Wutung Provincial Constituencies; the Vanimo–Green River National Constituency; and Block 6 of the Vanimo Timber Rights Purchase Area (WSDS 9,14-18). If Krisa territory spans

typically two of the minor administrative and electoral districts, Krisa village falls into but the first of each set. Yet, the residential division of the community into a plateau-based and a coastal fraction obliterates this correspondence, mirroring the division of the territory.

[289] Colin Filer (1998:71f.) observes precisely the same phenomenon for PNG at large, noting that "as Christianity has been 'localised', it has also been diversified, an herein lies a paradox", which "consists in the fact that organised religion seems to have been 'taken over' by an indigenous tendency to cultural fragmentation, and yet the lines of fragmentation cut across the local boundaries of traditional society."

[290] In fact, the Vanimo coast was first visited by a Catholic priest in 1903; his missionary order, the Society of the Divine Word, bought land from the coastal Wanimo people in 1908. However, missionary attention was over the next three decades limited to occasional priestly visits; no noticeable mission work was carried out (Willy 1996:19f.; Thomas 1941-42:164).

[291] Although innovations in Mbo-speaking communities followed similar ones in Krisa typically with several decades delay, the process of abandoning men's ceremonial houses had by the 1950s apparently begun also there (PR 53-54/2).

[292] In our account at the time, we dated the event prior to 1940, following the protagonist's version of events according to which he was a young man or even barely initiated teenager at the time. From my notes taken during further fieldwork, though, it has become clear that this version constitutes an item of doctrine, and that the clearout cannot have taken place before the late 1960s and is more likely dated to the mid-1970s.

[293] While these qualities are increasingly necessary as leadership attributes, they are not sufficient, although in the context of the timber rights purchase they provided the basis on which the number of leaders became inflated (Ketan 1992:14).

[294] Northeast New Guinea was claimed as a colony by the German government in 1884, and fell under Australian military administration between 1914-21 (King & Ranck p1980:10; Swadling 1996:224,255). Subsequently under civilian administration, it became part of the Independent State of Papua New Guinea in 1975.

[295] In 1940, Tok Pisin speakers were still rare in Krisa (Cheesman 1941:182). A few surviving old people speak Tok Pisin only broken even now, although all others are fluent in it. Still, Tok Pisin is the second, the vernacular the first language for all of the older community members. This situation, though, reversed rapidly from the mid-1970s, as those born thereafter declare Tok Pisin to be their sole native tongue and report increasingly partial knowledge of the vernacular.

Donohue and San Roque (2004:8,10) suggest that younger community members may lack active language capability due to a cultural pattern in which people become active speakers only later in life, and which combines with the prestigious role of the vernacular to leave them reluctant to use it. I am, however, convinced that the vernacular is becoming extinct in an active process, in which precisely its role as a cultural marker has led to its accelerated demise. The causative chain is encapsulated in the concurrence between the commencement of formal education in the village and the turning point for language shift; the common local analysis which regards the school as one of the main culprits; the standard self-accusation "it was my fault, I didn't speak the local language with my children"; and the additional remark by one parent, "because I felt ashamed of my language".

Thus, the establishment of the school confronted people with one of the prime symbols for modernity in their own village, thereby raising their sentiments of inadequacy. As this development plotted the unique vernacular against Tok Pisin as the medium of instruction, the former became associated with backwardness, the latter with progressiveness. Consequently parents changed the language *spoken at home* from the vernacular to Tok Pisin, which rather than the use of Tok Pisin (and English) as language of instruction has been decisive for children's language abilities. Hence, the dates

for school establishment and language decline coincide rather than follow each other as would be expected if the school acted as an immediate agent of linguistic erosion. Further support from this analysis comes from atypical cases of language competence, with progressive families showing the pattern of language loss earlier, conservative families later than the average.

[296] Kuaso et al. (1998:19) date this change to the turn of the 19th century. Eyewitness accounts, though, confirm that the manufacture of pottery continued into the times of living memory and was probably abandoned not before the end of the war and increasing availability of commercial goods (cf. op.cit.:19,27f.). Christin Kocher Schmid (pers.comm. 2000) reports that in 1996 one old woman survived in Krisa as the sole person who had yet made pottery herself, which likewise suggests the abandonment of the craft about 50 years earlier.

[297] Alois Kuaso (pers.comm. 1998) notes that Krisa pottery, recovered during an archaeological reconnaissance survey, appears rough and lacks durability. He therefore suspects that Krisa people adopted the craft from their coastal neighbours who still practise it, and that its rapid rejection provides further evidence of its rather shallow establishment within Krisa culture.

[298] Evelyn Cheesman (1941:183) noted correspondingly: "Near the village sago is cultivated; not of the same species that grows in the swamps below, but the mountain species with unarmed rachis." At the time, though, thorny sago must have been present in Krisa, its introduction locally dated back at least 5 generations. It clearly grows on Krisa territory at present. Maybe the concentration of smooth forms near the village was higher than that of thorny forms, thus biasing Cheesman's observations. While I cannot confirm this possibility with systematic observations, I cannot refute it either. Maybe, however, Cheesman reported less her observations than local statements regarding the provenience of smooth and thorny forms, which she erroneously interpreted as referring to their current distribution.

[299] One might expect a time-lag of several generations for the innovation to take hold and manifest in any noticeable intensification. In fact, my incidental notes record no association between planted sago patches on Krisa territory and named ancestors prior to 5 generations bp (~1880 AD), while the planting of other vegetational markers is recalled up to 8-9 generations bp (~1760-1790 AD), the last generation of residence at Api and presumable period during which thorny sago was first introduced.

[300] The legend is from Suain, located roughly 200 kilometres east of Vanimo on the coast between Aitape and Wewak, and describes how a woman from the Vanimo coast introduced taro there. It was reported by K.H. Thomas (1941-42:165), stationed at Vanimo in 1930, in the context of ethnographic notes about the Vanimo coast, but must have been recorded during one of his various placements at Aitape and Wewak between 1927 and 1934 (Craig 2002:192-194). The legend likely referred to an event without any connection to living memory (cf. n.230), which dates the introduction to over 5 generations before ~1930, or before ~1780. This in turn suggests that by this time taro was cultivated at least at the Vanimo coast, if not inland. Written documents (PR 30-31/6, 53-54/2), however, are ambiguous regarding the antiquity of taro in the region, reporting both local cultivation of taro and the distribution of taro propagules by the administration—which though may have been intended to enhance, rather than initiate, local cultivation.

[301] This sequence of prevalence accords well with that ascertained by the National Nutrition Survey of 1982/ 83 for the region, which recorded the frequencies of starch foods eaten the previous day as sago 84 %, banana 39 %, sweet potato 20 %, taro 5 %, and yam 4 % (ASWP 3:1511-n.). In contradiction to this finding, the same source (op.cit.:1511) identified *Colocasia*-taro as a "subdominant staple", together with banana, in contrast to all other root crops, noting however (op.cit.:1511-n): "Overall, banana is the most common of the important garden crops, but in some locations taro is more important". Maibala (1996) has reported similarly inverse crop prevalences for Krisa upon a cursory garden survey, identifying banana and taro as the most common crops, followed by sweet potato. Alfred Gell (1975:16) has observed taro as the most important garden crop in Umeda, while making no mention at all of either banana or sweet potato, possibly reflecting their minor roles. Besides the geographical variations suggested by the Agricultural Systems Working Papers—based both on field

surveys and written sources such as Gell (1975)—these differences may manifest partly individual and seasonal variations, as might have been the case with Maibala's observations; partly, they may manifest an overall increase, within the last decades, in the reliance on sweet potato and concomitant decline in the reliance on taro.

[302] For use of the term 'cultivate' cf. p.145. This designation indicates that the respective plants are currently cultivated in Krisa, without referring at once to their domesticatory status.

[303] The upright infructescence identifies WUNUNG as a member of the Australimusa section ('fe'i bananas') of the genus *Musa*; members of this section are limited to New Guinea, where they are thought to have originated and served as early staple crop (e.g. Kennedy & Clarke 2004:24 and references quoted).

[304] The late adoption of sago as a staple may be a more common phenomenon in the wider region in areas located away from the floodplains. Gell (1975:221f.), for example, reports that Umeda legend alleges a perpetual shortage of sago in ancestral times, an assertion which he interprets in symbolic terms in view of the contemporary local abundance of sago palm (op.cit.:222). While this may accurately reflect the situation, a contrasting interpretation could be conceived, of the legend alluding to the minor role of sago in the past.

[305] This correlation makes good evolutionary sense, since the dry, and hence suboptimal, Krisa environment likely favoured variants which can more quickly outcompete forest regrowth than the introduced forms which, originating from swampier environments, had not been selected for this trait.

[306] An analogous development could be envisaged for the future, as Wamena immigrants (cf. n.223) have brought their own, intensive form of swidden cultivation. At present they alone practise it, in the small area on Krisa territory which they have been allocated (a similar phenomenon occurring in the Bewani area, where more of their compatriots have settled [ASWP 3:1511-n.]). Yet, with progressive intermarriage it might eventually spread through the community. Concomitantly, cultivated root crops might come to replace the current staple sago. Whereas Wamena people came as refugees in peaceful circumstances, however, immigration in the 18th century occurred under war pressure and must have come close to invasion. Cultural pressure would therefore have been considerably higher than at present, and with it the pressure of the respective system of land use on the autochthonous population.

[307] Although my observations suggest that sago pancakes represent an innovation from the Aitape area, I have also recorded the assertion that Krisa pottery shapes included the required set of two griddles—which, though, may itself have been an earlier innovation with the same origin. Similarly, Donohue & San Roque (2004:112) list a term SAKALE in their I'saka wordlist, translated as "frying pan (double)", which clearly denotes the utensil to prepare sago pancakes, but may of course be a loanword.

[308] Recall that TULIP leaves are one of the most protein-rich vegetable foodstuffs (cf. Table 2).

[309] The consumption survey yielded a similar prominence for corn (*Zea mays*) and PITPIT (*Saccharum edule*), which though must be regarded as a seasonal phenomenon, considering that the survey period (October) likely coincided with the wide availability of both crops. Thus, corn ripens as one of the first garden crops about two months after planting, which is typically done during the third quarter, while the flowering of PITPIT is typically seasonal (French 1986: 97) and may have occurred during the same time. On the other hand, breadfruit assumed a minor role during the survey period, while Maibala (1996) reported that it is a daily food when in season during June-July. Generally, meal composition is seasonal, with fast ripening garden crops prominent in the fourth quarter of the year, and forest greens abounding towards the end of the first quarter, when the rainy season draws to a close. On average, the second quarter of the year is the richest period overall in terms of abundance and variety of foodstuffs.

[310] Grading of meals by preference and frequency refers to Krisa village, where the household activities and consumption survey (see Appendix 10) was conducted. There are indications, though, that the diet of people living closer to town is biased towards commercial foodstuffs, due to scarcity of garden land and sago resources; higher levels of cash income; and the desire to imitate a modern lifestyle without subsistence labour.

[311] Two kinds of megapode, or brush turkey (?*Talegalla* spp., family Megapodiidae), are known in Krisa, the one laying eggs of about 10 centimetres length with pale red shells, the other laying slightly smaller eggs with white shells. Eggs contain a large-size yolk and have superior taste. They are deposited by the birds in mounds of leaf litter, typically in cavities formed by buttress roots, where they incubate through the heat released by decomposition processes, and from where they are excavated by humans (cf. Beehler et al. 1986:72-74).

[312] The fact that both carrier substances for the blood are strong-smelling and/ or produce a burning taste sensation suggests that a physiological response of the treated dog contributes to the desired effect.

[313] Cf. Guddemi (1992:306) who observed among the Sawiyanö: "Hunting success involves personal vigor, the knowledge of magic, and the co-operation of the dead. Hunting magic is more prevalent than gardening magic."

[314] Masses of pigs' skulls were found at Yeble, the site of the first village, during the archaeological survey of 1997 (pers.comm. Christin Kocher Schmid 1998). They probably indicate the location of the first communal ceremonial house or its successor there (cf. p.202) rather than the more recent clearout, as this must have taken place in Wolu, where the ceremonial house was established upon relocation of the village to Desawa.

[315] Despite the sketchiness of my data regarding performance and purpose of the ADI ritual, there is an unmistakeable correspondence—beyond the purely lexical one—between this and the Umeda IDA ritual, so elaborately described and interpreted by Gell (1975). If my data highlight the regeneration of life as the principal function of the Krisa ADI, this may have constituted but the substrate for the regeneration of society itself, analogous to the principal function of the Umeda IDA as traced by Gell (op.cit.:295-343). For, "assert[ing] human control over the processes of regeneration in nature" (op.cit.:295) at once entails the "sacrifice of individual autonomy... [as]... the price paid for the restoration of the human order against the natural world" (op.cit.:296), thereby enabling restoration of the "collective authority of the society" (ibid.). The notion of 'nature' being absorbed into society ('culture') which thereby reproduces itself (op.cit.:295f.) raises intriguing questions regarding the cognitive dimensions involved in this operation and the conceptions of 'nature' held respectively by the ritual practitioners and the investigator (cf. sections 4.2., 4.4.). Their exploration would however exceed the scope of this study. On a more concrete, structural, level than Gell, Peter Huber (1980) has documented the ritual importance of the pig hunt among Anggor people and its corresponding role for the reproduction of society. The superficial resonance with the surviving importance and cognitive salience of pig in Krisa may likewise indicate a more fundamentally important social function of this in the past and hint at potential patterns of meanwhile vanished symbolic relevance. Without reference to Huber's article, Bernard Juillerat (1996[1986]:177-182) and Phillip Guddemi (1992:307f.) have indicated similar practices associated with pig hunting among the Yafar and Sawiyanö, respectively, thus presumably indicating a cultural pattern widespread in the region.

[316] More specifically, malnutrition need not be a direct function of poor nutrient intake, but may arise from infection, which "has a negative impact on the absorption and utilization of nutrients" (e.g. Cohen 1994:281). A high level of infection has certainly figured prominently among populations in the Vanimo hinterland since the commencement of written records. In 1930, patrol officer Thomas remarked: "This area is badly in need of a Medical Patrol." (PR 30-31/6). Subsequent reports

enumerated various tropical diseases afflicting local populations, without even mentioning the most prevalent and vicious of them, malaria (PR 44-45/6, 46-47/9, 48-49/6, 49-50/13; cf. Willy 1996:183). The middle of the century saw a succession of epidemics, in a typical contact scenario (Crosby 1986:chpt.9; Kunitz 1994). The first was dysentery, brought allegedly by Japanese troops at the onset of the Pacific War and sweeping through the area in the first years, with sporadic outbreaks later on (PR 44-45/6, 46-47/9, 48-49/6). In concert with general wartime distress (cf. p.220), it likely accounted for the serious demographic decline and poor individual fitness in local populations (PR 46-47/7, 48-49/6), which in turn will have fostered subsequent epidemics of influenza (DOR 57-58/2nd, PR 57-58/5, 63-64/8) and meningitis (PR 62-63/8). The impact of endemic and epidemic infectious diseases was certainly aggravated by a lack of modern healthcare facilities, which by 1961 were still largely restricted to the hospital in Vanimo (Willy 1996:181). The spread of these diseases will in turn have been encouraged by the sedentisation and residential concentration which the administration actively promoted and which modernisation furthered (cf. pp.19,220,223f.). After all, infection levels are correlated with group size and permanence of settlement (e.g. Cohen 1994:273,281; cf. also p.222/ n.283). Any trends contributing to poor health in the local population will have been reinforced through a cultural tendency for malnourishment of females (cf. n.252), which if not documented for Krisa seems possible, and whose effects these trends will have exacerbated in turn.

[317] Although Krisa people generally claim that they artificially propagate only the giant bamboo TONI (45), since all others occurred spontaneously in sufficient numbers, a garden survey (cf. Appendix 11) revealed that at least the common bamboo YAXAU (43) is also planted in gardens.

[318] Cf. Juillerat (1996[1986]:167), who reports that among the Yafar felling a tree to incubate grubs similarly transfers these into private ownership.

[319] Although in Krisa access to megapode breeding mounds seems to correspond to clan territories, among Mbo-speakers mounds are apparently claimed as individual property by women and passed on in the female line, with facultative access by maternal relatives (pers.comm. Christin Kocher Schmid 2000). The difference may be as much cultural as a product of logging, which strengthened the patrilineal element of local politics, and hence the significance of clan land boundaries (cf. p.225, n.287).

[320] Note that in particular Peter Huber (1980) has documented elaborate and strictly prescribed modes for the distribution of pork, hinted at also by Phillip Guddemi (1992:307f.) (cf. n.315).

[321] Cf. e.g. Dwyer & Minnegal (1991), who "explore outcomes of several hypothetical patterns of sharing meat" (op.cit.:199) among the Kubo, a PNG lowland society, and conclude that "the outcome of community-wide sharing would have been to greatly reduce variability in the availability of meat to all individuals" (op.cit.:203). Indeed, they assert: "Without sharing, the hunting system at Gwaimasi would have been ineffective" (loc.cit.).

[322] Cf. Juillerat (1996[1986]:158-n.9), who observed among the Yafar: "In fact [planted] trees are the only valuables governed by a formal system of private property. Their value comes from their productivity spread over ten or twenty years and from their reproductivity." Contrary to the justification summoned by Juillerat, though, I would maintain that "productivity" and "reproductivity" constitute only proximate reasons for the values of trees; after all, both characteristics attach similarly to other resources. Rather, I would hold that the value of planted trees comes ultimately from their potential to embody human action for subsequent generations, thus manifesting claims to territory and history (cf. pp.215f., and see pp.272,276 and Figure 15 [p.290] below).

[323] A consumption unit comprises typically 2-3 adults and several dependent children (see pp.264ff.).

[324] The traditional way of processing sago in Krisa is by a single (female) person flaking the pith lengthwise to produce one bagload of chips, which is then leached by the same worker or an accompanying person before flaking continues. The typical scenario is that at the end of the working day the processed starch is recovered; no unprocessed chips remain; unprocessed pith remains in-situ in the opened bole. Depredation by pigs is therefore not an issue.

[325] If the pith is left in-situ in the opened bole for several days, it darkens and develops black streaks, presumably indicating fungal infection. Starch processed from such pith produces very dark jelly with intensive taste, known as "black sago" (BLAKPELA SAKSAK, SU'U).

[326] Community work has been an official obligation since the times of Australian administration. Today, it is carried out under the authority of the Local Level Government (cf. n.288), which in turn allocates monies for various maintenance activities. In Krisa, community members are called by the Councillor (cf. p.228) or his representative on Mondays and Tuesdays to discharge their duties. The considerable social aspect of this programme has led Kara (1996:11) to note, somewhat disapprovingly:

> "A particularly interesting aspect of this community work is that people take time to gather for roll call and assigning of work which usually takes between 2 to 4 hours which also involve a lot of talking, advising etc. that takes up most of the time. However, when it comes to the actual work (which is about 11 am or 12 noon), only a few do the work while [the] majority sit around chatting, chewing betel nut and feeling lazy to do any work because of the heat of the sun."

[327] This dilemma is widespread throughout the country, perfectly captured by Colin Filer (1994:193), in his discussion of attitudes towards development and conservation and the respective role of millenarian ideas, in the formula:

> "Once people's desire for 'development' is so thoroughly detached from what is feasible in practice, their impossible dreams may actually hinder those limited forms of material progress which are most likely to swing the balance of rural opinion towards an understanding of the need for nature conservation."

[328] Cf. PR 49-50/13 for an early description of the sexual division of labour in the region, which corresponds largely to my own observations in Krisa, save for a recent participation of men in the processing of sago palm (see main text below).

[329] As polygyny promises a disproportionate increase in group size, which in turn safeguards territory, it supports the mandate of the leader to ensure abundance of land and resources (cf. p.226).

[330] Very rarely, several related men may prepare *and use* a communal garden. Otherwise, they will merely pool their labour for clearing but then subdivide the plot for individual use.

[331] The respective Patrol Report (PR 49-50/13) anticipates this conclusion, noting: "... all work connected with the preparation of sago is performed by the women. This is to allow the men more time for hunting which is their principal occupation."

[332] A wife may join her husband if he goes hunting without male company, but will not participate in a pursuit or execute a kill. There are occasional claims that women could engage in a hunt in principle, but I have never heard of an actual case. Very rarely, women will clear garden plots in easy to cut vegetation. No woman, however, will fell trees, whether for gardening or construction, or erect a house, tasks which everyone considers beyond the physical capacities of females.

[333] If today the economic union of the conjugal pair is paralleled by their residential union, in the past both were uncoupled, as men found accommodation principally in the men's (ceremonial) house. Today, a few married men substitute for the absence of a men's house with an additional dwelling within the family compound. The occasional collective living arrangements of several young unmarried men (cf. p.265) may conform to a similar concept. Kameata et al. (1997:5) report a corresponding

pattern for the Mbo-speaking community of Isi, though with yet more pronounced segregation of men, which may once again indicate a lesser degree of modernisation for Krisa's southern neighbours:

> "The present household composition would comprise of a nuclear family or the extended family with the inclusion of a spouse's brothers or sisters, nephews and nieces as well as parents of usually just one spouse. Family would usually refer to two or more extended families living together in a single household and more commonly it is womenfolk and children that practically live in that household. The men have their own house or otherwise sleep with the young boys in their 'boy haus'. However, all other household activities like cooking and eating are done in the main household."

With the standard separation of spouses in the past, women in both monogamous or polygamous unions would have formed households of truncated families, in which their husband would have been present only sporadically, without prejudice to his economic involvement. Polygyny today moves however away from the concept of a plural union and towards that of sequential monogamy or indeed promiscuity, with the respective residential arrangements and the man's attendant economic involvement, or lack of it. The present tendency for co-wives to associate with other households may therefore be born out of economic necessity. On the other hand, women may always have been rather independent residentially. Oral accounts may just obscure this circumstance through an emphasis on marriage as opposed to residence. In particular, the formerly more pronounced dispersal to the forest (cf. p.220) will have at once removed men from the men's ceremonial house for prolonged periods of time, thus permitting residential union of husband and wife, but will potentially have separated co-wives, who may never have formed collective households.

[334] Typically, accommodation and cooking facilities are separated in space, in the form of a principal dwelling (HAUS SILIP—"sleep house") and a kitchen (HAUS KUK—"cook house", often supplemented with an outdoor fireplace), although both may also occur as two different compartments of the same building. In the past, adolescent boys and adult men would have slept separately from these in the men's (ceremonial) house (cf. n.333).

