The Australian National University

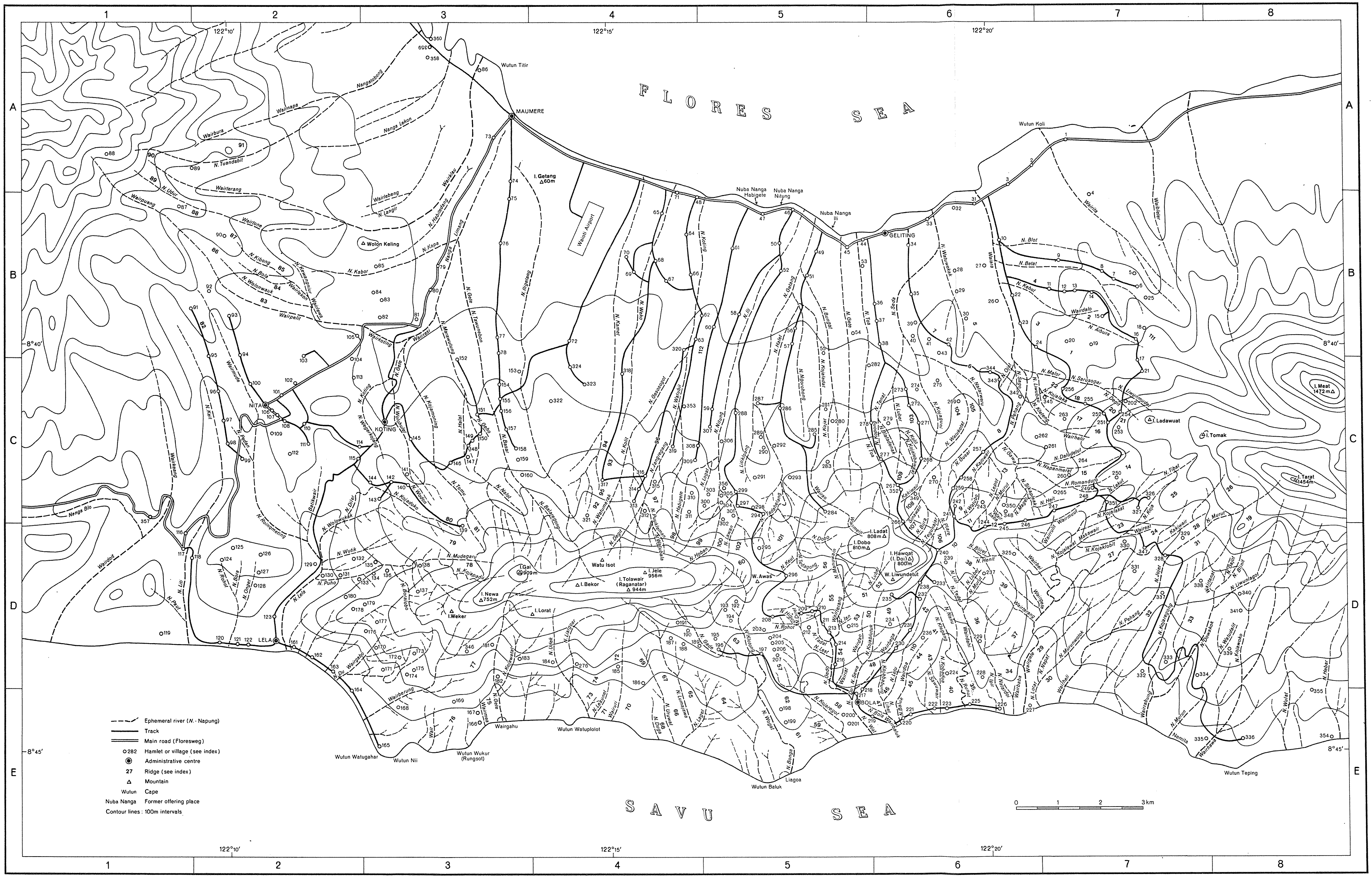
Development Studies Centre
Monograph no. 28

Agriculture and population pressure in Sikka, Isle of Flores

A contribution to the study of the stability of agricultural systems in the wet and dry tropics

Joachim K Metzner

Agriculture and population pressure in Sikka, Isle of Flores



FLORES SEA
SAVU SEA
MAUMERE
GELITING
NITA
KOTING
LELA
BOLA
Wutun Titir
Wutun Koli
Waioti Airport
Nuba Nanga Habigete
Nuba Nanga Nitung
Nuba Nanga Ili
I. Getang 60m
Wolon Keling
I. Meat 1472m
I. Tarat 1454m
I. Tomak
I. Ladawuat
I. Ladat 808m
I. Dobo 810m
I. Hawoat (I. Doi) 800m
W. Liwundetut
W. Awas
Watu Isot
I. Jele 956m
I. Tolawair (Raganatar) 944m
I. Bekor
I. Gai 909m
I. Newa 752m
I. Weker
I. Lorat
Wutun Watugahar
Wutun Nii
Wutun Wukur (Rungsot)
Wairgahu
Wutun Watuplolot
Wutun Baluk
Liagoa
Wutun Teping
Nemita
Ephemeral river (N. - Napung)
Track
Main road (Floresweg)
o282 Hamlet or village (see index)
Administrative centre
27 Ridge (see index)
Mountain
Wutun Cape
Nuba Nanga Former offering place
Contour lines: 100m intervals
0 1 2 3 km
122°10'
122°15'
122°20'
8°40'
8°45'

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To my wife, Gotlind

Summary

The twin problems of land shortage and soaring population figures are a recurrent topic in the discussion of underdevelopment. They are of particular relevance to islands with limited resources. In most parts of island Southeast Asia the critical population limits have long been exceeded.

Environmental deterioration and decreasing yields are frequently the result. Yet even under an itinerant type of agriculture, population densities of several hundred persons per square kilometre can be found which have led neither to destruction of the environmental base nor to decreasing yields. A case in point is Central Sikka on the isle of Flores, one of Eastern Indonesia's most densely populated rural areas. It is here that the author investigated in detail both qualitatively and quantitatively the main forces that determine the stability of agricultural systems, thereby demonstrating that the simple relationship between population density and natural resources under a given agricultural system does not suffice as a guideline for planning.

Contents

Figures

Tables

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her help all through the research my stay would have been both much poorer and harder and the months of preparing the manuscript would have been considerably more strenuous. The burden imposed on my family members by my Sikkanese fancy has been very great indeed. In spite of this they are still patient listeners to news from 'our island'.

Given such assistance on all sides, I need hardly add that I alone am to blame for any shortcomings in the following pages.

J. Metzner

Heidelberg
March 1982

Abbreviations

AAAG	*Annals of the Association of American Geographers*
APDN	Akademi Pemerintahan Dalam Negri
BDP	Bagian Dokumentasi Penerangan Kantor Waligereja Indonesia
Bijd.	*Bijdragen tot de Taal-, Land- en Volkenkunde van Nederlandsch-Indie*, Den Haag
DJKP	Direktorat Jenderal Kehutanan, BrigadeVIII Planologi Kehutanan Nusa Tenggara
DKS	Dinas Kehutanan Kabupaten Sikka
DPRD	Dewan Perwakilan Rakyat Daerah
DPRDF	Dewan Perwakilan Rakyat Daerah Flores
DPRNT	Dinas Pertanian Rakyat Propinsi Nusa Tenggara
DPRNTT	Dinas Pertanian Rakyat Propinsi Nusa Tenggara Timur
DPS	Dinas Pertanian Kabupaten Sikka
Ds.	Desa
f	Guilders
GR	*Geographische Rundschau*, Braunschweig
GZ	*Geographische Zeitschrift*, Wiesbaden
I	Iling (or Ili); Sikkanese term for hill
IAE	*Internationales Archiv für Ethnologie*
IPB	Institut Pertanian Bogor
Ind. Stbl.	*Indische Staatsblad* (official government gazette)
INMAS	Intensifikasi Masal (= mass intensification)
IPP	Ikatan Petani Pancasila
J. Trop. Geogr.	*Journal of Tropical Geography*
KNAG	Koninklijk Nederlands Aardrijkskundig Genootschap
KM	De Katholieke Missien, 's-Hertogenbosch
KUD	Koperasi Unit Desa
LPTI	Lembaga Penelitian Tanaman Industri, Bogor
NTT	Nusa Tenggara Timur