[335] For example, a woman's brother may clear a larger garden plot and then offer her part of it for further preparation, while attending to his part together with his wife.

[336] This all-encompassing meaning of PU may be what distinguishes it from an analogous term for forest, WISAU, which seems to denote more specifically the respective vegetation. Donohue & San Roque (2004:112) likewise list both terms as "forest", but do not refer to any distinction between them.

[337] With the spatial grouping of humans and spirits on the one hand, and their collective opposition to forested environments on the other, Krisa lifeworlds may range somewhere in-between those of non-cultivators, considered to perceive a contrast between visible and invisible spheres, and of intensive cultivators, considered to perceive a contrast between human and nonhuman spheres, and may thus be poised on the brink of 'inventing nature', as suggested by the argument put forward by Peter Dwyer (1996—cf. section 4.4.).

[338] Notably, Ningera people, who according to local understanding represent a related linguistic group (cf. n.210), have at least in the past claimed a similar status as forest people, hunters and erstwhile mountain people (Cheesman 1941:182; 1958:256; Simet 1992:63, Annex Four).

[339] The conceptual distinction between environments recently affected by logging and environments recently affected by gardening makes good ecological sense. After all, logging removes trees selectively (cf. n.276), while garden preparation removes trees completely. Hence regrowth upon logging proceeds within a remaining, if damaged structure of both softwoods and undersize hardwoods, while upon gardening herbaceous and juvenile flora dominate initially. Besides, burning may alter the composition of the subsequently establishing pioneer flora (Whitmore 1990:128). Regrowth upon logging will therefore resemble forest much faster than regrowth upon gardening.

[340] The term IWESAU is composed of the term for dwelling place, I, and the term WESAU, which even though I was told has no meaning in itself might represent a modulation of WISAU ("forest", see n.336). IWESAU might therefore literally denote "forest around a dwelling place".

[341] For previous descriptions of activities mentioned in the following, cf.

- pp.264f. (overview—sexual division of labour);
- p.262 (house construction);
- pp.245,246 (Case Study 3, Case Study 4) (manufacture of artefacts);
- pp.237f. (meals);
- p.261, section 5.3. (gardening);
- pp.241 (Case Study 2), 262 (sago).

[342] The irrelevance of gardens/ swidden fallows for hunting corresponds to the situation described by Dwyer & Minnegal (1991:193,205), while contrasting with observations commonly reported for other areas of the tropics (cf. references quoted ibid.—cf. n.41).

[343] I rely on email correspondence with John Wagner (pers.comm. 2001), who had via mailing list inquired about the possible effects of logging activities on the populations and feeding habits of wild pigs in Papua New Guinea. Several scholars, including Peter Dwyer, Robin Hide, James Menzies and George Morren, provided information, which John Wagner subsequently summarised and posted in return. Besides noting the lack of published material on the topic, he mentioned in particular the tendency of pigs to favour disturbed habitats and relayed research results reported in Mitchell and Mayer (1997)* regarding the stimulating effects of logging roads and skidding tracks by offering travel corridors, wallowing spots after rain and rooting ground along their sides and banks.

* Mitchell, J., and R. Mayer. 1997. Diggings by feral pigs within the wet tropics World Heritage Area of North Queensland. *Wildlife Research and Exploration* 24:591-601.

[344] Cf. the observation by Gell (1975:17) that "[a] few pigs are kept (never more than four in Umeda during my stay, and similar numbers in the other villages) but are not bred in captivity: these domestic pigs had been captured in the forest when small and bred up." Juillerat (1996[1986]:209) similarly recorded low numbers of pigs among the Yafar, typically captured as piglets, but occasionally bred in captivity (op.cit.:206). Guddemi (1992:306), in contrast, reported higher numbers of domestic pigs among the Sawiyanö (without reference to breeding patterns), approximating between 50-100 % of those for the human population, despite the importance of hunting in general (cf. n.313) and wild pigs in particular. Yen (1991b—cf. n.157) has noted that the emphasis on keeping and breeding pigs increases overall with altitude in New Guinea, with lowlands communities either practicing exclusively hunting or additional rearing only.

[345] The adverse effects of logging on megapode breeding mounds is suggested by a range of circumstantial evidence:

- megapodes favour precisely the buttress roots of the large trees (cf. n.311) which logging removed, but which traditional zoning would safeguard also beyond the mountains;
- among neighbouring communities in the Pual floodplains, not yet affected by logging at the time of research, the importance of collecting megapode eggs seemed more pronounced (pers.comm. Christin Kocher Schmid 1999 for Mbo-speakers, John Wuni [Imbinis community] 1997 for Imbinis);
- a positive ecological effect of lower altitude with these communities is unlikely considering that on Krisa territory the breeding mounds concentrate on the contrary in higher altitudes;

- a potentially higher subsistence value of megapode eggs in these communities due to their lesser modernisation would likely be offset in Krisa by its proximity to urban markets where the eggs fetch high prices.

[346] Note that game, eggs, grubs and TULIP leaves constitute the principal sources of fat and/ or protein in the Krisa diet (cf. p.238, n.308), which presumably accounts for the prime attention accorded them.

[347] Evelyn Cheesman (1958: 257) vividly illustrated this aspect when she related:

> "Once when collecting alone in the forest, I chanced to disturb a pig asleep. It was in the same lair three mornings running so I considered this an event worth reporting. It was stop-press news in the village that evening. Sorn [her assistant] ran to fetch his pals, and several of them squatted below the rest-house [her accommodation] to be told in detail where this pig was to be found. Fortunately for my reputation, I had been following a trail of my own, and thus had memorized certain landmarks for my own guidance—as bushmen had taught me on Malekula. I cited these in the order in which I thought they occurred, watched by all these intelligent eyes. They got that pig, but Sorn told me gravely that one landmark was in the wrong order on my list. The knotted fern came *before* the mutilated palm, and not *after*, as I had said."

[348] "VANIMO I GAT NEM LONG TAIM YET. DISPELA BUS INSAIT LONG VANIMO, OL KRISA I BIN WORK, OLSEM I GAT BUSMAK I STAP: OL WARA I GAT NEM, OL MERI—OL SPIRITMERI."

[349] Only male nurturers of trees remain genealogically visible (see section 5.3.).

[350] Cf. Leklek (1996: 9f.), who listed similar aspects of environmental impact of logging in Krisa.

[351] "KAIKAI OL TULIP NABAUT!"

[352] Besides the maternal and sororal connections typically employed with other forms of usufruct, gardening often also follows uxoral links, with men maintaining gardens on their wives' land—indeed the sole option for in-married men. Officially, though, such gardens tend to be considered the woman's, their use offered to her by her male clansfolk, her husband but supplying the necessary labour. His inconsequential role with this constellation was reflected during the garden survey in people tending to mention the respective gardens only as an afterthought, if at all.

[353] If sago seems an exception to this rule, being largely planted outside gardens for ecological reasons, sago patches correspond to gardens conceptually and legally, and require maintenance like these. In fact, the correspondence between sago patches and gardens extends to the interplanting of various perennial species. Thus, Christin Kocher Schmid (pers.comm. 2000) reports that among Mbo-speakers especially TON (*Pometia pinnata*) is planted among sago palms, "in order to strengthen the soil" (LONG STRONGIM GRAUN). That I have not documented the same practice in Krisa may be due as much to incomplete observation as to a genuine limitation of species diversity for ecological reasons. Perennating species propagated outside gardens include also swamp cabbage (KANGO, *Ipomoea aquatica*) and watercress (WARA KARI, *Nasturtium officinale*), which have been adopted during the last few decades. For ecological reasons, they need to be planted in ponds, which are in principle areas of common access. The act of planting, however, transforms common into individual access, launching rights of ownership to the respective plants. Some perennials may therefore diverge from the common pattern in ecological terms, but agree with it in terms of the legal principles governing their management and use. As long, though, as the plants' requirements are compatible with the ecological conditions of the garden, their cultivation conforms to the classical pattern. If Maibala (1996) therefore remarked that "the cultivation of the banana in Krisa is less confined to the gardens" since bananas were also planted at the "base of large trees which had been pulled down during logging operation some years back", he may have overlooked that the clearings generated by the fall of these trees would have been transformed into garden plots by additional human activity prior to the planting of banana. He may have been misled by expecting large and orderly cropped plots.

[354] Kara (1996:42) presumably referred to such external ownership when he observed that "there is an inter-mixing of peoples properties in one piece of land".

[355] Subtle legal differentiations apply, however, depending on the value of the resource and/ or how unambiguously its descent can be traced. Thus, suckers of a breadfruit tree (*Artocarpus* spp.), or a sprouting coconut clearly dropped from an identifiable palm belong to the erstwhile nurturer, while scattered TULIP seedlings—even if likely the progeny of a nurtured tree in the plot—or surviving sugar cane (*Saccharum officinarum*) are appropriated by the new gardener.

[356] Maibala (1996) reported that firing is not necessary and not practised throughout, and hence the system better described as slash-and-mulch. This is contrary to my own observations and the interview responses I recorded.

[357] The change in legal emphasis is reflected by the use of taboo-signs, which tend to be applied to the plot during the earlier stages of gardening, and to individual plants later on.

[358] Again (cf. n.206), I use the term 'schedule' in a purely commonsense meaning, here referring in particular to the temporal organisation of activities.

[359] According to official documents (WSDS 6), monthly rainfall in the Vanimo hinterland oscillates between about 150 and 380 mm, with lowest levels in July and September, and highest levels in January and March; when added up, the figures yield an annual amount of around 2,600 mm. Accordihg to Allen (1976:323), annual rainfall is considerably higher, on average about 3,960 mm. The latter figure seems more accurate, although the pattern is probably well represented in the official data. In recent years, the annual climatic cycle has been somewhat upset following the El Niño drought of 1997-98, even though its impact was less severe in the region than in other parts of PNG and the Pacific/ South East Asia at large. By the time of my arrival in Vanimo, in September 1997, there had been no rains for several weeks, a situation which continued into October. The subsequent monsoon rains not only set in late, but were also less prolonged than usual, though apparently more intense, a pattern which continued during the following two years: in 1998, rains were concentrated in February/ early March; in 1999, James Menzies (pers.comm.) reported that March was still very wet.

[360] The Agricultural Systems Working Papers (ASWP 3:1511) note correspondingly that several authors have indicated the seasonal planting of gardens in the Vanimo hinterland.

[361] The bird identified in Krisa as APIA is presumably the Magnificent Bird of Paradise (*Cicinnurus magnificus*). It is the only species listed in Beehler, Pratt & Zimmerman (1986) which matches the description by Krisa people in both range and habit. According to the species account provided by Beehler, it occurs "[t]hroughout forested uplands of NG... from foothills near sea level..." and in localities of "hilly lowland forest and lower montane forest, edge, and regrowth", where the "[m]ale displays from a terrestrial dance ground in forest, like a parotia" (op.cit.:231), which in turn "builds dance court by clearing a space on the ground" (op.cit.:229). If local descriptions of the bird's appearance diverge slightly from the scientific one, this may indicate more a difference in emphasis and perception, and possibly a confusion either in my recording or in local description, than a genuinely different species. Thus, APIA is said to be a pretty bird, with yellow underside, brown wings, black back, and a long beak. The Magnificent Bird of Paradise, in turn, is described as "dark below, golden above", confirming the two-colour pattern if in inverse form; the respective illustration (op.cit.:plt.53) just about satisfies the characteristic of long beak, which though is of course a relative attribute. If APIA is not recognised as Bird of Paradise (KUMUL) locally, even though it has ornithologically been classed as a 'Typical Bird of Paradise' (op.cit.:223,plt.53), this is clearly due to members of this family being less strikingly plumaged than the emblematic 'Paradisaeas' (op.cit.:223,plt.51).

[362] My documentation of the corresponding vernacular terms is only partly reliable. Thus, I have recorded PILI TA YUPLU (garden/ stays/ near) and PILI TA POYE (garden/ stays/ distant) for the two types outside the village, although contrasting information suggests that the meanings of POYE and YUPLU might be inverse to the ones given here. Also, I have recorded house garden as WEI PILI (house/ garden), which though may be an artefact of questioning, considering that the respective environment is commonly not conceptualised as a garden. An alternative term, PILI TA WEISOU (garden/ stays/ house/ around) may be more faithful, apparently providing the template for the phrase used in Tok Pisin, ARERE LONG HAUS, with the addition of PILI possibly again an artefact. Any uncertainty about labels notwithstanding, I am however confident about the threefold conceptual division of gardens by relative location.

[363] House gardens may receive spent coconut flakes, which though are likely to be scavenged by dogs.

[364] Conversions are: 0.5 ha = 5,000 square metres; 1 acre = 4,047 square metres. In Krisa, only exceptionally large gardens reach these sizes, either upon collective work efforts or from sequential extension (see main text below). They are beyond the sizes of plots prepared by single garden units in individual years.

[365] A typical constellation is of (clan-)brothers (i.e. agnates) and potentially an in-law pooling their labour and then subdividing the resulting plot among them, the rationale for the participating in-law being the clan affiliation of his wife, who also becomes the actual owner of his portion of the plot (cf. nn.330,352).

[366] This correlation suggests that it is valid to integrate the models proposed by Beckerman (1983a) and Harris (1977), which respectively relate crop diversity to labour expenditure and this to plot distance, into an overall model which relates crop diversity via labour expenditure to plot distance (cf. p.53). If some of the parameters associated with distance relate to labour expenditure only indirectly, they must nevertheless be explained as a function of it. Thus, keeping crops which are susceptible to plundering or pig damage near dwellings constitutes a minimisation of labour time expended for warding or construction of fences in outlying gardens.

[367] "OLSEM MI TOK PASTAIM: GRAUN BILONG [F2], OLSEM MIPELA INAP LONG PLANIM KAIKAI TASOL; OL STRONGPELA SAMTING MIPELA NO INAP LONG PLANIM!"—The garden provided the example for Case Study 10, presented in the main text below.

[368] More specifically, the (heavily) seeded variant, NUPO (56), for which Maibala (1996) accordingly noted: "Like the other it is cultivated though some of the trees in the village were dispersed by birds."

[369] That the nurturing of perennials should have public character may seem obscure, but is really a matter of course. For, a clan's territory is a public space for its members as far as concerns its freely accessible portions available for gardening (cf. pp.215,267f.,274). Ownership of a particular garden is well-known at least to members of the landholding clan, and so will consequently be ownership of nurtured perennials. Conversely, the nurturing of perennials on territory other than one's own would not escape the attention of the landholders.

[370] There may be certain borderline cases regarding the rule that on the one hand planting and/ or nurturing of trees establishes individual ownership, while on the other hand this procedure is restricted to the land of one's own clan.

Thus, I have repeatedly recorded references about the artificial propagation of TON (*Pometia pinnata*), but never documented ownership of an individual tree. In fact, my records indicate collective access for TON trees throughout. Presumably, artificial propagation must be confirmed by continued maintenance of either the plot at large or the respective plant to manifest in ownership. Since TON is very tolerant of regrowth, it may be sowed only in plots which are soon abandoned, thus leaving the

seedlings to merge back into common access. If this was the case, it would provide an example of management activities performed for the common good, without immediate benefits to the individual.

Another exception to the rule seems to occur with the propagation of sago palm. Thus, I have repeatedly recorded that people entrust suckers to relatives for them to plant and nurture the palms, which though remain the property of the entrusting person. Possibly, this constitutes a mechanism which ensures both equal access to sparsely distributed habitat suitable for sago growth and supports the maintenance of dormant usufructory rights on the territories of ancestral clans (cf. pp.207,212).

[371] Ecological principles are slightly different for sago, which is restricted to fixed locations and repropagated continuously rather than discontinuously, as other perennials. Clearing activities likewise proceed continuously, to prevent encroachment of forest trees, whereas with gardening they proceed discontinuously, each time commencing the swidden cycle anew. In sago patches, therefore, gradual maturation of the vegetation is suppressed rather than repeatedly launched, as in garden plots. However, the need for repropagation and its necessary connection with clearing activities remain (cf. n.353).

[372] "KAIKAI TULIP *MIPELA* BIN PLANIM!"

[373] The resource most frequently identified as subject to intergenerational planting in Krisa is sago. This may reflect its economic importance as much as its comparatively slow growth on the Krisa plateau. While I myself have no reliable data from Krisa which indicate the regular age of palms at the point of processing, Flach (1997:43) reports maturation periods of 20 or more years for palms under adverse ecological conditions. Although the example he provides identifies stress through extreme fluctuation of water levels, he indicates elsewhere (op.cit.:52) that water shortage alone "is detrimental to growth", which may be the factor applying in Krisa.

[374] The degree of sedentism therefore constitutes an additional variable in any model which correlates distance, labour, and crop diversity (cf. n.366). It may be conceptualised as labour expended on the spatial distribution of plots as opposed to labour expended on individual plots, thus indicating that spatial variation constitutes an important dimension of swiddening.

[375] Such a uniform view of subsistence activities is only partly reflected in local conceptions, as Krisa people do distinguish activities also in spatial terms (cf. Appendix 10, questionnaire item 3, which is largely representative of the categories distinguished locally). Among Mbo-speakers, however, the tendency is indeed towards a definition of activities by approach rather than space (pers.comm. Christin Kocher Schmid 2000).

[376] Maibala (1996) has speculated that garden magic was employed in the past but was given up upon contact with Catholic teachings. When gardening in Krisa is viewed in its wider subsistence context, though, this interpretation seems unlikely. Not only do gardens constitute a secondary environment in terms of their immediate importance for subsistence, but have I never recorded any references to a past ritual connected with gardening. In contrast, secondary growth as the principally important environment(s) were and still are the object of ritual attention, which in turn has declined with Christian influence, as recorded in oral accounts (cf. pp.239f.).

[377] I believe that investigating the mechanics of subsistence change must precede speculations about the forces driving it, which may otherwise produce hypotheses of improbable scenarios (cf. p.73). Of course, both will usefully complement each other, but attending to them equally would exceed the scope of this study.

[378] "TAIM YU KATIM GADEN, STAP LONGPELA TAIM, I SAVE KAMAP."

[379] Incidentally, there are some indications that the term for garden, PILI, denotes an upward motion—in this context the sprouting of regrowth—and thus identifies originally the emergence of adventitious pioneer flora, and hence the clearing, rather than the cropped plot. So far, I lack however reliable data to support this speculation. Intriguingly, Gell (1975:260f.) reports a similar emphasis on an upwards thrusting movement in Umeda conceptions of garden fertility—if rather associated with garden crops—whose symbolic analogy with male sexuality might in turn have some resonance in Krisa. Further data are needed, though, for any valid conclusions.

[380] The fruits of wild bananas are generally inedible; edibility in the genus *Musa* was only attained upon development of both sterility and parthenocarpy (i.e. autonomous stimulation of pulp growth) through human selection (Simmonds 1995:371f.,fig.72.1). With the loss of sexual reproduction, survival of the respective taxa would have relied on the dispersal of their asexual (vegetative) propagules by humans; the faculty of vegetative reproduction itself possibly increasing in the process of domestication (cf. pp.153ff.). Hence, evolution of edible fruit in *Musa* must have necessarily entailed planting practices. As both wild and edible bananas thrive in conditions of heavy vegetational disturbance and early rather than advanced regrowth—in contrast to wild yams—we may assume that banana domestication also entailed nurturing through weeding from the beginning.

[381] I have earlier defined 'agriculture' as the fixed-field cultivation of seed crop domesticates (cf. pp.161f.), and 'horticulture' implicitly as the cultivation of primarily vegecrop domesticates in swiddening regimes (cf. section 3.4. passim, esp. pp.53ff.). With the designation of 'intensive horticulture', I want to indicate forms of swiddening which tend towards lengthening of the cropping phase and shortening of the fallow phase, towards a situation in which the latter does not any longer exceed the former substantially. Thus, an emphasis on permanent (or at least semi-permanent) plots is common to both, and I will use the adjective 'agricultural' in the following to indicate this tendency..

[382] Compound phrases in this fashion are common for European innovations (cf. the authors' example of "white man's arrow" for "cartridge" on the same page). In fact, APE denotes spirit beings, its extension to humans with Caucasian features presumably reflecting local sentiments at first contact. Indeed, related sentiments persist throughout the Vanimo hinterland, with local people occasionally suspecting Europeans to be immortal (cf. Kocher Schmid 2000c:81).

[383] Cultivation of coffee, though, seems to have been actively discouraged or even banned in the region by the administration, to stop the spreading of coffee rust from Indonesia (Leklek 1996:8).

[384] This effect has been explicitly reported for the Kilimeri area (Siuta Sam 1998:15,27).

[385] Cf. the straightforward assessment by Christin Kocher Schmid (2000a:8):

> "Development is only initiated when the traditional land management practices are taken as a base to improve the local, economic situation. The integration of various randomly introduced cash crops... which were incompatible with the traditional arboricultural management system (eg. rice), was therefore doomed from the start."

[386] Cf. a corresponding observation by Townsend (1991:746), of Saniyo-Hiyowe people integrating exotic lemon trees into their tree-based subsistence system.

[387] In a similar pattern, cocoa cash cropping has recommenced in some Mbo-speaking communities, following disenchantment in the aftermath of logging and professional guidance.

[388] An additional factor may have been a proliferation of pig populations and the destabilisation of slopes upon logging (cf. pp.268,272).

NOTES TO CHAPTER 6

[389] Hart, R. D. 1980. A natural ecosystem analog approach to the design of a successional crop system for tropical forest environments. *Biotropica* 12:73-83.

[390] Cf. the analogous argument by Morren (1986:34) that a methodological emphasis on mobility reveals fundamental similarities in the approaches towards animal management taken by groups classed otherwise as hunter-gatherers, hunter-horticulturalists, shifting cultivators, and pastoral nomads, obscured though by these established taxonomies which are principally based on techno-economical parameters.

[391] This logical dilemma remains typically unacknowledged in general discussions of subsistence system development, which tend to imply the emergence of rainforest swiddening in a prêt-à-porter fashion. For example, Peter Bellwood (1978:142) explained:

> "When man enters this system [i.e. rainforest] as a cultivator, his first requirement is to clear a space and burn the vegetation, since most cultigens demand light and would not survive forest floor competition."

[392] The characteristic of shade tolerance becomes particularly apparent in swiddening regimes which employ slash-and-mulch strategies, where only part of the vegetation may be removed and left to rot before planting, as described for example by George Morren (1986:86).

[393] *Coix lachryma-jobi* as a cereal apparently contradicts the postulated domesticatory scenario and suggested evolutionary sequence, yet in fact confirms it (cf. n.39, p.156). As Yukino Ochiai (2002) has demonstrated, the ecological characteristics of this taxon—drawn-out and uneven maturation—resemble those of the vegeculture–vegecrop configuration so typical of swiddening regimes, which combines with the feature of continued seed shattering (dehiscence) and contemporary plant management practices which focus on individual plants to suggest domestication "under the influence of vegeculture and in a vegecultural manner" (op.cit.:59).

[394] Jones, R. 1969. Fire-stick farming. *Australian Natural History* 16:224-228.

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Plate 1: Krisa Territory. Aerial view southward from the coast, showing the three sacred mountains. From left to right: Sau with rounded peak; Dale with table-top; Sawa in clouds. The brown patch in the foreground is a landslide, the green patches indicate the sites of former logyards. (Image courtesy of Alan McNeil.)

Plate 2: Pual Basin and Bewani Mountains. View southward from the Krisa plateau, showing the forested plain of the Pual river basin in the foreground, the silhouette of the Bewani mountain range in the background.

Plate 3: Krisa Village Aspect of the village core at the original site Desawa (cf. Map 8)

Plate 4: Sago Choppers. The image shows the entire spectrum of chopper designs used in Krisa (cf. Case Study 2). From left to right: reduced-size model of obsolete design with stone blade; designs with dry and green bamboo heads, the latter serving demonstration purposes only; design with rattan head; design with reinforced hardwood head.

Plate 5: Use of Sago Chopper. The pith is excavated lengthwise, typically female work, and here rather unusually carried out by Daniel Waki who is helping his mother.

Plate 6: Washing Sago (Clara-Mepu Wep). The gutter of the hand-pressing apparatus is from sago palm leaf sheath, the filter from coconut leaf sheath.

Plate 7: Preparing Sago Jelly (Victoria-Subaxai Song). The hot paste is apportioned with two sticks, placed on leaves and wrapped in them, where it will keep for up to 2 days.

Plate 9: Making Arrows (Vincent Dukala). Left a scene indicating the necessary materials: a reed grass shaft (in the foreground); a finished bamboo blade; very finely sliced rattan stem; glue from heated breadfruit sap (in lying canister) and, for decorative purposes, the red fruit of *Bixa* and possum fur, which is currently being applied to a finished arrow with wooden tip. Below a detail indicating the technical expertise required, as the tip of the bamboo blade being carved needs to coincide with the node of the culm. In the background a finished blade; a cassowary bone awl, a wooden tip next to it; and three reed grass culms for shafts (cf. Case Study 4).

Plate 10: Planting Techniques: broadcasting the seeds of a *Brassicacea* by beating two bunches against each other (Gertrud Bewa, left) and using a digging stick to make a cavity for the banana sucker leaning to the lying trunk (Bewa Tou, right).

Plate 11: Crop Abundance and Diversity. Image of the richly stocked garden described in Case Study 9.

Plate 12: Propagation of Perennials in Gardens. A newly planted garden, with crops barely established. In the foreground a recently planted sago palm sucker, behind it the stump of a lopped tree, retained during plot preparation.

Plate 13: Regrowth Thicket. Vegetation several years after total garden abandonment. Note the palm seedlings establishing among the regrowth.

Plate 14: Erstwhile Site of Settlement. Extensively transformed vegetation containing a high proportion of nurtured trees indicates clusters of past house gardens.

APPENDIX 1

Fallow Farming—
examples of similar terms denoting other concepts in the literature

Hans Ruthenberg (1971:3) employs a phrase identical to my own, though in the meaning of any land use system that involves fallowing. Hence, his designation might be transcribed as "farming involving fallows". In this meaning, shifting cultivation (swiddening) constitutes a particular, extensive, instance of fallow farming, whereas in my own usage, fallow farming constitutes a particular, extensive, instance of swiddening.

Craig Elevitch (2004) uses the term "forest farming" (op.cit.:514) interchangeably with that of "farm forestry" (op.cit.:e.g.228-230,245-252), by which he denotes the growing of trees for their wood on agricultural land (op.cit.:227). His designation may therefore be transcribed as "farming of forest". The contrast with fallow farming according to my definition lies not only in the much more limited range of resources covered, but more importantly in the conjunction between farming and the environments generated. While Elevitch's concept is synchronic, referring to the farming *of* these environments, mine is diachronic, referring to farming *for the purpose of* generating them. The synchronic outlook recurs with the wider perspective of the book at large. Although it takes systems which show the cyclical and dynamic characteristics of fallow farming as models for the development of modern systems which incorporate trees (op.cit.:1-58,passim), these modern systems are aimed at establishing permanent plant communities, reflected in particular in the key role attributed to permaculture principles (op.cit.:esp.437-443). The book, intended as a manual, does not attempt to provide a coherent theoretical framework, as reflected by the absence of a unifying term for the described phenomena

Robert Hart's (2001) "Forest Gardening" subscribes to a similar philosophy, as a testimony and manual inspired by locally developed systems (op.cit.:esp.chpt.11) but aiming at sustainable land use and living through application of permaculture principles (op.cit.:e.g.1). Even though his perspective is not necessarily static (op.cit.:149), his designation transcribes therefore rather as "farming of forest plots containing a multitude of resources".

Peter Kunstadter et al.'s (1978) "Farmers in the Forest" refers plainly to "farming in forests", with the forest as substrate for farming, not its product. In fact, some of the swidden forms which the authors examine do not return swidden plots to forest, but lead to scrub or grass cover (Kunstadter & Chapman 1978:7,10f.). In principle, though, swiddening entails both the aspects of the forest as substrate and as product, emphasis merely depending on perspective, as I demonstrate in particular in section 3.3., as in this study at large.

The title of the **ETFRN** workshop "Cultivating (in) Tropical Forests?" (Asbjornsen et al. 2000) introduces a more dynamic perspective through the ambivalence between "farming in forests" vs. "farming of forests", suggesting a developmental transition from the one to the other. Indeed, the authors do refer to long-term plot development

or even cyclical processes with some cases (op.cit.:15-17). A related publication emphasises in fact the successional nature of the respective environments (de Foresta et al. 2004:23). Yet, the reference to 'forest' rather than 'fallow' entails at once a reference to stability rather than transformation, which reflects the authors' focus on the most mature environmental forms within the process. This focus is highlighted in another related publication (Michon 2005), titled "Domesticating Forests", which is principally concerned with cultivated forests (op.cit.:x,passim). Furthermore, in all publications, the authors' emphasis on resources with commercial potential contrasts with my concern with subsistence at large, an aspect which I address more specifically in section 3.5. This contrast is further reflected in their examination of managed environments (Asbjornsen et al. 2000:5) or strategies of environmental management (op.cit.:6) vs. my own examination of systems of land use of which these environments and strategies might form a part.

William Denevan and Christine Padoch (1987) similarly regard the value of "Swidden-Fallow Agroforestry" as primarily commercial (op.cit.:esp.chpts.6,7). They do, however, assume a dynamic perspective, with attention to successive stages of fallowing. Still, their focus remains primarily on the swidden, with fallow and agroforest considered its extension (op.cit.:2,passim), or at best transformation (op.cit.:45), rather than the principal aim of the process. Hence, their concern is something like "farming and fallows".

William Balée (1992) titles his article "People of the Fallow", but the functional connection between both is historical rather than contemporaneous, as his subtitle "A Historical Ecology of Foraging in Lowland South America" indicates. His interest is in the use of fallows left as environmental artefacts by past populations and may therefore be labelled as "past farming and present fallows".

Laura Rival (1998) subtitles her article "Wild Gardens and Cultivated Forests in the Ecuadorian Amazon". The twofold complementarity, though, refers not to a functional ecological connection between both environments (which though I suspect to exist), but mainly to the two domesticates representing them, manioc and peach palm, and which fulfil complementary social roles, reflected in the principal title "Domestication as a Historical and Symbolic Process". In fact, references to gardening and forest management explicitly downplay cultivation (op.cit.:esp.239f.), which contrasts with an emphasis on the historical nature of current subsistence forms, similar to Balée, and on the aspect of choice. This is in contrast to my primary concern of modelling the ecological reproduction of the subsistence system.

APPENDIX 2

Overview of APFT-sponsored research in the Vanimo–Kilimeri area 1996-2000

research topic	method	researcher*	location	time
ethnography, subsistence, ethnohistory, concepts of future	observation, interviews, recordings, archival sources	Christin Kocher Schmid (Kent)	Krisa/ Mbo-communities	1996-2000
ethnography, forest management, impact of logging	rapid appraisal, interviews, observation	Roger Kara (NRI)	Krisa	1996
impact of logging	interviews	Ian Leklek (UPNG) –honours special project–	Krisa	1996
gardens	interviews	Baulon Maibala (UPNG) –honours special project–	Krisa	1996
social network analysis	questionnaires	Christin Kocher Schmid (Kent) Oliver Kortendick (Kent) 5 anthropology honours students (UPNG) design: Oliver Kortendick (Kent) adaptation: Christin Kocher Schmid (Kent)	Krisa	1996
archaeology	reconn.survey	Baiva Ivuyo (NMAG) Alois Kuaso (NMAG) Herman Mandui (NMAG) Robert Mondol (NMAG) design: Herman Mandui (NMAG)	Krisa/ Mbo-communities	1997
forest management & conservation (see Appendix 12)	rapid appraisal, interviews	Stefanie Klappa (Kent) Felix Topni Niofiarl (NRI) Vakaloloma Siuta Sam (NRI) 10 students (UPNG) .....*—ctd.*	Krisa/ Mbo-communities	1997

* primary affiliation of researchers:
Kent: University of Kent at Canterbury, UK
Krisa: Krisa community
MHom: Musée de l'Homme, Paris, France
MPI: Max-Planck-Institute for Behavioural Physiology, Andechs, Germany
NMAG: National Museum and Art Gallery of Papua New Guinea
NRI: National Research Institute of Papua New Guinea
UPNG: University of Papua New Guinea

		design: Colin Filer (NRI) Paul Sillitoe (NRI) adaptation: Rodney Kameata (NRI)		
ethnography, subsistence, ethnohistory	observation, interviews, recordings, archival sources	Stefanie Klappa (Kent) –PhD research–	Krisa	1997-99
census (see Appendix 9)	interviews	Stefanie Klappa (Kent)	Krisa	1998-99
gardens (see Appendix 11)	interviews, plot surveys	Stefanie Klappa (Kent) Vakaloloma Siuta Sam (NRI) design: Stefanie Klappa (Kent), based on previous surveys	Krisa	1998
diets, activities (see Appendix 10)	questionnaires	Daniel Waki (Krisa) design: Stefanie Klappa (Kent) Daniel Waki (Krisa)	Krisa	1998
market	survey	Daniel Waki (Krisa) design: Stefanie Klappa (Kent)	Krisa	1998-99
ethnobotany (see Appendix 14)	herbarium collection	Stefanie Klappa (Kent)	Krisa	1997-99
material culture (see Appendix 13)	museum collection	Stefanie Klappa (Kent)	Krisa	1999
zoology	survey	James Menzies (UPNG)	Krisa	1999
demography	rapid appraisal, interviews	Rodney Kameata (NRI) Vakaloloma Siuta Sam (NRI) Felix Topni Niofiarl (NRI) design: Paul Sillitoe (NRI)	Mbo-community Isi	1997
gardens	survey	Rodney Kameata (NRI) Vakaloloma Siuta Sam (NRI) Felix Topni Niofiarl (NRI) design: Paul Sillitoe (NRI)	Mbo-community Isi	1997
diets	survey	Vakaloloma Siuta Sam (NRI) design: Vakaloloma Siuta Sam (NRI)	Mbo-community Isi	1998

sago, gender	observation, interviews	Vakaloloma Siuta Sam (NRI)	Mbo-community Isi	1998-99
ethnobotany	herbarium collection	Christian Coiffier (MHom)	Krisa/ Mbo-communities	1998
ethnobotany	interviews, herbarium collection	Christin Kocher Schmid (Kent) Vakaloloma Siuta Sam (NRI)	Mbo-community Isi	1998-99
construction materials	interviews	Christin Kocher Schmid (Kent) Felix Topni Niofiarl (NRI) design: Christin Kocher Schmid (Kent)	Mbo-community Isi	1998-99
demography	questionnaires	Felix Topni Niofiarl (NRI) design: Felix Topni Niofiarl (NRI)	Mbo-communities	1998-99
local politics of logging	interviews	Rodney Kameata (NRI) Roger Kara (NRI) Felix Topni Niofiarl (NRI)	Mbo-communities/ Vanimo	1996-98
transport	questionnaires	Roger Kara (NRI) design: Roger Kara (NRI) Paul Sillitoe (NRI)	Vanimo	1997
urban diets	questionnaires	Roger Kara (NRI) Felix Topni Niofiarl (NRI) design: Roger Kara (NRI) Paul Sillitoe (NRI)	Vanimo	1997-98
urban markets	questionnaires	Roger Kara (NRI) Felix Topni Niofiarl (NRI) design: Roger Kara (NRI) Paul Sillitoe (NRI)	Vanimo	1997-98
forest products in urban markets	survey	Felix Topni Niofiarl (NRI) design: Christin Kocher Schmid (Kent)	Vanimo	1998-99
comparative research	observation, interviews	Paul Sillitoe (NRI)	Krisa/ Mbo-communities	1997
comparative research	observation, interviews	Wulf Schiefenhövel (MPI)	Krisa	1997
comparative research	observation, interviews	David Ellis (Kent)	Krisa	1997

APPENDIX 3

Selection of post-1996 documents generated from APFT-sponsored and independent linguistic research in the Vanimo–Kilimeri area

a) documents generated from APFT-sponsored research in the Vanimo–Kilimeri area which are used in this study:

published texts
Klappa (1999a, 1999b, 1999c)
Kocher Schmid (2000b, 2000c, 2000d)
Kocher Schmid & Ellen (2000)
Kocher Schmid & Klappa (1999)

website
Ellis & Klappa (1999)

methods work sheets (web-publication)
Ellis & Topni [Niofiarl] (1999)
Kocher Schmid (1999)
Kocher Schmid & Ellis (1999)

unpublished texts
Kameata et al. (1997)
Kara (1996)
Kocher Schmid (1996)
Kocher Schmid (2000a)
Kuaso et al. (1998)
Leklek (1996)
Maibala (1996)
Menzies (1999)
Niofiarl (1998)
Siuta Sam (1998)

b) documents generated to date from independent linguistic research in the Vanimo–Kilimeri area:

published texts
Donohue & San Roque (2004)
Donohue & Crowther (forthcoming)

unpublished texts
San Roque (2001)

literacy material
San Roque & Corris (2000)
San Roque et al. (2000)

APPENDIX 4

Selection of pre-1996 documents relating to the Vanimo–Kilimeri area

(listed in the sequence mentioned in the main text)

Leonhard Schultze-Jena (1914)

— report from the 1910 joint German-Dutch expedition which explored the area between the coast and the Bewani Mountains along the common border at 141° EL.

District Office reports (1957-58/2, 1957-58/3, 1958-59/1, 1958-59/3, 1961-62/1) **& Patrol Reports** (1930-31/6, 1944-45/6, 1946-47/9, 1948-49/6, 1949-50/13, 1953-54/2, 1955-56/4, 1957-58/5, 1962-63/8, 1963-64/6)

— selection of reports from stationed work in the district office at Vanimo/ Aitape, and from administrative expeditions into the Vanimo hinterland (cf. Conventions); produced intermittently between 1930 when a detachment of native police with a European (Australian) officer-in-charge was first stationed at Vanimo, and the mid-1970s when patrolling was given up upon PNG Independence.

Kenneth Hewitson Thomas (1941-42)

— academic account by the first officer-in-charge from the time of his placement in Vanimo in 1930.

Father Ignatius Willy (1996)

— a history of missionary activity along the Vanimo coast and its hinterland, spanning the first arrival of a priest of the S.V.D. (Societas Verbi Divini—Society of the Divine Word) in Vanimo in 1903; a subsequent half-century of intermittent missionary activity; the arrival in 1961 of the Passionist order, who had been active in New Guinea since 1955; the designation of Vanimo Diocese in 1966; and its consolidation up to 1993.

Evelyn Cheesman (1941, 1949, 1958)

— personal accounts from the author's entomological collecting expeditions, which included visits to Vanimo in 1939-40 and an extended encampment in Krisa in 1940.

Bruce Beehler (1991)

— personal account of the author's experiences from his various ornithological field visits to New Guinea, which included an encampment in the Bewani area, and a subsequent encampment with Krisa people in the early 1980s.

Jacob Simet & Joseph Ketan (1992)

— report from a survey including the Vanimo coast and its hinterland, commissioned in the context of development planning.

Agricultural Systems of PNG Working Papers (no.3)
— West Sepik part of a country-wide database inventorising agricultural systems, including the Vanimo coast (system 1506) and hinterland (system 1511) (cf. Conventions and p.20).

Paul Gorecki et al. (1991)
— report from excavations at two rockshelters on the Vanimo west coast.

Frances Deklin (1979)
— brief academic account of migration histories and memories of trading in bird-of-paradise plumes from a Wanimo community member.

Bryant Allen (1976)
— overview of the origins, recorded history, present day functions and demography of the town, and planning prospects, including a timber mill.

Welsch et al. (1992), **Welsch & Terrell** (1994)
— statistical analysis of historical material culture collections from the New Guinea north coast, including sites at the Vanimo coast, held at the Field Museum of Natural History in Chicago, for their correlation with documented cultural and linguistic diversity.

APPENDIX 5

The location of Krisa village according to Evelyn Cheesman —a geographical puzzle

Almost all of Cheesman's descriptions from Krisa accord superbly with local accounts and other evidence, including her photograph of the village site (plate 'Krissa village', following p.180 in Cheesman 1941). The two exceptions which make her account inconsistent are the geographical location of the village both as described in the text and as shown on her map. Thus, she reports: "I encamped in the village of Krissa... about a mile *to the north-east* of Mount Sawa." (1941:181, my emphasis), an orientation which is supported by her map.

However, Krisa village is located *south* of Mt.Sawa, the distance from the summit being over 4 kilometres, hence considerably more than a mile, which discounts the possibility of a mere typesetting error, anyway unlikely in view of her map. This map, in turn, assigns a location to the mountain she identifies as Sawa which neither matches that of the actual Mt.Sawa, nor indeed of any other mountain, nor could she have reached it within the walking time she reports. She gives its position with 3° South and thus roughly double its actual distance from the coast (the actual position of Sawa being slightly under 2°50', the position of Vanimo roughly 2°40'). Besides, she locates it *beyond* the presumed course of a river she labels as "Neumayer" (a name introduced for the Pual by Otto Finsch and still common on maps) and next to a tributary of this which she labels as "Po", whose course, in turn, accords roughly with that of the Puwani river. Furthermore, her map is grossly out of scale, though only in respect to the presumable location of Krisa and Mt. Sawa. Otherwise, it corresponds well to an earlier, professionally drafted map of the wider region, which was based on data obtained during the German-Dutch border expedition of 1910 (Schultze-Jena 1914). This map concentrates on the border region, only sketching out some mountain formations south of Vanimo, which the expedition must have surveyed from a distance. The region of the southern Krisa hills, though, the Pual basin and the plain up to the Bewani mountains remains white space. On the other hand, the expedition did note a hamlet 'Krissi', located on the northern slopes of the Bewani mountains.

Cheesman seems to have relied on the German-Dutch map as a template for her own, considering how well both maps tally, although she does not acknowledge this source. She does mention another source: "Two white men from Aitape have visited the district, Mr. Carey and Mr. Johnson. They furnished me with a rough sketch-map, which was most useful." (1941:184). This sketch-map may have provided her with the tentative courses of Pual and Pu(wani) rivers (the label PU̇ but denoting 'river' in the local language), while the correspondence of the name 'Krissi' in the German-Dutch map with that of the village she visited may have suggested to her that both places were identical. She may have attempted to reconcile the locations of both and match the tentative courses of the rivers in the region with the streams she herself encountered. In particular, she reports an episode of a difficult stream crossing (1941:181), which likely relates to Wasu Creek, which originates at Mt.Sawa. She may have considered this stream identical with the Pu(wani), resulting in her out-of place location of Mt.Sawa. What remains most puzzling is her insistence that the village was located north-east of the mountain, which contradicts all other evidence, and is out of tune with her otherwise acute and accurate observations.

APPENDIX 6

Selection of ethnographic accounts from the far northwest of Papua New Guinea

(organised geographically, from north to south)

Alfred Gell (1975)
— Waina-Sowanda speakers; Umeda group; Umeda hamlets (near Imonda)

Bernard Juillerat (1972, 1996[1986])
— Eri (Amanab) speakers; Yafar group; Yafar 1/ 2/ 3 villages (near Amanab)

Peter Huber (1977, 1978, 1980, 1990)
— Anggor speakers; Wamu village and 12 other Anggor communities (between Amanab and Green River)

Antje & Heinz Kelm (1980)
— presumably Ak and Awun (Yellow River) speakers (Moseley & Asher 1994: 35); Kwieftim and Abrau villages (where the Torricelli foothills meet the Sepik valley)

Phillip Guddemi (1992)
— Ama (Left-May) speakers; Sawiyanö group; Ama village

Patricia Townsend (1974, 1990)
— Saniyo-Hiyowe speakers/ group; Yareno hamlet (between April and Leonhardt Schultze rivers)

APPENDIX 7

Material culture in the far northwest of Papua New Guinea

Artefactual evidence which partly supports the designation of a region 'far northwest PNG' relates on the one hand to sago technology which has been documented both regionally and further westward; and on the other hand to objects which have been documented between the Vanimo coast and the Bewani mountains.

Choppers (sago pounders), used to flake the pith of the sago palm for starch extraction, follow largely a design shared with regions as far west as the Moluccas and Borneo, which differs from the design used further to the east (Raabe 1990:172f., Swadling 1996:161-163 [both following Crosby 1976]*). The western ('Indonesian') design involves the hafting of a pounding head in a fashion exclusive to the purpose, which entails the lashing together of two separate elements at an acute angle (cf. Case Study 2; Plates 4, 5); the eastern ('Melanesian') design, in contrast, employs the same fashion of hafting as for woodworking tools, by which the head is attached to a single V-shaped handle element. Apparently, the head itself is exclusively a concave bolt with the western design (loc.cit.-fig.32), but optionally either this or an adze-hafted blade with the eastern design.

According to the map reproduced in Swadling (1996:163-fig.33), the geographical boundary between both forms runs diagonally through the island, from west of the Humboldt Bay area in Indonesian West Papua in the north, to east of the Gulf of Papua in the south, with a gap across the central cordillera. According to my own experience and personal communication by Christin Kocher Schmid (2005), though, the northern end of the divide is located east of Vanimo, with choppers in the Vanimo–Kilimeri area following the western design. (A description by Wronska-Friend [1993:169] regarding chopper designs in Sissano, further east, is inconclusive; in the Maprik area, located approximately half-way between the far northwest region and the Sepik river delta, Arapesh choppers are clearly adze-hafted, according to a description by Tuzin [1992:106].)

South of the Vanimo hinterland, designs seem to increasingly tend towards the eastern form with increasing distance from the coast, supporting Pamela Swadling's (op.cit.) suggestion that the western form was introduced into the region through trade contacts. I acquired one chopper, manufactured in Krisa, but by an in-married man from the Imonda area, which is hafted according to the western design, but uses a different pounding blade—not a single bolt as common throughout the western technological zone, but an arrangement of two parallel stone blades in fashion of an adze, thus combining features from both zones. The same design was described by Schultze-Jena (1914:42) from a location some 20 kilometres further east, at the Keerom river across the international border; he contrasted it with the coastal and Sepik forms in terms of the single bolt which these used, but likened it to the form of the Sko people (presumably denoting populations in the Humboldt Bay area) in terms of the hafting employed. In contrast, Gell (1975:14) reports the use of a conical, hollowed stone lashed to a V-shaped handle among Umeda people in the Imonda area.

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* Crosby, E. 1976. Sago in Melanesia. *Archaeology and Physical Anthropology in Oceania* 11:138-155.

This design seems inverse to the former, although it may be so only in regard to the pounding blade; the "V-shaped handle", ostensibly referring to a single piece of wood fashioned from a branching stem, might also denote the lashed construction used further north. Hafting among both the Saniyo-Hiyowe (Ruddle et al. 1978:17-fig.6; Townsend 1974:223-fig.3) and among the Yafar (Juillerat 1986[1996]:157-plt.7) seems to conform to the eastern design.

Chopsticks/ sago forks, items of personal cutlery used in particular for the eating of sago jelly, show a similar distribution as the western chopper design. "Chopsticks" consist of two separate prongs about 20 centimetres long which are tied together at the top and are thus not movable against each other, in contrast to true chopsticks; occasionally each prong runs out in a further double prong (cf. Case Study 2 [p.241ff.]). They occur from the Humboldt Bay area (Swadling 1996:210-fig.46-D,E) to Aitape (Deklin 1979:32, also Wronska-Friend 1993:175). They are still common on the Vanimo coast (cf. Swadling 1996:208) and have traditionally been used in Krisa, but are apparently absent in the Pual basin (pers.comm. Christin Kocher Schmid 2005), which might mark their southern distributional limit in the region. Their design and distribution overlaps with that of sago forks, which are used as far west as the Moluccas (Swadling 1996:206-209,210-fig.46-A-C, who does not explicitly distinguish both forms, but labels them collectively as "tongs and forks"), have been documented for Indonesian West Papua (pers.comm. Kocher Schmid; also Oosterwal 1961:81f.,89f., Swadling 1996:210-fig.46-F), and are used in the Pual basin (pers.comm. Christin Kocher Schmid 2005). They may be more typical for inland areas; their eastern distributional limit lies west of the middle Sepik (pers.comm. Kocher Schmid 2004).

Woven rattan armours (obsolete) and **smoking devices** seem to be at least regionally specific. Rattan armours were used in Krisa in the past; Schultze-Jena (1914:41) reported their occurrence also in the northern Bewani mountains, along the Vanimo coast, and in Sissano; Gell (1975:14) their past use in Umeda.[†] Cylindrical smoking baskets are still used in Krisa and have likewise been reported by Schultze-Jena (op.cit.:37f.) for the northern Bewani mountains (cf. Case Study 2 [p.241ff.]).

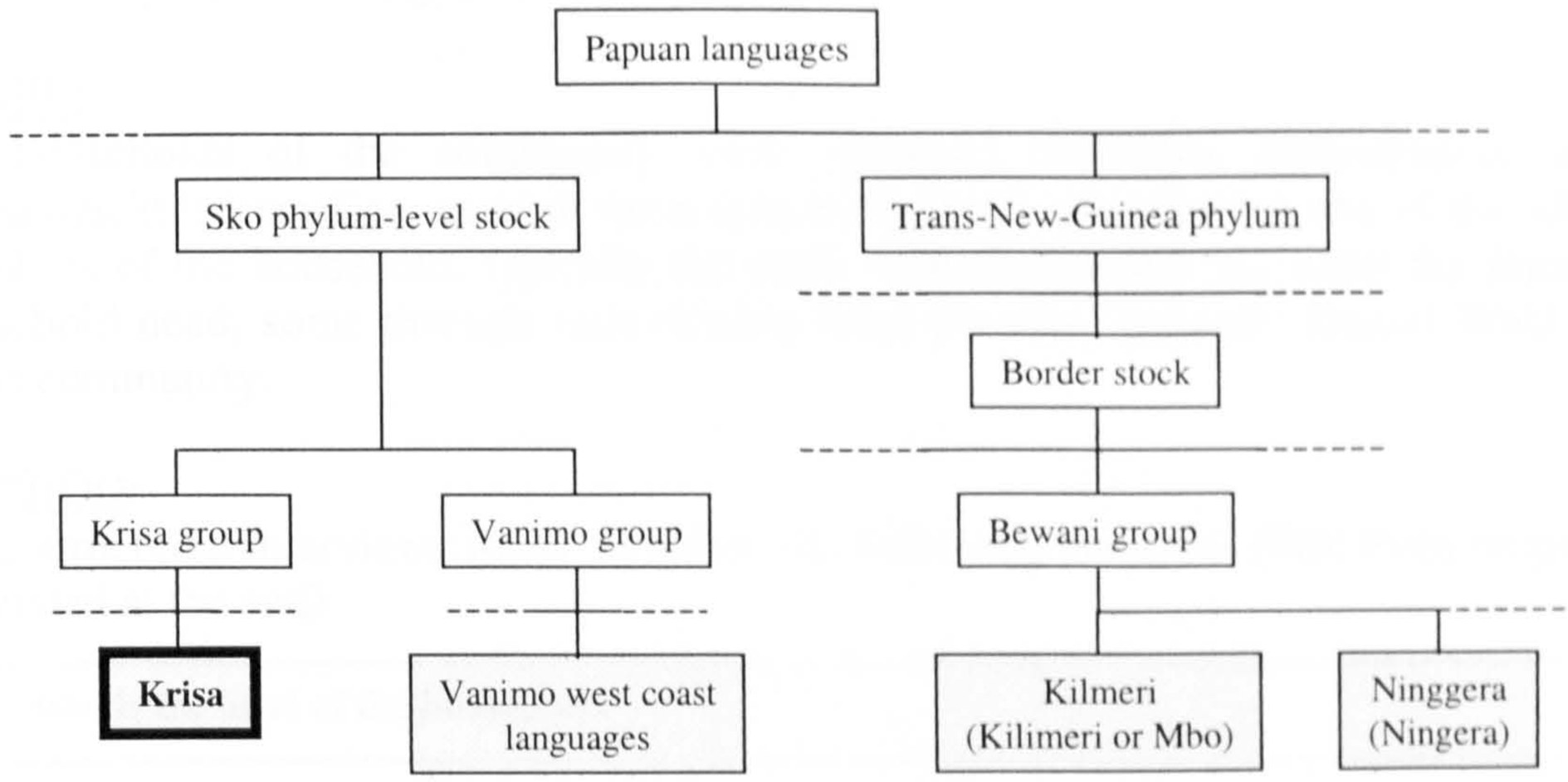
[†] Note, however, that according to Jocelyn Powell (1976:155, referring to Riesenfeld [1946][•]), plaited rattan cuirasses have been recorded also from western parts of New Guinea and south-western parts of PNG.

[•] Riesenfeld, A. 1946. Rattan cuirasses and gourd penis-cases in New Guinea. *Man* 46:31-36.

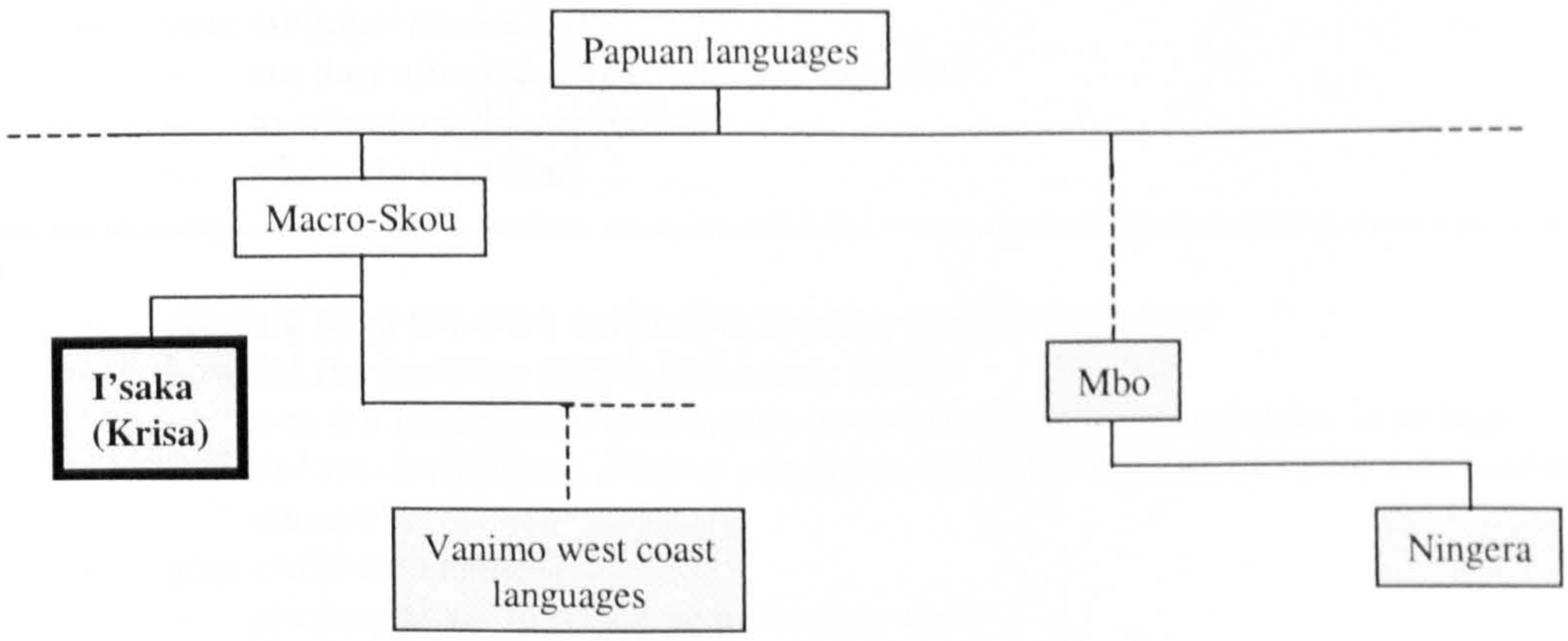
APPENDIX 8

Linguistic groups of the Vanimo coast and its hinterland

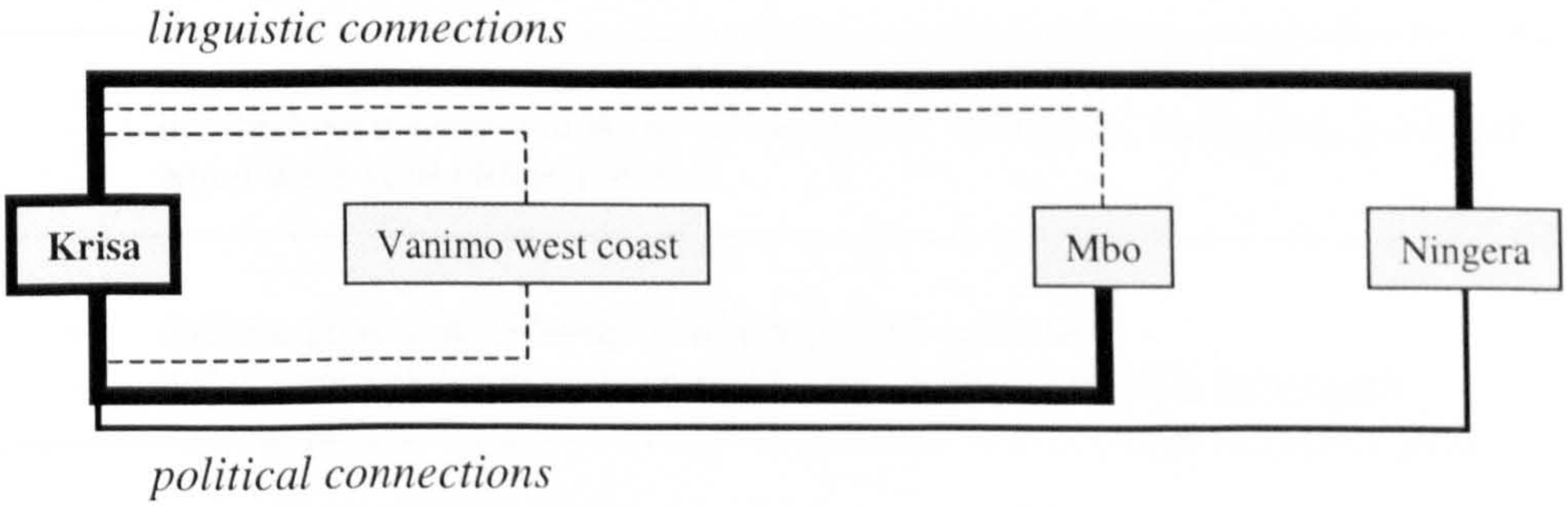
Past linguistic classification (after Moseley & Asher 1994):



Revised linguistic classification (after Donohue & Crowther n.d., Donohue & San Roque 2004, San Roque 2001):



Local classification:



APPENDIX 9

Krisa community census

TIME:
Sporadically between May 1998 and July 1999.

SCOPE:
All households of the community were surveyed regarding demographic and genealogical information, most of them directly through interviewing one of the adult members of the household, typically the male household head/ his wife/ the female household head, some through interviewing third persons, typically Daniel Waki of Krisa community.

METHOD:
Semi-structured interviews which relied on the following checklist (Tok Pisin original appended at the end):

- **who is the head of the household?**

(1)
  - your Christian name/ local name/ clan affiliation?
  - your parents' names—are they alive/ in which year did they die?
  - your ancestors' names?
    - who is knowledgeable about genealogies?
    - who is knowledgeable about legends?
    - who is the leader of this lineage/ clan?
  - your siblings' names?
    - are they alive/ in which year did they die?
    - to whom are they married?
    - where do they live?

(2)
  - are you/ have you been married to another man/ woman, too?
  - how did the marriage of you both come about?
    - *was it a love match? did parents or relatives betroth you—who were they?*
    - *did you exchange a sister or pay for your bride? how much? who received this money?*
  - your children's names?
    - are they alive/ in which year did they die?
    - are they married yet—to whom?
    - where do they live?
  - do you have other children? (*with another man/ woman?—have they died?*)
  - (FOR WOMEN:) how many children have you born altogether? (*are they alive, or have they already died?*)

(3)
  - in which year were you born? [*if exact year not known, indicate age cohort*]
  - when were your children born?

(4)
  - did you go to school?—up to which grade?—where?
  - do/ did your children go to school?—in/ up to which grade?—where?

(5)
  - what is your first/ second/ third language?
  - what is the first/ second/ third language of your children?
  - can you/ your children speak/ understand the local language?

(6)

– what is your religious denomination?

- **this house:**

– in which area does it stand?—the land of which clan is this?
– is there also a toponym for the location itself?/ the camp of…

- [***communal living, commensality, residential & domestic mobility***]

[*residential mobility*]

– previously, did you live elsewhere?—where?
– when you were yet unmarried/ living with your parents, where did you live?

[*domestic mobility and household composition*]

– do you live in this house always, or do you also have another house in the village/ in the forest/ by the roadside/ in town?
  – when/ for how long do you usually stay in this/ these other house(s)?
– the names of everybody who sleeps in this house?
  – do they always sleep here, or only occasionally?—where do they otherwise sleep?
  – are there others who sleep here occasionally? (*for example last year*)

[*commensality*]

– the names of everybody who eats with you? (*are they the same people who sleep here, or others?*)
  – do they always eat with you, or only occasionally?—where do they eat otherwise?
  – who does the cooking?

additional questions which received consideration:

- if clan affiliation/ residence deviate from the norm, what are the reasons?
- if the marriage is considered not proper, what are the reasons?
- do any particular kin relationships warrant further inquiry?
- do household members typically exchange food with other people? with whom?
- does anyone in the house pursue wage labour or cash cropping?

PRINCIPAL RESULTS:

– genealogies, named kin relationships, marriage patterns
– changes in language competence
– patterns of residential and domestic mobility

Tok Pisin original of checklist:

- **husat i save bosim dispela haus?**

(1)
  - kristen nem/ nem ples/ klen
  - nem bilong papa na mama—ol i stap yet/ indai long wanem yia?
  - ol nem bilong ol tumbuna
    - husat i save gut long lain bilong ol papa long taim bipo?
    - husat i save gut long ol tumbuna stori?
    - husat i lida bilong dispela lain/ klen?
  - ol nem bilong ol narapela pikanini bilong mamapapa bilong yu yet?
    - ol i stap yet/ indai long wanem yia?
    - ol i marit wantaim husat?
    - ol i stap we?

(2)
  - yu (bin) marit wantaim narapela man/ meri, tu?
  - yutupela kamap marit olsem wanem?
    - *laik bilong yutupela? mamapapa o rilesen i bin makim—husat?*
    - *yu senisim susa o baim meri? long haumas? husat i bin kisim dispela mani?*
  - ol nem bilong ol pikanini bilong yutupela?
    - ol i stap yet/ indai long wanem yia?
    - ol i marit yet—wantaim husat?
    - ol i stap we?
  - yu gat narapela pikanini? (*long narapela man/ meri?—ol i indai?*)
  - (MERI:) haumaspela pikanini yu bin karim olgeta? (*ol i stap na ol i indai pinis*)

(3)
  - mama i karim yu long wanem yia? [*if exact year not known, indicate age cohort*]
  - ol pikanini bilong yu, mama i bin karim long wanem yia?

(4)
  - yu bin skul?—inap long wanem gred?—we?
  - ol pikanini bilong yu i (bin) skul?—(inap long) wanem gred?—we?

(5)
  - wanem fes/ sekon/ ted tok bilong yu?
  - wanem fes/ sekon/ ted tok bilong pikanini bilong yu?
  - yu/ pikanini bilong yu save toktok long/ harim tok ples?

(6)
  - wanem lotu bilong yu?

- **dispela haus:**
  - i stap long wanem hap graun?—graun em i bilong wanem klen?
  - i gat nem bilong liklik ples, tu?/ kem bilong…

- [***communal living, commensality, residential & domestic mobility***]

[*residential mobility*]
  - pastaim, yu(pela) i bin stap long narapela hap?—we?
  - taim yu no marit yet/ yu bin stap wantaim mamapapa bilong yu, yu bin stap long wanem hap?

[*domestic mobility and household composition*]

- yu(pela) save stap long dispela haus olgeta taim, o yu(pela) gat narapela haus long ples/ bus/ haiwe/ taun, tu?
  - wanem taim/ haumaspela taim yu save stap long (ol) dispela narapela haus?
- ol nem bilong olgeta lain ol i save silip long dispela haus?
  - ol i save silip long hia long olgeta taim o wanwan taim tasol?—narapela taim ol i silip we?
  - i gat narapela lain ol i save silip long hia long wanwan taim tasol? (*olsem las yia*)

[*commensality*]

- nem bilong olgeta lain ol i save kaikai wantaim yu? (*wankain olsem ol lain ol i silip long hia, o narakain?*)
  - ol i save kaikai wantaim yu long olgeta taim, o wanwan taim tasol?—narapela taim ol i kaikai we?
  - husat i save wokim kaikai bilong ol?

APPENDIX 10

Krisa Village consumption and activities survey

TIME:
Over two weeks in October 1998, thus coinciding with the onset of the rainy season.

SCOPE:
All 210 adult members of the 70 households resident in the main village by October 1998 were asked about foodstuffs eaten and activities undertaken during the day, over twice the course of a week.

METHOD:
Questionnaire survey with forms designed with the help of, and administered by Daniel Waki of Krisa community. Forms for the first week are reproduced in the following; forms for the second week were identical but omitted item [1] (Tok Pisin original appended at the end):

[1] What kinds of food do you eat?

	pork	other game	cassowary	beef	tinned fish or meat	sago	TULIP	banana	garden crops	rice
yes										
no										

[2] What did you eat on

	Mon.			Tue.			Wed.			Thur.			Fri.			Sat.			Sun.		
	morning	noon	evening	morning	noon	evening	morning	noon	evening	morning	noon	evening	morning	noon	evening	morning	noon	evening	morning	noon	evening
pork																					
other game																					
cassowary																					
larvae																					
beef																					
chicken																					
tinned fish or meat																					
coconut																					
sago																					
TULIP																					
banana																					
root crops																					
garden crops																					
corn, pumpkin or pitpit																					
rice																					
doughnuts																					
drinking coconut or sugarcane																					
something else - what?																					

[3] Which kind of work did you do on…	Mon	Tue	Wed	Thur	Fri	Sat	Sun
go to the forest							
which area (toponym)?							
with whom did you go?							
⇒ hunting							
⇒ collecting TULIP leaves							
⇒ collecting other food - *which?*							
⇒ collecting firewood							
⇒ collecting materials for making objects							
⇒ collecting something else - *what?*							
⇒ felling trees for house construction							
⇒ felling/ processing LIMBUM palm for house construction							
⇒ other work - *which?*							
go to the sago patch							
which area (toponym)?							
with whom did you go?							
⇒ felling sago palm							
⇒ chopping sago pith							
⇒ washing out sago starch							
⇒ collecting larvae of the sago weevil							
⇒ other work - *which?*							
go to the garden							
which area (toponym)?							
whose garden?							
with whom did you go?							
⇒ clearing undergrowth (plot preparation)							
⇒ felling trees (plot preparation)							
⇒ burning (plot preparation)							
⇒ planting crops - *which ones?*							
⇒ planting food trees - *which ones?*							
⇒ weeding							
⇒ harvesting crops - *which ones?*							
⇒ other work - *which?*							
house construction							
whose house?							
with whom did you work?							
⇒ erecting house posts							
⇒ erecting pillars, putting in beams or rafters, walling in the house, or laying floorboards							
⇒ making thatched shingles							
⇒ lashing thatched shingles onto the roof							
⇒ using sawn timber, planks or corrugated iron sheets							
⇒ demolishing a house							
⇒ other work - *which?*							
making LIMBUM containers							
making something else (such as a sago pounder, bow and arrow, or a fork) - *what?*							
go to the market - *where?*							
⇒ to sell food							
⇒ to buy food							
⇒ for another purpose - *which?*							
go to a tradestore in the village							
go to a tradestore/ supermarket in town							
go somewhere else - *where?*							
rest							
other work - *which?*							

PRINCIPAL RESULTS:

- work and meal schedules
- combination of activities
- co-operation
- meal composition

Under the circumstances (illiteracy of many respondents; ideological bias of respondents which led to false claims regarding foodstuffs eaten; logistical difficulties due to large number of respondents which led to some forms being administered outside the actual survey period), responses have proved only partly reliable. If this precludes detailed quantitative evaluation, responses seem consistent enough for a meaningful impressionistic assessment.

Tok Pisin original of questionnaire form:

[1] Yu save kaikai wanem kain samting?

	pik	narakain abus	muruk	kau	tinpis o tinmit	saksak	tulip	banana	gaden kaikai	rais
yes										
nogat										

[2] Yu bin kaikai wanem kain samting long

	Mande			Tunde			Trinde			Fonde			Fraide			Sarere			Sande		
	moning	belo	apinun	moning	belo	apinun	moning	belo	apinun	moning	belo	apinun	moning	belo	apinun	moning	belo	apinun	moning	belo	apinun
pik																					
narakain abus																					
muruk																					
binatang																					
kau																					
kakaruk																					
tinpis o tinmit																					
drai																					
saksak																					
tulip																					
banana																					
kaukau o taro o yam o mami																					
gaden kumu																					
kon o pamken o pitpit																					
rais																					
flauwa																					
kulau o suga																					
narakain samting - wanem kain?																					

[3] Yu bin wokim wanem kain samting long	Mande	Tunde	Trinde	Fonde	Fraide	Sarere	Sande
go long bus							
wanem nem bilong bus?							
yu bin go wantaim husat?							
⇒ painim abus							
⇒ painim tulip							
⇒ painim narakain kaikai - *wanem kain?*							
⇒ brukim paiawud							
⇒ painim diwai o rop long wokim samting							
⇒ painim narakain samting - *wanem kain?*							
⇒ katim diwai long wokim haus							
⇒ katim o brukim o sapim limbum long wokim haus							
⇒ narakain wok - *wanem kain?*							
go long saksak							
wanem nem bilong bus?							
yu bin go wantaim husat?							
⇒ katim saksak							
⇒ paitim saksak							
⇒ wasim saksak							
⇒ painim binatang							
⇒ narakain wok - *wanem kain?*							
go long gaden							
wanem nem bilong bus?							
gaden bilong husat?							
yu bin go wantaim husat?							
⇒ klinim bus							
⇒ katim diwai							
⇒ kukim gaden							
⇒ planim kaikai - *wanem kain?*							
⇒ planim diwai kaikai - *wanem kain?*							
⇒ klinim gaden							
⇒ kisim kaikai - *wanem kain?*							
⇒ narakain wok - *wanem kain?*							
wokim haus							
haus bilong husat?							
yu bin wok wantaim husat?							
⇒ planim pos							
⇒ planim sut, slipim pilo, putim sapnil, banisim wantaim pangal o putim limbum long floa							
⇒ sumapim morota							
⇒ ropim morota							
⇒ wokim wantaim timba o palang o kapa							
⇒ brukim haus							
⇒ narakain wok - *wanem kain?*							
sumapim limbum							
wokim narapela samting (olsem paiv o spia na banara o fok) - *wanem kain samting?*							
go long maket - *maket we?*							
⇒ long salim kaikai							
⇒ long baim kaikai							
⇒ long mekim narapela samting - *wanem samting?*							
go long stoa long ples							
go long stoa long taun							
go long narapela hap o ples - *we?*							

APPENDIX 11

Krisa Village garden survey

TIME:
Over 2½ weeks in June 1998.

SCOPE:
Of the 90 gardening units identified in the village at the time, adult members from 25 (28 %) were asked about location, size, age and crop composition of their gardens. Of these, 15 gardens were sampled in detail.

METHOD:
The survey method was developed from experiences gained during two previous garden surveys conducted within the scope of the APFT research programme,

- by Rodney Kameata, Felix Niofiarl Topni and Vakaloloma Siuta Sam in the Mbo-speaking communities of Isi 1 and 2 during August 1997, and
- by David Ellis and Felix Topni Niofiarl in the Pawaia-speaking community of Haia (Southern Highlands/ Chimbu/ Gulf Provinces) during May 1998 (subsequently published on the FRP-PNG website as Methods worksheet 2 [Ellis & Topni 1999]),

both based in turn on guidelines developed by Christin Kocher Schmid and Paul Sillitoe.

The Krisa village garden survey was conducted in three successive stages, together with Vakaloloma Siuta Sam, Research Officer at the PNG National Research Institute:

STAGE 1
— overview —

METHOD (2 days):
Extended semi-structured interview with Daniel Waki of Krisa community to obtain baseline information.

PRINCIPAL RESULTS:
- inventory of all 90 gardening units in the main village
- overview of gardening procedures, stages and variables and the respective local concepts.

STAGE 2
— survey of gardening units —

METHOD (3 days):
Semi-structured interviews with members of 25 (28 %) gardening units, selected on basis of their availability and willingness to participate in the survey. Questions asked relied on the following checklist:

- **number of gardens**—for each:
  - where?
    - relative distance (housegarden/ nearby garden/ distant garden)
    - area (toponym)
    - landholding group (name)
  - what size?
    - relative size (large/ medium/ small)
  - what stage—when was it made?
    - relative age (young/ old)
    - various stages of preparation/ harvesting
  - what has (ever) been planted in it?
    - species and landraces
    - already finished/ still being harvested/ not ready yet
  - what else will be planted before the garden will be 'given up'?
  - how about
    - economic trees (and their mode of propagation)
    - other plants/ things useful in the garden (trees not planted, weeds, firewood)

- are there any **new gardening sites** in preparation?
  - where?
  - what stage?

- are **cash crops** grown?

- **during the last 2 weeks**,
  - how often have you (or someone from the same garden-making unit) visited each of these sites?
    - who went?
    - what have they done there?
    - if anything was harvested: what?—how much?—who received it?—sold at the market?

PRINCIPAL RESULTS:
- local concepts applied
- connection between nurtured perennials and gardens
- typical gardening patterns and crop compositions
- inventory of banana landraces.

STAGE 3
— garden sampling —

METHOD (11 days):
Sampling of 15 gardens and semi-structured interview with the respective gardener, selected on basis of gardeners' availability and willingness to participate in the survey and with the view to cover a wide range of variables, regarding aspects such as location and size of gardens and socio-political situation, financial situation, zeal, religious orientation, and family size of gardeners. Questions asked and measurements taken relied on the following checklist:

- **location of garden**

  - physical/ ecological features (slope, sunlight, soil, surrounding vegetation)
  - toponym, land rights, use rights ('big name/ small name', landholding unit, garden-owning unit, planter/ owner/ user of economic trees)

- **decision-making process**

  - who decided about the location?
  - what contributed to the choice of the location and its size (is it considered a small/ medium-size/ large garden)?—are there problems with this location?
  - did anyone (have to) grant permission?

- **history of gardens of this garden-making unit**

  - where was the previous garden, and the one before that? (⇒ swiddening pattern)

- **history of site/ land use**

  - predominant vegetation type before clearing
  - was there ever anything else (a garden?) in this spot before?—when? (estimate according to age of the house, personal history, age of children)

- **history of present garden/ division of labour/ distribution of produce**

  - when was it first prepared (i.e. and has been in use ever since—is it considered a young or an old garden/ (how) is soil fertility maintained)?
  - preparation:
    - which activities—how often—who participated?
  - planting:
    - what—in which sequence—how often—who participated—where did the planting material come from?
    - will anything else be planted?
  - harvesting:
    - what has been harvested yet—who has helped with harvesting so far—who can harvest from this garden—who receives food from this garden?
  - maintenance (weeding, cleaning, further burning, etc.):
    - which activities—how often/ in which sequence—who participated?
  - further uses:
    - firewood—economic trees (propagation, source)—'wild' plants?
  - visits last week:
    - how often—with whom—activities—harvesting: what/ how much/ where did it go to?

- **garden measurements**

- circumference, shape, orientation
- species:
  - planted crops remaining in-situ
  - economic trees (planter, owner, user—propagation/ source)
  - 'wild' plants which are used/ have been deliberately planted
- decision-making process:
  - what are the reasons for the observed planting pattern? (i.e. what conditions do crops need? what accounts for the choice of planting location and sequence?)
  - why have certain crops (not) been planted?

PRINCIPAL RESULTS:
- verification and fine-tuning of results obtained in STAGE 2
- plant management schemes

for each garden sampled:
- sketchmap of location
- sketchmap of garden layout
- inventory of crop plants.

APPENDIX 12

Kilimeri land use survey

TIME:
Over two consecutive weeks in November/ December 1997 among Mbo-speakers; sporadically between December 1997 and July 1998 in Krisa.

SCOPE:
Of the 14 Mbo-speaking communities in the Pual basin, 12 were surveyed by means of a rapid appraisal. Available community members were asked in semi-structured interviews about traditional forest management and attitudes to forests. In Krisa, similar questions were addressed, though within the context of long-term ethnographic research.

METHOD:
The set of survey questions was based on the rural community survey form developed by Colin Filer and Paul Sillitoe at the National Research Institute of PNG for the country study on 'Policy that works for Forests and People', which was addressed at social scientists working in rural areas throughout PNG. For the Kilimeri Land Use Survey, this form was adapted by NRI research assistant Rodney Kameata. The following aspects were addresssed (cf. Kocher Schmid 2000d:19-App.1):

- development indicators
- local classification of forest land
- hunting of wild animals and birds
- harvesting of wild plants and other natural raw materials
- other activities in areas of primary forest
- traditional forest management
- commercial values of the forest
- major land use decisions
- generational differences in attitude and practice
- gender differences in attitude and practice
- concepts of sustainable development
- impact of government policy
- incentives for conservation

This questionnaire was administered in the Mbo-speaking communities by a research team of 10 students from the University of Papua New Guinea, headed by NRI research officers Felix Topni Niofiarl and Vakaloloma Siuta Sam. The team was accompanied by myself, who subsequently administered the questionnaire in Krisa also.

PRINCIPAL RESULTS:
- socio-economic baseline data regarding community services and formal economy
- intra- and inter-community politics
- land use practices
- impact of logging
- attitudes to forest conservation
- ideas about development

APPENDIX 13

Artefact collection

FORMAT OF COLLECTION SHEETS:
(incorporating suggestions by Christin Kocher Schmid [pers.comm.1999])

name of object **purchase price**
(Krisa vernacular – Tok Pisin – English)

(1) owner/ seller

---

(2) producer

---

(3) circumstances/ date of production
(i.e. produced specially for collection or previously used—incl. history of ownership)

---

(4) sketch of object

---

(5) name and source of materials and component parts (with reference to **(4)**)

---

(6) production and use—general information
(e.g. gender differences, typicality for producer, description of use, extent of use: common/ rare, village/ forest, contemporary/ obsolete etc.)

---

(7) cross-references to
- pages in field notes
- photographs
- collection numbers of herbarium specimens

---

collector **date of acquisition** **collection number**
(date of receipt of purchase)

APPENDIX 14

Herbarium collection

FORMAT OF COLLECTION SHEETS:
(incorporating suggestions by Kocher Schmid & Ellis [1999] and Martin [1995])

local name **suggestions for botanical identification**

---

(1) locality of collection
(e.g. toponym, owner of garden)

---

(2) topography, vegetation type

---

(3) appearance of plant
- life-form
- anatomy
- photographic references

---

(4) use

---

(5) part preserved and method of preservation

---

collector **date of collection** **collection number**

APPENDIX 15

Krisa resource use

Source of Information

The following table provides a selection of Krisa resource use in three-dimensional overview, drawing together information from four major data sources (cf. section 4.7., Figure 8b,c [p.179]):

- material culture inventory (>830 entries)—incl.
- artefact collection (630 items; see Appendix 13)
- ethnobotanical inventory (>1,350 entries)—incl.
- herbarium collection (>150 specimens; see Appendix 14).

Despite the resulting wealth of data, the synopsis should be treated as illustrative rather than exhaustive, for three reasons.

Firstly, I introduce a conscious bias towards vegetal resources. This seems justified on the one hand by their substantially greater differentiation and volume in utilitarian terms, and on the other by their more fundamental role in ecological terms.

Secondly, my records are necessarily incomplete, as I had reached the point of diminishing returns only with some of the more important and frequently used plants by the time I concluded field research. Some entries therefore represent a collation of several similar records; others rely on only one or two references; many plants and some uses I may not have recorded at all. It is likely that of the major life forms represented in the table further representatives are recognised for all but the pandans.

Thirdly, the synopsis constitutes a further selection from my incomplete records. Thus, I recorded information, typically with description and use, on overall 237 plant taxa belonging to the major life forms represented in the table. These already exclude garden annuals (see Table 24), exotic fruit trees introduced within the last century (cf. p.303) for uses other than wood, and individual forms distinguished for sago, banana and yams (see Tables 14-16); also numerous grasses, herbs, epiphytes and lycopodiums. Of them, I selected as the most relevant and/ or typical for local subsistence:

life-form	taxa recorded	taxa selected	percentage
tree palms	20	18	90 %
rattans	13	10	77 %
pandans	4	2	50 %
large monocotyledon herbs	17	12	71 %
grasses	11	8	73 %
(of these bamboos:	7	4	57 %)
trees	140	55	39 %
shrubs, large herbs	7	7	100 %
vines	19	16	84 %
ferns	6	6	100 %
TOTAL	237	134	57 %

In particular, I have left out plants and uses which are of minor importance, and uses for which a related entry exists already in the table. Also, I have left out plants used as lures for game or as hides for ambush, besides the large group known as food plants for game animals—under "indirect food uses" I include only plants recognised as substrate for mushrooms or insect larvae.

Mode of Presentation

The three dimensions of the diagram are:

1. columns,
   which differentiate uses relevant and/ or typical for Krisa subsistence, grouped according to classes which respect both the different types of needs (food, shelter, etc.) and the structure of artefacts (body, handle, lashing, etc.).*
2. rows,
   which differentiate plant resources by their vernacular names (identifications see below), grouped by life form to indicate plant habit and structure. Entries are numbered for ease of reference. Animal and mineral resources and modern substitutes are indicated generically in the last rows, as are uses which have become obsolete within the last decades.
3. cells,
   which differentiate plant part used and the resource's relative significance, with the following designations:

symbol	denoting plant part	including
S	stem	bole, climbing stem, culm, wood, cortex, pith, branches, stilt roots, inner/ outer bark
Sh	shoot	
L	leaf	leaf, pinna, midrib of pinna, frond
Lp	leaf petiole, rachis	stalk, skin, pith
Ls	leaf sheath, spathe	upper/ lower portions

—ctd.

* Some details cannot be accommodated in the table, but are indicated there with an asterisk* and listed here:

mesh: as filter for washing sago; also in hand-held strainers for preparing sago jelly and coconut milk (cf. Case Study 2 [p.241ff.])
arrow blade: for large game and in warfare (cf. Case Study 4 [p.246])
chopsticks: (design and use see Case Study 2 [p.241ff.])
sago servers: — " —
sago paddle/ stirrer: — " —
container: includes dishes, bowls, basins, buckets, tubs and the bag element of carrying bags (cf. Case Study 3 [p.245])
axe-/ knife handle: other tool handles see under beams, pillars, rafters
threads: various qualities required for sewing thatch; for sewing containers; for tying arrowtips to the shaft (needs to be fastened with glue); for delicate tying and interlacework; for robust binding and lashing; for temporary binding of firewood (cf. Case Study 5 [p.247])

R	reproductive organ (incl. sterile fruit/ parts of fruits)	flower, inflorescence, seed, fruit, infructescence shell, husk
U	underground parts	roots, tubers, rhizomes
X	sap, latex	
x	whole plant/ item	
*	principal/ paradigmatic/ sole resource for the purpose	
( )	substitute/ less suitable resource for the purpose	

The Question of Scientific Identification

As I have set out in section 4.7. (pp.182ff., esp. Case Study 1 [p.184ff.]), scientific identifications require a large amount of data, great care and substantial expertise to be reasonably reliable, and consequently become an extravagant exercise in the context of limited means. I have therefore focused on the collection of other data, which have proven more relevant for this study. The identifications which I provide on the last two pages of the following table are therefore tentative, partial and biased towards common resources. I offer them in the interest of orienting the reader rather than making any authoritative botanical statements. I rely on the following sources: French (1986); Johns & Hay (1984); Kocher Schmid (1999); Bob Johns and David Floyd of the Herbarium at Kew Botanic Gardens (pers.comm. 1999—preliminary identification of herbarium specimens); and Naomi Rumball of the Economic Botany Collection at Kew Botanic Gardens (pers.comm. 2000—preliminary identification of artefact components).

		food & drink			**sago processing** (s. also containers)					**hunting & fishing**							**food storage, preparation & eating** (s. also containers)										
		food	drink	indirect food uses	sago pounder (shaft)	gutter	filter*	plank (to fit filter)	pegs	bailer	fishing poison	bow	bowstring	arrow shaft	arrow blade*	arrow tip	chopsticks*	sago servers*	ladle - handle	ladle - scoop	spoon	fork	sago paddle/ stirrer*	coconut scraper	tongs	skewer	food wrappers
	TREE PALMS																										
1	SU	S*,Sh		S, S		Ls*		S*		Ls*													S	S			
2	SONG	R,Sh	R				Ls													R*	R					L	
3	PU																										
4	ASI																	S									
5	ANASI			S											S	S	S							S			
6	KISSI																							S			
7	YIY											S*				S	S										
8	PASSAPO											S				S	S										
9	PASSA											(S)					S										
10	MESME											S		S			S	S									
11	PAXAU															S*	S										
12	SISEI															S	S					S					
13	AOA															S	S	S									L
14	KOLOU	Sh																S									
15	SABLEI	Sh																									
16	TEBE	Sh																									
17	WELE	Sh*																									
18	SUBU			S																							
	RATTANS																										
19	BOXORU	R,Sh	S	S	S																						L
20	YAXANU BOXORU												S														
21	YEYKI												S*														
22	KASUEYA												S														
23	SUKENA												S														
24	WAIAU												S														
25	WOUBRO						Ls						S														
26	WASLAM																										
27	WUU																										
28	WASAPO	Sh		S																							
	PANDANS																										
29	SAU, ~ ASMAK	R																									
30	SUBOU																										
	LARGE MONOCOT. HERBS																										
31	WI	R																									L
32	ABUSI																										L
33	BOGOSI																										L
34	TUBAPLU																										L
35	WOUBEL	R																									L
36	WO	R																									
37	SULUP																										
38	WI KEI																										
39	YAPUP																										
40	PUIWAI																										
41	PUIDEI																										
42	SIBEI																										
	GRASSES																										
43	YAXAU				S										S		S	S							S*		
44	WANI													S	S												
45	TONI																(S)	S									
46	KAR																										L
47	BOU													S*													
48	NOU	S	S																								
49	PUIWAR	R																									
50	SAY																										
	TREES																										
51	WISIA	L*																									
52	YOGWAL	L																									
53	WAKANA	L																									
54	WASI	L,R																									
55	DEI	R																									
56	NUPO	R																									
57	TINIA	R																									
58	SAUWE (several kinds)	R																									
59	PANI	R																									
60	ILO	R																									
61	WOMO	R																									
62	IL	R																									
63	TIA																										
64	PUDUBEU			S																							
65	WESENG			S																							
66	WINI			S																							
67	WOMO			S																							L
68	SE																										L
69	SUU																										L
70	TUBOPO																										L
71	APAP			L																							
72	KAPLA			L																							
73	SAPU			L																							
74	SALAU			L																							

		food & drink			sago processing (s. also containers)					hunting & fishing							food storage, preparation & eating (s. also containers)											
		food	drink	indirect food uses	sago pounder (shaft)	gutter	mesh*	plank (to fit strainer)	pegs	bailer	fishing poison	bow	bowstring	arrow shaft	arrow blade*	arrow tip	chopsticks*	sago servers*	ladle - handle	ladle - scoop	spoon	fork	sago paddle/ stirrer*	coconut scraper	tongs	skewer	food wrappers
75	AXAUTANO								S*		S																	
76	YOPNO				S														S				S					
77	PUDUTOMO																				S		S					
78	SIL	R																				S	S					
79	AMO																	S	S			S	S					
80	KISI																						S					
81	DISSA																											
82	TOR																		S									
83	other hardwoods, esp. guava, coffee				S													S	S									
84	TIDA																											
85	TOROU																											
86	YAXALU																											
87	TEBLEI																S	S										
88	NISENG																											
89	PASI																											
90	WOUS																											
91	SULUP																											
92	SUWE																											
93	DIBE																											
94	BUSUI																											
95	WAL, several kinds																											
96	KASKAI																											
97	PA																											
98	SELI																											
99	PUDUTRE																											
100	TAPNI																											
101	DABUAI																											
102	PIN																											
103	YAU																											
104	WIUS																											
105	numerous other trees																				S	S						
	SHRUBS, LARGE HERBS																											
106	SOXAI																											
107	WASI	L																										
108	DISSA																											
109	PINA																											
110	YUWA																											
111	UWEL																											
112	DIPOB																											
	VINES																											
113	KUP (several kinds)	U																										
114	PE																											
115	POL																											
116	UBEI										U																	
117	UWAI	R																										
118	SONGBEI	R																										
119	AXANI/ ANIDAXA		S																									
120	BEIPIR			S																								
121	WASKO																											
122	APLO																											
123	UPLI																											
124	WOUPA																											
125	WAIAU																											
126	UR																											
127	APNU NAXAU																											
128	PAIAXAU																											
	FERNS																											
129	KUKA																											
130	WA	L, Sh																										
131	WA PUPUNAS	L, Sh																										
132	NAXA	L, Sh																										
133	NEP	L, Sh																										
134	ULARU	Sh																										
	NON-VEGETAL RESOURCES																											
135	animal parts	x																			x				x			
136	minerals																											
	MODERN SUBSTITUTES																											
137	glass																											
138	fishing line & string																											
139	rice- & flour bags																											
140	fabric						x																					
141	metal & flywire				x		x								x	x												
142	rubber																											
143	commercial ware	x					x																					
144	USE OBSOLETE									(x)							(x)				x	x			x	x		

			firewood		shelter & dwelling										carrying aids & containers					tools & implements											weapons	
			firewood	firemaking equipment	house posts	beams, pillars, rafters	roof batons	thatch	floorboards	walling	shelving	roof & wall frames	mat	blanket (bark cloth)	baby carrying sling	carrying bag - strap	waterproof container	baking & water tube	fireproof container	digging stick	butchering knife	tool knife	razor	polishing implement	axe-/ knife handle*	spade, shovel	awl	broom	comb	spear (warfare)	club
	TREE PALMS																														
1	SU						Lp	L*		Lp	Lp		Ls													S					
2	SONG			+ R																								(L)			
3	PU						S																								
4	ASI								S*	S			Ls				Ls*											R			
5	ANASI																								S	S				S	S
6	KISSI								(S)																	S					
7	YIY																														
8	PASSAPO																														
9	PASSA							(L)																							
10	MESME																														
11	PAXAU						S																								
12	SISEI																														
13	AOA																														
14	KOLOU								(S)								(Ls)														
15	SABLEI								(S)																						
16	TEBE								(S)																						
17	WELE																											L			
18	SUBU																														
	RATTANS																														
19	BOXORU			S*								S																			
20	YAXANU BOXORU																														
21	YEYKI			S																											
22	KASUEYA																														
23	SUKENA																														
24	WAIAU																														
25	WOUBRO																														
26	WASLAM																														
27	WUU																														
28	WASAPO																														
	PANDANS																														
29	SAU, ~ ASMAK																														
30	SUBOU						S*				S																				
	LARGE MONOCOT. HERBS																														
31	WI																														
32	ABUSI																														
33	BOGOSI																														
34	TUBAPLU																														
35	WOUBEL																														
36	WO																														
37	SULUP																														
38	WI KEI																														
39	YAPUP																														
40	PUIWAI																														
41	PUIDEI																														
42	SIBEI																														
	GRASSES																														
43	YAXAU																	S			S										
44	WANI						S															S	S								
45	TONI						S																						S*		
46	KAR																														
47	BOU																														
48	NOU																														
49	PUIWAR																														
50	SAY																														
	TREES																														
51	WISIA					S								S	S	S															
52	YOGWAL																														
53	WAKANA																														
54	WASI																														
55	DEI													S																	
56	NUPO													S																	
57	TINIA		S			S																									
58	SAUWE (several kinds)																														
59	PANI																														
60	ILO																														
61	WOMO																														
62	IL																														
63	TIA													S	S	S															
64	PUDUBEU													S	S																
65	WESENG		S			S																									
66	WINI																														
67	WOMO																														
68	SE																														
69	SUU					S																									
70	TUBOPO																														
71	APAP																														
72	KAPLA																														
73	SAPU																														
74	SALAU																														

			firewood		shelter & dwelling										carrying aids & containers					tools & implements										weapons	
			firewood	firemaking equipment	house posts	beams, pillars, rafters	roof batons	thatch	floorboards	walling	shelving	roof & wall frames	mat	blanket (bark cloth)	baby carrying sling	carrying bag - strap	waterproof container	baking & water tube	fireproof container	digging stick	butchering knife	tool knife	razor	polishing implement	axe-/ knife handle*	spade, shovel	awl	broom	comb	spear (warfare)	club
75	AXAUTANO																			S*											
76	YOPNO				S*																								S		
77	PUDUTOMO		S		S																				S				S*		
78	SIL				S																				S						
79	AMO																												S		
80	KISI		S			S																							S		
81	DISSA																												S		
82	TOR																														
83	other hardwoods, esp. guava, coffee																														
84	TIDA																								S						
85	TOROU																														
86	YAXALU															S*															
87	TEBLEI					S										S															
88	NISENG																														
89	PASI																														
90	WOUS																														
91	SULUP					S																									
92	SUWE			+ S		S																									
93	DIBE																														
94	BUSUI																														
95	WAL, several kinds																														
96	KASKAI					S																									
97	PA																														
98	SELI																														
99	PUDUTRE		S																												
100	TAPNI					S																									
101	DABUAI																														
102	PIN																														
103	YAU																														
104	WIUS																														
105	numerous other trees		S			S																									
	SHRUBS, LARGE HERBS																														
106	SOXAI																														
107	WASI																														
108	DISSA																														
109	PINA																														
110	YUWA																														
111	UWEL																														
112	DIPOB																														
	VINES																														
113	KUP (several kinds)																														
114	PE																														
115	POL																														
116	UBEI																														
117	UWAI																														
118	SONGBEI																														
119	AXANI/ ANIDAXA																														
120	BEIPIR																														
121	WASKO																														
122	APLO																														
123	UPLI																														
124	WOUPA																														
125	WAIAU																														
126	UR																														
127	APNU NAXAU																														
128	PAIAXAU																														
	FERNS																														
129	KUKA																														
130	WA																														
131	WA PUPUNAS																														
132	NAXA																														
133	NEP																														
134	ULARU																														
	NON-VEGETAL RESOURCES																														
135	animal parts																							x*		x*					
136	minerals																		x												
	MODERN SUBSTITUTES																														
137	glass																							x							
138	fishing line & string																														
139	rice- & flour bags																x														
140	fabric														x																
141	metal & flywire																														
142	rubber																														
143	commercial ware			x									x	x			x		x		x	x	x			x			x		
144	USE OBSOLETE																													x	x

			weap-ons		rope, thread, fibre								attire		marker, medicine & related							instruments				body adornment			colour
			whip	dagger	object frames	thread for thatch*	thread for containers*	thread for arrowtips*	thread (delicate)*	thread (robust)*	thread (temporary)*	string	fibre skirt	penis gourd	boundary marker	taboo sign	dog hunting magic	medicine	narcotic, stimulant	aromatic	decorative	hand drum body	hand drum membrane	signalling horn	flutes & Jew's harps	leaves	beads	other	paint, varnish, dye
	TREE PALMS																												
1	SU					Lp							L*														R		
2	SONG																					S							
3	PU																		R*										
4	ASI																												
5	ANASI																										R		
6	KISSI																									R			
7	YIY																												
8	PASSAPO																												
9	PASSA																												
10	MESME																												
11	PAXAU																												
12	SISEI																												
13	AOA																												
14	KOLOU																												
15	SABLEI																												
16	TEBE																		(R)										
17	WELE						Lp	Lp																					
18	SUBU																												
	RATTANS																												
19	BOXORU		S		S		(S)		S	S																			
20	YAXANU BOXORU					S	S			S																			
21	YEYKI								S	S																			
22	KASUEYA																												
23	SUKENA																												
24	WAIAU					S	S*		(S)	S																			
25	WOUBRO						S		S	S																			
26	WASLAM								S	S																			
27	WUU							S	S																				
28	WASAPO																												
	PANDANS																												
29	SAU, ~ ASMAK																												
30	SUBOU											L																	
	LARGE MONOCOT. HERBS																												
31	WI																												X
32	ABUSI																												
33	BOGOSI																												
34	TUBAPLU																												
35	WOUBEL														L														
36	WO														L														
37	SULUP					S	S	S																					
38	WI KEI																L												
39	YAPUP																R												
40	PUIWAI																U												U
41	PUIDEI																U												
42	SIBEI															U													
	GRASSES																												
43	YAXAU																				S								
44	WANI																				S								
45	TONI																												
46	KAR																												
47	BOU																												
48	NOU																												
49	PUIWAR																												
50	SAY																										R*		
	TREES																												
51	WISIA											S																	
52	YOGWAL																												
53	WAKANA																												
54	WASI																												
55	DEI							+ X																					
56	NUPO							+ X																					
57	TINIA																												
58	SAUWE (several kinds)																												
59	PANI																						S						
60	ILO																												
61	WOMO																												
62	IL																												
63	TIA																												
64	PUDUBEU																												
65	WESENG																												
66	WINI																												
67	WOMO																												
68	SE																												
69	SUU																												
70	TUBOPO																												
71	APAP																												
72	KAPLA																												
73	SAPU																												
74	SALAU																												S

			weap-ons		rope, thread, fibre								attire		marker, medicine & related							instruments				body adornment			colour
			whip	dagger	object frames	thread for thatch*	thread for containers*	thread for arrowtips*	thread (delicate)*	thread (robust)*	thread (temporary)*	string	fibre skirt	penis gourd	boundary marker	taboo sign	dog hunting magic	medicine	narcotic, stimulant	aromatic	decorative	hand drum body	hand drum membrane	signalling horn	flutes & Jew's harps	leaves	beads	other	paint, varnish, dye
75	AXAUTANO																											
76	YOPNO																											
77	PUDUTOMO																											
78	SIL																											
79	AMO																											
80	KISI																											
81	DISSA																											
82	TOR																											
83	other hardwoods, esp. guava, coffee																											
84	TIDA																				S							
85	TOROU																				S		S					S
86	YAXALU												S															
87	TEBLEI												S															
88	NISENG											S	S															
89	PASI											S	S															R
90	WOUS												S															
91	SULUP																											
92	SUWE																											
93	DIBE																S											
94	BUSUI															S	S											
95	WAL, several kinds																R											
96	KASKAI																L											
97	PA																L											
98	SELI																L/X?											
99	PUDUTRE																X											
100	TAPNI																X											X
101	DABUAI																											X
102	PIN																									R		R
103	YAU																											R
104	WIUS																											R
105	numerous other trees																											
	SHRUBS, LARGE HERBS																											
106	SOXAI																	L										
107	WASI																											
108	DISSA																		R									
109	PINA																								L			
110	YUWA												Sh		x	L				x					L			
111	UWEL																			x					L			
112	DIPOB																			x								
	VINES																											
113	KUP (several kinds)																											
114	PE													R														
115	POL																		R									
116	UBEI																											
117	UWAI																											
118	SONGBEI																											
119	AXANI/ ANIDAXA																X											
120	BEIPIR																X											
121	WASKO																X											
122	APLO																X											
123	UPLI																Sh											
124	WOUPA																Sh											
125	WAIAU																S											
126	UR																									R		
127	APNU NAXAU										S																	
128	PAIAXAU							S*	S	(S)																		
	FERNS																											
129	KUKA							S	S*																			
130	WA																											
131	WA PUPUNAS																											
132	NAXA																											
133	NEP																											
134	ULARU																											
	NON-VEGETAL RESOURCES																											
135	animal parts			x*																		x*				x		
136	minerals																											x
	MODERN SUBSTITUTES																											
137	glass																											
138	fishing line & string								x																			
139	rice- & flour bags								x				x															
140	fabric																											
141	metal & flywire																											
142	rubber							x	x	x																		
143	commercial ware											x							x									x
144	USE OBSOLETE		x										x	x							x	x	x					

	VERNACULAR NAME	Tok Pisin name or class (local designation)	*scientific name*
	TREE PALMS		
1	SU	SAKSAK	*Metroxylon sagu*
2	SONG	KOKONAS	*Cocos nucifera*
3	PU	BUAI	*Areca catechu*
4	ASI	LIMBUM	*?Gulubia costata*
5	ANASI	WAIL LIMBUM	*Caryota rumphiana* var. *papuana*
6	KISSI	WAIL LIMBUM	
7	YIY	WAIL LIMBUM	
8	PASSAPO	WAIL LIMBUM	
9	PASSA	WAIL LIMBUM	*Licuala* sp.
10	MESME	WAIL LIMBUM	
11	PAXAU	WAIL LIMBUM/ BUAI	
12	SISEI	WAIL LIMBUM	
13	AOA	WAIL KOKONAS	
14	KOLOU	WAIL LIMBUM	
15	SABLEI	WAIL LIMBUM	
16	TEBE	WAIL LIMBUM/ BUAI	
17	WELE	WAIL BENSIN	
18	SUBU	WAIL SAKSAK	
	RATTANS		
19	BOXORU	KANDA	*Calamus* sp.
20	YAXANU BOXORU	KANDA	*Calamus* sp.
21	YEYKI	KANDA	*Calamus* sp.
22	KASUEYA	KANDA	*?Calamus* sp.
23	SUKENA	KANDA	*?Calamus* sp.
24	WAIAU	KANDA	*?Calamus* sp.
25	WOUBRO	KANDA	*?Calamus* sp.
26	WASLAM	KANDA	*?Calamus* sp.
27	WUU	KANDA	*?Calamus* sp.
28	WASAPO	KANDA	*?Calamus* sp.
	PANDANS		
29	SAU ASMAK (when planted: SAU)	ARAN	*Pandanus conoideus*
30	SUBOU	WAIL ARAN	*Pandanus* sp.
	LARGE MONOCOT. HERBS		
31	WI	BANANA	*Musa* sp.
32	ABUSI		*Phrynium* sp.
33	BOGOSI		(Zingiberaceae)
34	TUBAPLU	KORKOR	*Curculigo* sp.
35	WOUBEL	KORKOR	(Zingiberaceae)
36	WO	KORKOR	*?Alpinia* sp., also *Tapermochilus* sp.
37	SULUP	KORKOR	*?Donax* sp.
38	WI KEI	WAIL BANANA	*Musa* sp.
39	YAPUP	(KAUAR)	*Alpinia* sp.
40	PUIWAI	KAUAR	*?Zingiber* sp.
41	PUIDEI	KAUAR	*?Zingiber* sp.
42	SIBEI	KAUAR	*?Zingiber* sp.
	GRASSES		
43	YAXAU	MAMBU	
44	WANI	MAMBU	
45	TONI	MAMBU	
46	KAR	MAMBU	
47	BOU	TIKTIK	*Miscanthus* sp.
48	NOU	SUGA	*Saccharum officinarum*
49	PUIWAR	PITPIT	*Saccharum edule*
50	SAY	WAIL RAIS	*Coix lachryma-jobi*
	TREES		
51	WISIA	TULIP	*Gnetum gnemon*
52	YOGWAL	PALPAL, BALBAL	*Erythrina variegata*
53	WAKANA		(Leguminosae)
54	WASI	KUMU MOSONG	*Ficus copiosa*
55	DEI	KAPIAK (KAIKAI MIT)	*Artocarpus altilis*
56	NUPO	KAPIAK (KAIKAI SIDS)	*Artocarpus altilis*
57	TINIA	TON	*Pometia pinnata*
58	SAUWE (several kinds)	MANGO	*Mangifera* sp.
59	PANI	(WAIL) LAULAU	*?Syzygium* sp.
60	ILO		
61	WOMO		
62	IL	GALIP, TALIS	*?Canarium/ Terminalia* sp.
63	TIA	MAL	*?Ficus/ Broussonetia* sp.
64	PUDUBEU	MAL	*?Ficus* sp.
65	WESENG		
66	WINI	DIWAI DALINGA	
67	WOMO		
68	SE		
69	SUU		
70	TUBOPO		
71	APAP		
72	KAPLA		
73	SAPU	SOP DIWAI	
74	SALAU		

	VERNACULAR NAME	TOK PISIN name or class (local designation)	*scientific name*
75	AXAUTANO		
76	YOPNO (2 kinds)	KWILA	*Intsia bijuga*
77	PUDUTOMO		
78	SIL		
79	AMO		
80	KISI	KOMORERE	
81	DISSA		
82	TOR		
83	other hardwoods, esp. guava, coffee		*(Psidium guajava, Coffea* sp.*)*
84	TIDA		
85	TOROU	NAR	*Pterocarpus indicus*
86	YAXALU	MAKAS	*?Hibiscus tiliaceus*
87	TEBLEI	MAKAS	
88	NISENG	MAKAS, DIWAI SALAT	
89	PASI	MAKAS	
90	WOUS	MAKAS	
91	SULUP	MAKAS	
92	SUWE (several kinds)	MAKAS	*Macaranga* sp., *Melanopsis multiglandulosa* and others
93	DIBE (2 kinds)		
94	BUSUI		*Santalum* sp.
95	WAL, several kinds		*Myristica* sp.
96	KASKAI		
97	PA		
98	SELI		*Cassia alata*
99	PUDUTRE		*Ficus* sp.
100	TAPNI	AIDIN	
101	DABUAI		
102	PIN		
103	YAU		*Bixa orelleana*
104	WIUS		
105	numerous other trees		
	SHRUBS, LARGE HERBS		
106	SOXAI	SMUK BRUS	*Nicotiana tabacum*
107	WASI	AIBIKA	*Hibiscus manihot*
108	DISSA	LOMBO	*?Capsicum frutescens*
109	PINA		*Euodia* sp.
110	YUWA	TANGET	*Cordyline terminalis*
111	UWEL		
112	DIPOB		*Hibiscus rosa-sinensis*
	VINES		
113	KUP (several kinds)	WAIL YAM	*Dioscorea* sp.
114	PE	SEL KAMBANG	*Lagenaria siceraria*
115	POL	DAKA	*Piper betle*
116	UBEI	ROP	
117	UWAI	ROP	
118	SONGBEI	ROP	
119	AXANI/ ANIDAXA	ROP	
120	BEIPIR	ROP	
121	WASKO	ROP	
122	APLO	ROP	
123	UPLI	ROP	
124	WOUPA	ROP	
125	WAIAU	ROP	
126	UR	ROP	
127	APNU NAXAU	ROP	
128	PAIAXAU	ROP	
	FERNS		
129	KUKA	ROP	*Lygodium* sp.
130	WA	KUMUGRAS	*Stenochlaena* sp.
131	WA PUPUNAS	KUMUGRAS	
132	NAXA	KUMUGRAS	
133	NEP	KUMUGRAS	
134	ULARU	KUMUGRAS	

APPENDIX 16

Krisa resource significance

The following table tentatively ranks the resources listed in Appendix 15, following largely the format described in section 4.7. (esp. Figure 8d-f [p.180]). I proceed in three stages:

1. I rate uses according to their significance for livelihoods. For this, I assign values from 1-5, with

   5: vital
   4: very important
   3: important
   2: convenient
   1: accessory.

I purposely assume a pre-modernity perspective, including obsolete uses with their likely past significance, to obtain an overview of resource use in a traditional subsistence context. This valuation exercise yields:

value	use	**use category**
5	food	**food & drink**
5	drink	
3	indirect food uses	
4	sago chopper (shaft)	**sago processing**
3	gutter	
4	filter	
2	plank (to fit filter)	
3	pegs	
2	bailer	**hunting & fishing**
2	fishing poison	
4	bow	
4	bowstring	
4	arrow shaft	
4	arrow blade	
4	arrow tip	
2	chopsticks	**food storage, preparation & eating**
2	sago servers	
2	ladle - handle	
2	ladle - scoop	
2	spoon	
2	fork	
2	sago paddle/ stirrer	
3	coconut scraper	
3	tongs	
2	skewer	
2	food wrappers	
4	firewood	**firewood**
4	firemaking equipment	

—ctd.

3	house posts	**shelter & dwelling**
3	beams, pillars, rafters	
3	roof batons	
4	thatch	
3	floorboards	
3	walling	
2	shelving	
3	roof & wall frames	
2	mat	
3	blanket (bark cloth)	
3	carrying sling for babies	**carrying aids & containers**
3	carrying bag - strap	
4	container	
2	cooking- & water tube	
2	fireproof container	
4	digging stick	**tools & implements**
4	butchering knife	
4	tool knife	
3	razor	
2	polishing implement	
4	axe-/ knife handle	
2	spade, shovel	
3	awl	
3	broom	
3	comb	
2	spear (warfare)	**weapons**
2	club	
2	whip	
2	dagger	
3	object frames	**rope, thread, fibre**
3	thread for thatch	
3	thread for containers	
4	thread for arrowtips	
2	thread (delicate)	
3	thread (robust)	
2	thread (temporary)	
3	string	
2	fibre skirt	**attire**
2	penis gourd	
3	boundary marker	**marker, medicine & related**
2	taboo sign	
2	dog hunting magic	
3	medicine	
3	narcotic, stimulant	
1	aromatic	
1	decorative	
3	hand drum body	**instruments**
3	hand drum membrane	
2	signalling horn	
2	flutes & Jew's harps	
1	leaves	**body adornment**
1	beads	
1	other	
1	paint, varnish, dye	**colour**

2. I rate <u>resources</u> according to their significance for the respective use. For this, I transcribe the rating of relative significance, contained in the cells of Appendix 15, into values from 1-3, thus:

   3 = *
   2 = no specification
   1 = ( ).

3. To rate overall significance of resources, I then multiply each value obtained in step 2 with the respective value from step 1 (columns 1-16); add the results (column 'sum'); and multiply them with the number of uses (column 'times').

4. To enhance the quantitative element of the valuation, I perform a further step, accounting for the volume and cultural salience of resources. Ideally, this would be contained within the original rating of significance for single uses (step 2), but is in this form beyond the scope of the present study. I therefore perform a surrogate operation, rating significance for uses overall, by multiplying the subtotals received in step 3 with a factor 1, 10, or 100, with

   100: salience/ use volume high
   10: salience/ use volume medium
   1: salience/ use volume low.

Since data are inevitably incomplete (cf. notes to Appendix 15), the resulting figures can merely serve as guidelines. In particular, it is likely that for many resources not all possible uses have been recorded, thus lowering their valuation against comparable, but more completely assessed resources. Besides, any valuation will suffer from the dilemmas described in section 4.7. Nevertheless, the overall image derived from above calculations tallies well with my impressions and appears a reasonably accurate rendition of Krisa resource significance.

	use no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	sum	times	SUBTOTAL	factor	TOTAL
	TREE PALMS																					
1	SU	25	12	9	6	6	4	6	6	12	6	4	4	4	6	6	2	118	16	1,888	100	188,800
2	SONG	20	10	8	6	4	4	8	3	6								69	9	621	100	62,100
3	PU	6	9															15	2	30	100	3,000
4	ASI	4	9	6	4	12	6											41	6	246	100	24,600
5	ANASI	6	8	8	4	6	8	4	4	4	2							54	10	540	100	54,000
6	KISSI	6	3	4														13	3	39	1	39
7	YIY	12	8	4														24	3	72	10	720
8	PASSAPO	8	8	4														20	3	60	1	60
9	PASSA	4	4	4														12	3	36	1	36
10	MESME	8	8	4	4													24	4	96	1	96
11	PAXAU	12	4	6														22	3	66	10	660
12	SISEI	8	4	4														16	3	48	10	480
13	AOA	8	4	4	4													20	4	80	1	80
14	KOLOU	10	4	3	4													21	4	84	1	84
15	SABLEI	10	3															13	2	26	1	26
16	TEBE	10	3	3														16	3	48	1	48
17	WELE	15	6	6	8													35	4	140	10	1,400
18	SUBU	6																6	1	6	1	6
	RATTANS																					
19	BOXORU	20	10	6	8	4	12	6	4	6	3	4	6					89	12	1,068	100	106,800
20	YAXANU BOXORU	8	6	6	6													26	4	104	10	1,040
21	YEYKI	12	8	4	6													30	4	120	10	1,200
22	KASUEYA	8																8	1	8	10	80
23	SUKENA	8																8	1	8	1	8
24	WAIAU	8	6	9	2	6												31	5	155	100	15,500
25	WOUBRO	8	8	6	4	6												32	5	160	10	1,600
26	WASLAM	4	6															10	2	20	1	20
27	WUU	8	4															12	2	24	1	24
28	WASAPO	10	6															16	2	32	1	32
	PANDANS																					
29	SAU, ~ ASMAK	10																10	1	10	1	10
30	SUBOU	9	4	6														19	3	57	1	57
	LARGE MONOCOT. HERBS																					
31	WI	10	4	2														16	3	48	100	4,800
32	ABUSI	4																4	1	4	10	40
33	BOGOSI	4																4	1	4	1	4
34	TUBAPLU	4																4	1	4	1	4
35	WOUBEL	10	4	4														18	3	54	1	54
36	WO	10	4															14	2	28	1	28
37	SULUP	6	6	8														20	3	60	1	60
38	WI KEI	6																6	1	6	1	6
39	YAPUP	6																6	1	6	1	6
40	PUIWAI	6	2															8	2	16	10	160
41	PUIDEI	6																6	1	6	1	6
42	SIBEI	4																4	1	4	1	4
	GRASSES																					
43	YAXAU	8	8	4	4	9	2	8	4									47	8	376	100	37,600
44	WANI	8	8	6	8	6	4											40	6	240	10	2,400
45	TONI	2	4	6	9													21	4	84	10	840
46	KAR	4																4	1	4	1	4
47	BOU	12																12	1	12	100	1,200
48	NOU	10	10															20	2	40	100	4,000
49	PUIWAR	10																10	1	10	100	1,000
50	SAY	3																3	1	3	10	30
	TREES																					
51	WISIA	15	6	6	6	6	6											45	6	270	100	27,000
52	YOGWAL	10																10	1	10	10	100
53	WAKANA	10																10	1	10	1	10
54	WASI	20																20	1	20	10	200
55	DEI	10	6	8														24	3	72	100	7,200
56	NUPO	10	6	8														24	3	72	100	7,200
57	TINIA	10	8															18	2	36	10	360
58	SAUWE (several kinds)	10																10	1	10	10	100
59	PANI	10	4															14	2	28	1	28
60	ILO	10																10	1	10	1	10
61	WOMO	10																10	1	10	1	10
62	IL	10																10	1	10	10	100
63	TIA	6	6	6														18	3	54	10	540
64	PUDUBEU	6	6	6														18	3	54	10	540
65	WESENG	6	8	6														20	3	60	1	60
66	WINI	6																6	1	6	1	6
67	WOMO	6	4															10	2	20	1	20
68	SE	4																4	1	4	1	4
69	SUU	4	6															10	2	20	1	20
70	TUBOPO	4																4	1	4	1	4
71	APAP	6																6	1	6	1	6
72	KAPLA	6																6	1	6	1	6
73	SAPU	6																6	1	6	1	6
74	SALAU	6	2															8	2	16	1	16

	use no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	sum	times	SUBTOTAL	factor	TOTAL
75	AXAUTANO	9	4	12														25	3	75	10	750
76	YOPNO	8	4	4	9	6												31	5	155	100	15,500
77	PUDUTOMO	4	4	4	8	6	8	9										43	7	301	10	3,010
78	SIL	10	4	4	6	8												32	5	160	10	1,600
79	AMO	4	4	4	4	6												22	5	110	100	11,000
80	KISI	4	8	6	6													24	4	96	10	960
81	DISSA	6																6	1	6	10	60
82	TOR	4																4	1	4	1	4
83	other hardwoods	8	4	4														16	3	48	1	48
84	TIDA	8	6															14	2	28	10	280
85	TOROU	6	4	2														12	3	36	10	360
86	YAXALU	9	4															13	2	26	100	2,600
87	TEBLEI	4	4	6	6	4												24	5	120	10	1,200
88	NISENG	6	4															10	2	20	10	200
89	PASI	6	4	2														12	3	36	10	360
90	WOUS	4																4	1	4	1	4
91	SULUP	6																6	1	6	1	6
92	SUWE	8	6															14	2	28	10	280
93	DIBE	6																6	1	6	10	60
94	BUSUI	4	6															10	2	20	1	20
95	WAL, several kinds	6																6	1	6	1	6
96	KASKAI	6	6															12	2	24	1	24
97	PA	6																6	1	6	1	6
98	SELI	6																6	1	6	1	6
99	PUDUTRE	8	6															14	2	28	1	28
100	TAPNI	6	6	2														14	3	42	1	42
101	DABUAI	2																2	1	2	1	2
102	PIN	2	2															4	2	8	1	8
103	YAU	2																2	1	2	1	2
104	WIUS	2																2	1	2	1	2
105	numerous other trees	4	4	8	6													22	4	88	1	88
	SHRUBS, LARGE HERBS																					
106	SOXAI	6																6	1	6	100	600
107	WASI	10																10	1	10	100	1,000
108	DISSA	2																2	1	2	1	2
109	PINA	2																2	1	2	1	2
110	YUWA	4	6	4	2	2												18	5	90	1	90
111	UWEL	2	2															4	2	8	1	8
112	DIPOB	2																2	1	2	1	2
	VINES																					
113	KUP (several kinds)	10																10	1	10	10	100
114	PE	4																4	1	4	100	400
115	POL	2																2	1	2	100	200
116	UBEI	4																4	1	4	1	4
117	UWAI	10																10	1	10	1	10
118	SONGBEI	10																10	1	10	1	10
119	AXANI/ ANIDAXA	10	6															16	2	32	1	32
120	BEIPIR	6	6															12	2	24	1	24
121	WASKO	6																6	1	6	1	6
122	APLO	6																6	1	6	1	6
123	UPLI	6																6	1	6	1	6
124	WOUPA	6																6	1	6	1	6
125	WAIAU	6																6	1	6	10	60
126	UR	2																2	1	2	1	2
127	APNU NAXAU	4																4	1	4	1	4
128	PAIAXAU	12	4	3														19	3	57	100	5,700
	FERNS																					
129	KUKA	8	6															14	2	28	100	2,800
130	WA	20																20	1	20	100	2,000
131	WA PUPUNAS	20																20	1	20	100	2,000
132	NAXA	20																20	1	20	100	2,000
133	NEP	20																20	1	20	100	2,000
134	ULARU	10																10	1	10	1	10

APPENDIX 17

Krisa resource management

The following table provides an overview of Krisa management practices for the resources listed in Appendix 15, with valuations transferred from Appendix 16. Its three dimensions are:

1. rows
   differentiating the same plant resources as listed in Appendix 15;
2. columns
   differentiating management practices;
3. cells
   differentiating data sources, with the following designations:

data source & relevant information	symbol
regrowth survey incidental survey of pioneer plants in 8-month old weedy garden = **pioneer conditions**	r
herbarium specimens—origin of plants weedy garden = **pioneer conditions** open space/ old garden land = **heavy disturbance** fallow or post-logging regrowth = **secondary growth** oldgrowth forest = **oldgrowth**	p
material culture collection—origin of materials (if recorded) (see herbarium specimens, above)	a
local information* "KAMAP LONG GADEN" ("grows in gardens") = **pioneer conditions** "KAMAP ARERE LONG PLES" ("grows around the village") = **heavy disturbance** "KAMAP LONG OLGETA HAP (LONG BUS)" ("grows everywhere [in the forest]") = **secondary growth** "STAP LONG BIKBUS TASOL" ("grows only in the deep forest") = **oldgrowth**	x

The list represents therefore less a systematic management survey than a collation of variously sourced information. Consequently, only information on planting and cleaning is complete, while information on other forms of management is likely incomplete and for some resources not available at all. Nevertheless, trends are clearly discernible and in the context of the patterns described in the text allow for meaningful conclusions about overall management strategies.

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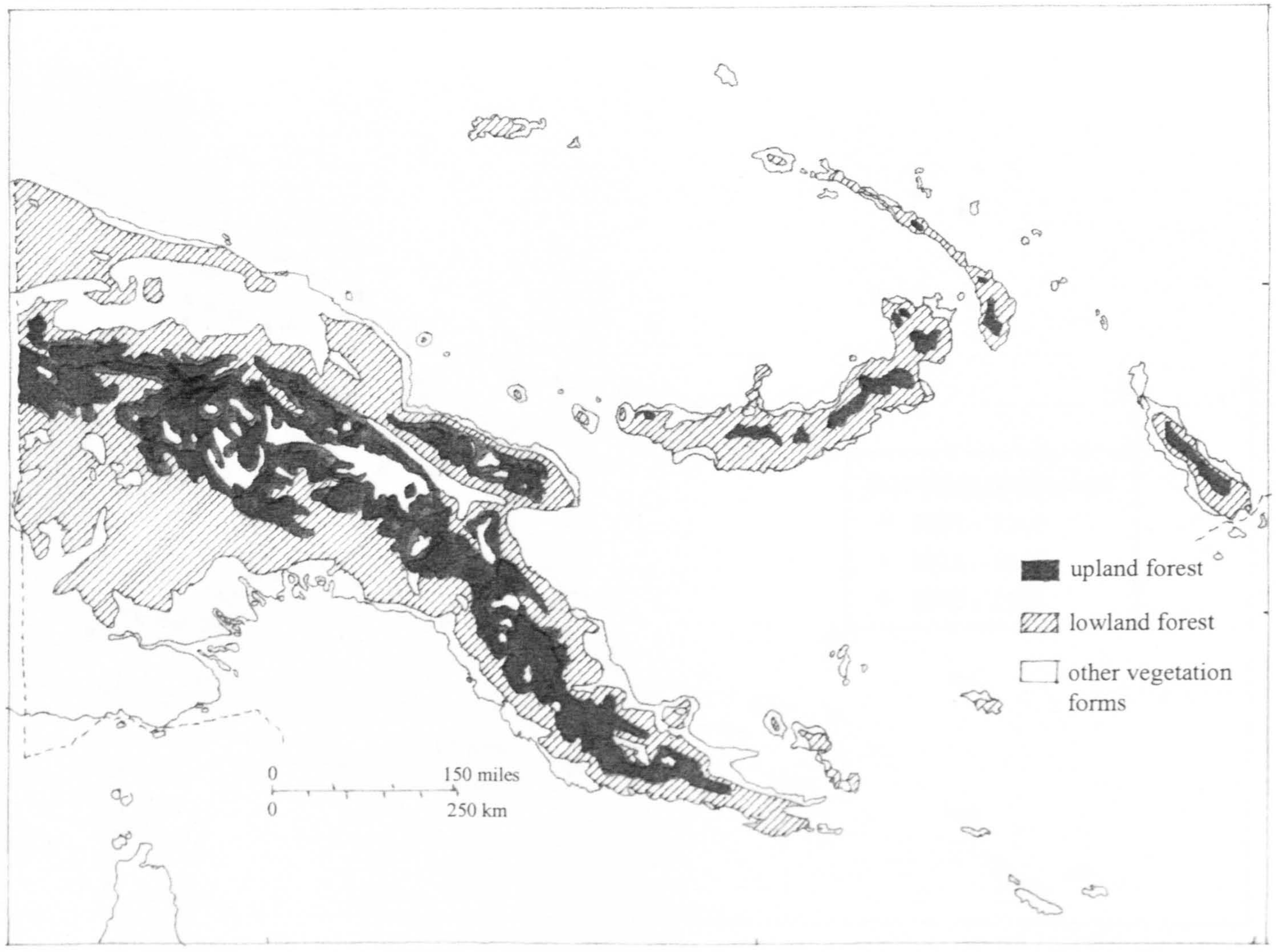
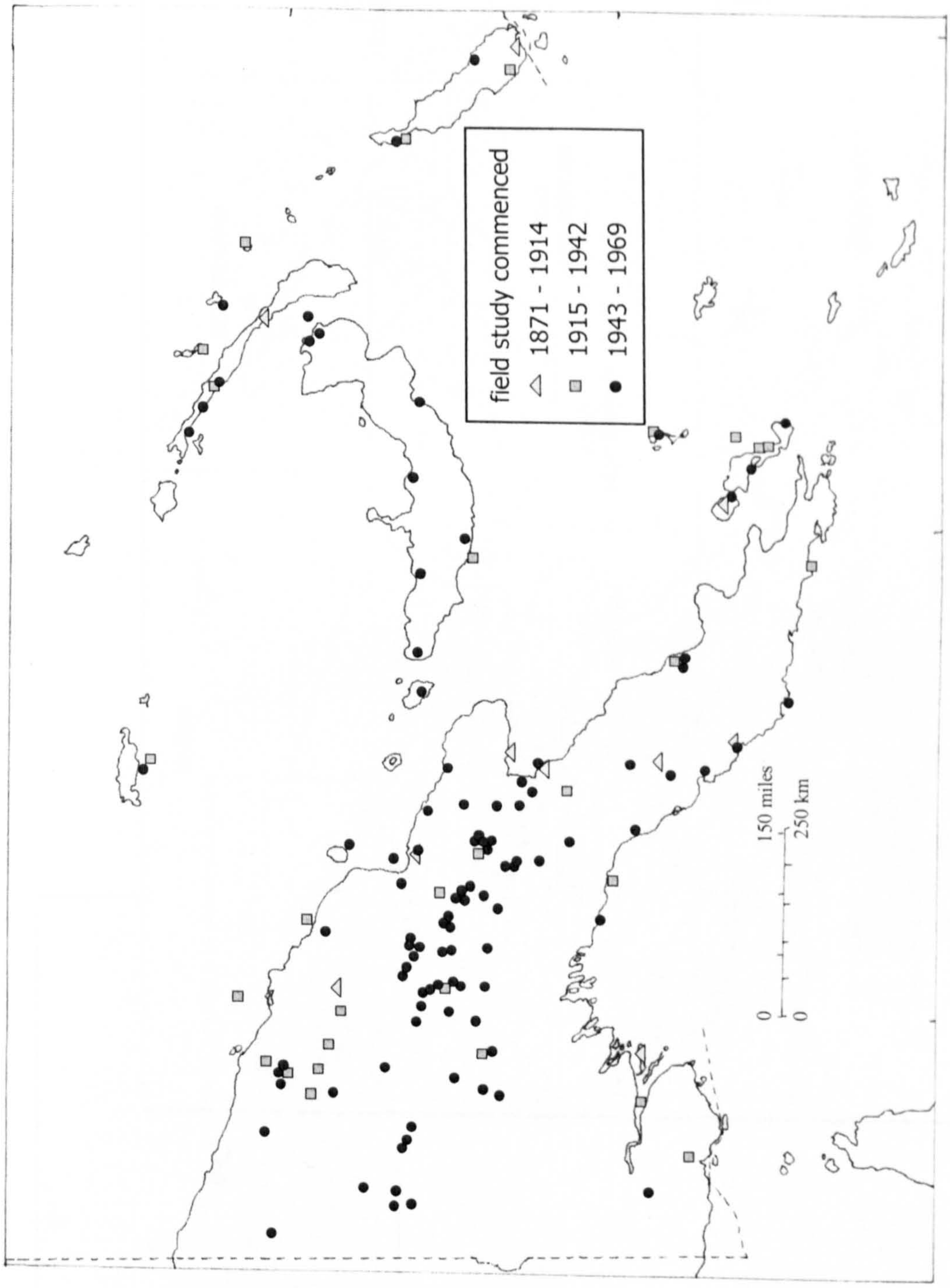
* This information has occasionally been supplemented with own observations (cf. e.g. n.317).

	management	direct	indirect (specific)		indirect (unspecific)				
		sowing, planting, transplanting	cleaning	retention	pioneer conditions	heavy disturbance	secondary growth	oldgrowth	RESOURCE SIGNIFICANCE
	TREE PALMS								
1	SU	x	x	x					188,800
2	SONG	x	x	x					62,100
3	PU	x	x	x					3,000
4	ASI	x		x					24,600
5	ANASI						x, p	x	54,000
6	KISSI								39
7	YIY					?a			720
8	PASSAPO								60
9	PASSA						p		36
10	MESME								96
11	PAXAU						?p, a		660
12	SISEI								480
13	AOA						p		80
14	KOLOU								84
15	SABLEI								26
16	TEBE				r		p, x	x	48
17	WELE								1,400
18	SUBU								6
	RATTANS								
19	BOXORU						p		106,800
20	YAXANU BOXORU						p		1,040
21	YEYKI							x	1,200
22	KASUEYA								80
23	SUKENA								8
24	WAIAU								15,500
25	WOUBRO						a		1,600
26	WASLAM								20
27	WUU							x	24
28	WASAPO								32
	PANDANS								
29	SAU, ~ ASMAK	x					x	x	10
30	SUBOU						x	x	57
	LARGE MONOCOT. HERBS								
31	WI	x	x						4,800
32	ABUSI				p	p			40
33	BOGOSI	x			r, p	x, p			4
34	TUBAPLU				x, r, p				4
35	WOUBEL				x, r, p				54
36	WO				p		x		28
37	SULUP				p				60
38	WI KEI				x				6
39	YAPUP				p	p	x	x	6
40	PUIWAI	x							160
41	PUIDEI	x							6
42	SIBEI	x					p		4
	GRASSES								
43	YAXAU	x				x	x, a		37,600
44	WANI					x, a	x		2,400
45	TONI	x							840
46	KAR					x	x		4
47	BOU	x							1,200
48	NOU	x							4,000
49	PUIWAR	x							1,000
50	SAY								30
	TREES								
51	WISIA	x	x	x	x		x		27,000
52	YOGWAL	x		x					100
53	WAKANA	x							10
54	WASI			x	x, p		x		200
55	DEI	x	x				?x		7,200
56	NUPO	x	x				?x		7,200
57	TINIA	x					?x		360
58	SAUWE (several kinds)	x				x	x	x	100
59	PANI							p	28
60	ILO								10
61	WOMO								10
62	IL								100
63	TIA				r		x	x	540
64	PUDUBEU					?a	x, p	x	540
65	WESENG						p		60
66	WINI								6
67	WOMO								20
68	SE						?p		4
69	SUU								20
70	TUBOPO							p	4
71	APAP								6
72	KAPLA								6
73	SAPU								6
74	SALAU						p		16

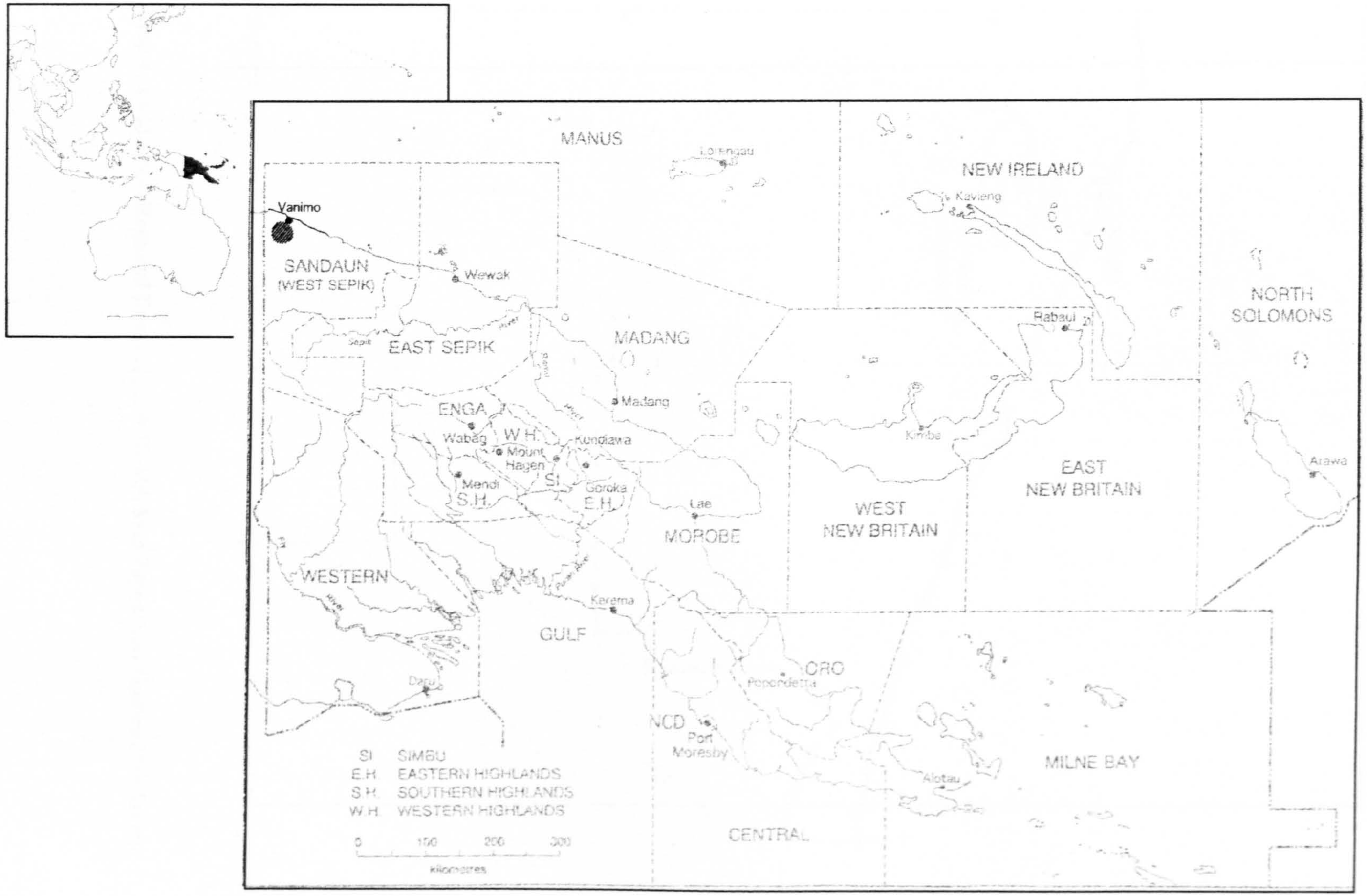
	management	direct	indirect (specific)		indirect (unspecific)				
		sowing, planting, transplanting	cleaning	retention	pioneer conditions	heavy disturbance	secondary growth	oldgrowth	RESOURCE SIGNIFICANCE
75	AXAUTANO							x, p	750
76	YOPNO			x			p		15,500
77	PUDUTOMO								3,010
78	SIL						?a		1,600
79	AMO								11,000
80	KISI							x	960
81	DISSA						?p		60
82	TOR						?p		4
83	other hardwoods, esp. guava, coffee								48
84	TIDA								280
85	TOROU				p				360
86	YAXALU				x, r*	a	p		2,600
87	TEBLEI						p		1,200
88	NISENG				p				200
89	PASI				x				360
90	WOUS				x				4
91	SULUP					a			6
92	SUWE				x, r, p	p	p, a	p	280
93	DIBE			x	x	x	x	x	60
94	BUSUI								20
95	WAL, several kinds							x	6
96	KASKAI								24
97	PA								6
98	SELI					p			6
99	PUDUTRE						p		28
100	TAPNI				x, r		x	x	42
101	DABUAI								2
102	PIN								8
103	YAU					p			2
104	WIUS						p		2
105	numerous other trees				x	x	x	x	88
	SHRUBS								
106	SOXAI	x							600
107	WASI	x							1,000
108	DISSA	x							2
109	PINA						p	p	2
110	YUWA	x							90
111	UWEL	x							8
112	DIPOB	x							2
	VINES								
113	KUP (several kinds)	x			x		x		100
114	PE	x				p, a			400
115	POL	x							200
116	UBEI								4
117	UWAI								10
118	SONGBEI				x		p		10
119	AXANI/ ANIDAXA								32
120	BEIPIR				x, r		x, p		24
121	WASKO								6
122	APLO								6
123	UPLI								6
124	WOUPA								6
125	WAIAU							p	60
126	UR						p		2
127	APNU NAXAU				r, p				4
128	PAIAXAU							x	5,700
	FERNS								
129	KUKA				p				2,800
130	WA				r, p		x		2,000
131	WA PUPUNAS								2,000
132	NAXA							x	2,000
133	NEP								2,000
134	ULARU								10



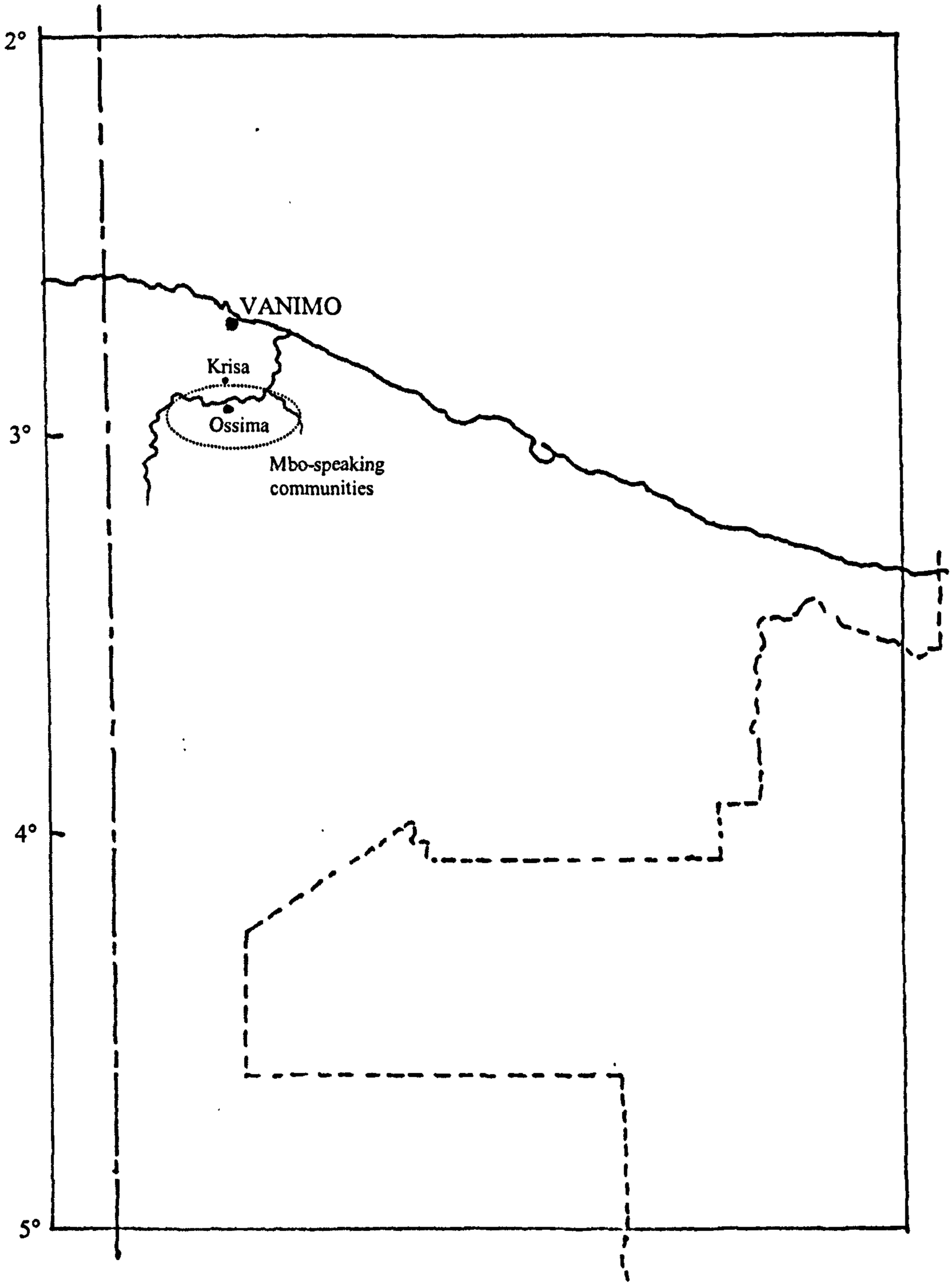
Map 1: Papua New Guinea—Vegetation Cover (after Filer 1998:17-fig.2.3. and Ward & Lea 1970:map26)



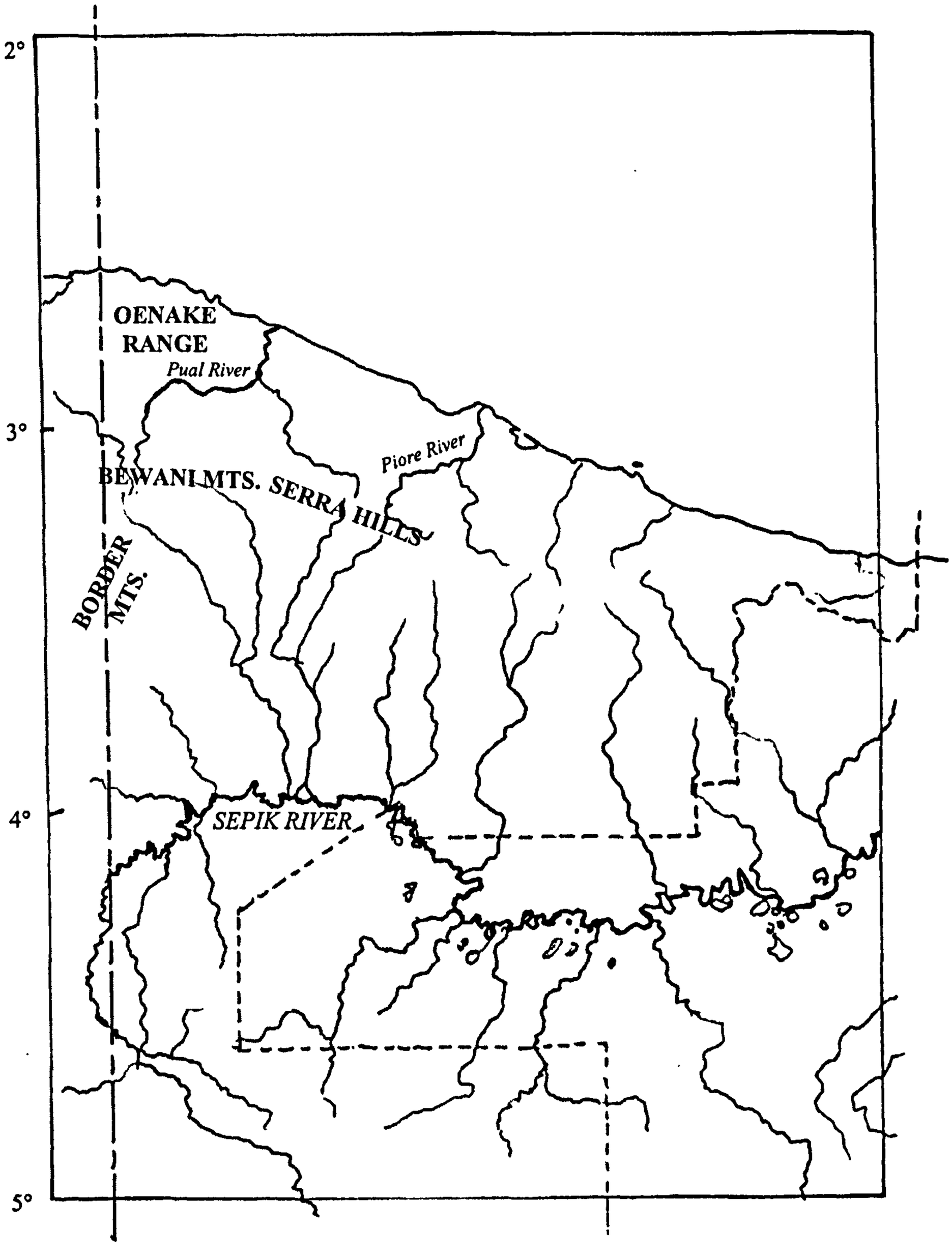
Map 2: Papua New Guinea—Ethnographic Research Sites (after Ward & Lea 1970:map49)



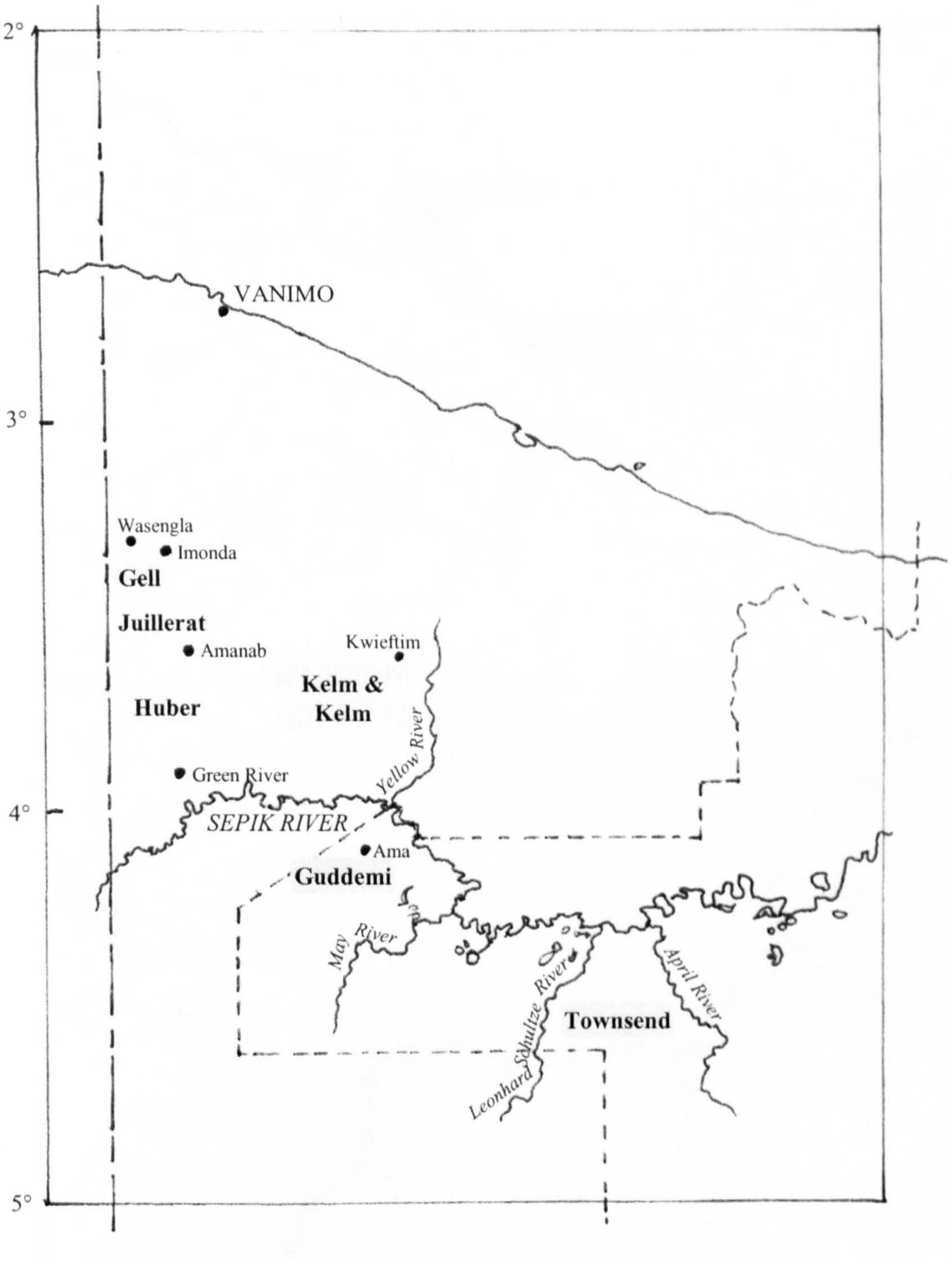
Map 3: Field Site—National Context (source: APFT; insert after King & Ranck c1980:3)



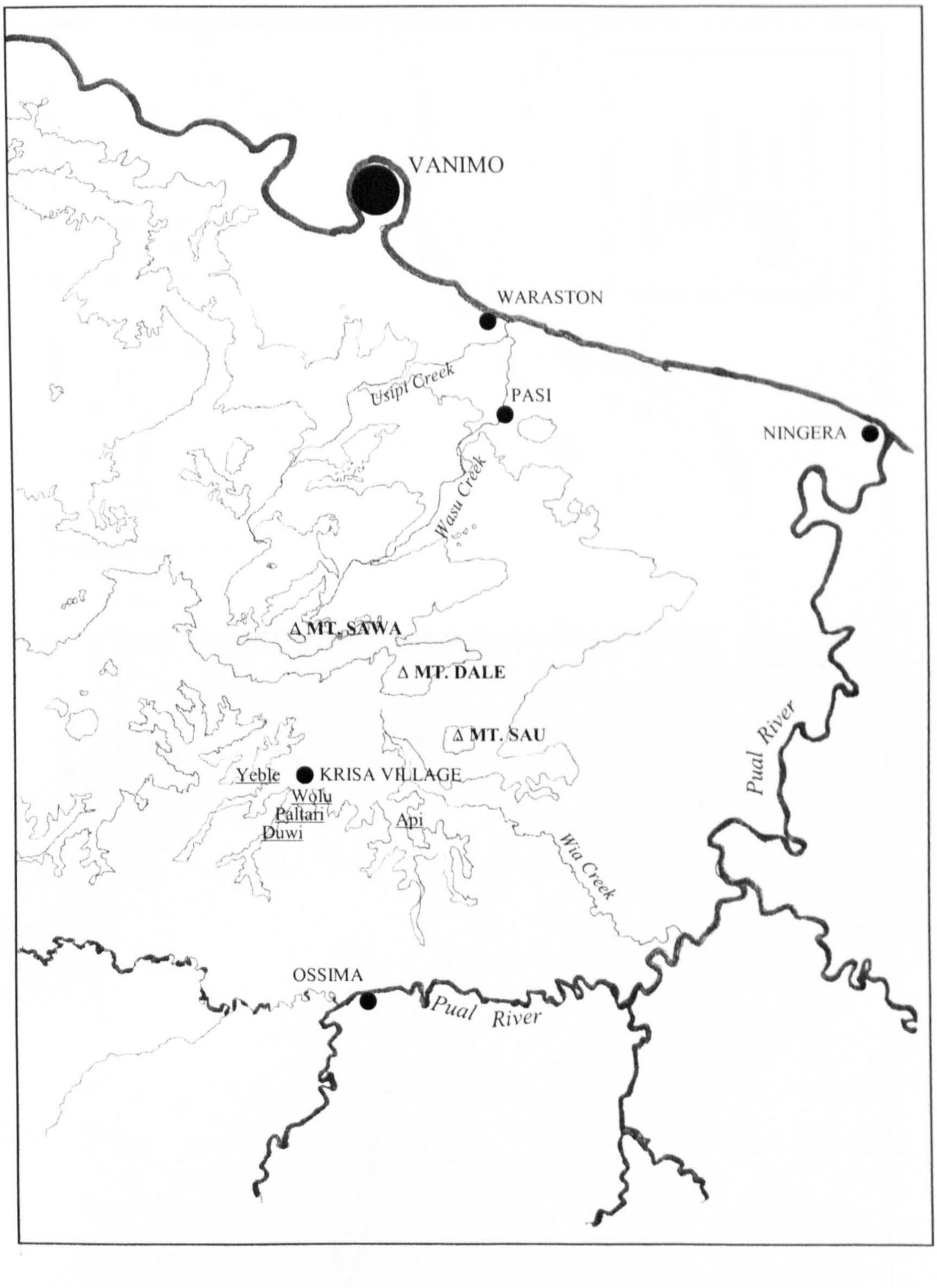
Map 4: Field Site—Regional Context (after HEMA Map Papua New Guinea 2nd edition)



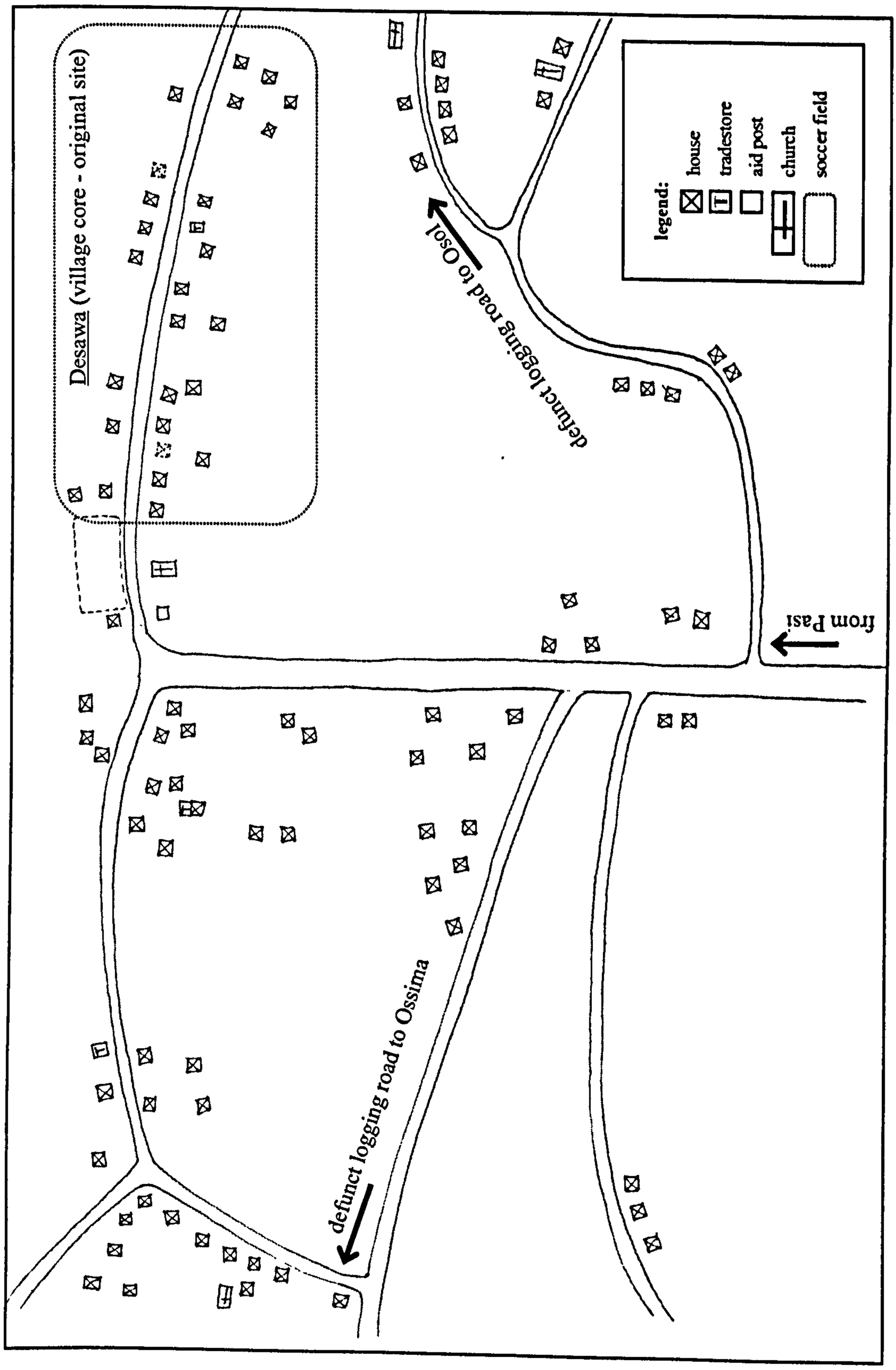
Map 5: The Far Northwest of Papua New Guinea—Geographically (source cf. Map 4)



Map 6: The Far Northwest of Papua New Guinea—Ethnographically (source cf. Map 4)



Map 7: Krisa Territory (indicating 200 m contours; topographic details after Royal Australian Survey Corps 1970)



Map 8: Krisa Village (sketchmap based on information provided by Daniel Waki, Damien Oman and Simon Tapi of Krisa)