NTNI	*Natuurkundig Tijdschrift voor Nederlandsch-Indië*, Batavia
PPTK	Perusahaan Percobaan Tanah Kering
Rp (=R)	Rupiah
RTK	Register Tanah Kehutanan
St.C.	*St. Claverbond* (later called *Berichten uit Nederlandsch Oost-Indie*), uitgave der PP. Jezuiten ten bate hunner Missie op Java, Den Haag
Tijd.	*Tijdschrift van Indische Taal-, Land- en Volkenkunde*, Batavia
TNAG	*Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig Genootschap*, Amsterdam, Utrecht, Leiden
TNI	*Tijdschrift voor Nederlandsch-Indie*
TNL	*Tijdschrift van Nijverheid en Landbouw in Nederlandsch-Indie*
VBGKW	*Verhandelingen van het Bataviaasch Genootschap van Kunsten en Wetenschapen*, Batavia
Z. Miss.	*Zeitschrift für Missionswissenschaft*

Glossary

S - Sikkanese
L - Lionese
D - Dutch
I - Indonesian

Note: Non-English words and phrases used only once in the text are similarly identified, but do not appear in the Glossary.

abo ulun S	to cover rice seed holes
adat I	local customary law
afdeeling D	subdivision of a former regency during Dutch times
afkoopgeld D	labour release fee
ai ohu S	cassava
ai puă S	stump of a tree near the centre of a garden/field at which rituals associated with planting and harvesting rice and maize are performed
'ajar waang S	spreading weeded grass over the field for mulching
amak gung S	third-year field
amak loar S	fallowed field
amak rewuk S	third-year field
amak welung S	fallowed field
amak weru S	second-year field
'aning borok S	strong wind
'aning tahi lai S	strong winds from the south during NW monsoon
aren I	sugar palm (*Arenga saccharifera*)
asam I	tamarind (*Tamarindus indica*)
'ata Alok S	people from the village of Maumere
'ata krowe S	people from the hills, likely to be of Melanesian origin
'ata duă moăng S	nobles
'ata lau watang S	lowland people
'ata maha S	slave

'ata nanê maing S	people who came long ago
'ata reta iling S	upland people
'ata riwung (sar) S	commoners
'ata Sikka S	(coastal people) people from the village of Sikka
'ata teri tana S	(permanent) emigrants
'ata wawa rang, 'ata wawa maing S	seasonal migrants (lit. *wawa* - to/from far; *rang* - to go; *mai* - to come)
badu (= tada badu) S	sign made of cross-shaped bamboo from which coconuts or parts of animals are hung, employed in a ritual by which a field is protected from theft
bahu I	0.71 hectare
bala mangung S	elephant tusk given by the *ratu* symbolizing allegiance
bala repang S	large elephant tusk used as bridewealth
bemo I	minibus for 8 to 10 passengers
beras I	hulled rice
beser S	measurement for 100 cobs of maize
bevolkingskatoen D	cotton grown by smallholders
BIMAS I	abbreviation for *bimbingan masal* (=mass guidance) - agricultural intensification program
blek S	10 litre oil container used as bulk measurement
blepeng S	bamboo poles used as anti-erosion device
borok S	Föhn-like wind occurring on Sikka's north coast
bue S	green gram (*Phaseolus radiatus*)
bui urang S	to wait for the rain
buluk S	obligation of heir of family land (eldest son) to divide the land equally among his younger brothers
bungkil I	oil press cake (resulting from the processing of copra)
camat I	head of subdistrict
civiel gezaghebber D	Dutch administrator
controleur D	Dutch administrator of an *onderafdeeling*
(bala) dêdung S	the two last elephant tusks not yet paid as bridewealth

desa I	smallest administrative unit consisting of several hamlets and villages (= *kampung* I)
dokit S	to weed, to transplant
eta pare S	to harvest rice
gai (moöng gai) S	village official formerly representing the *ratu* in each village and responsible for punishing minor offences
gajar waang dua S	second weeding by means of a hoe
gaking S (= *garu* I)	to scratch the soil slightly using a hoe
gelo	candlenut tree (*Aleurites moluccana*)
gemeente D	community
gemok (= remok) S	pulling grass by hand on stony soil (term used in Hokor)
habi S	Australian oak (*Schleichera oleosa*)
hak kepunyaan pribadi I	privately possessed land
hak ulayat I	right of disposal
hamente S	district (comparable to *kecamatan*)
hera blepeng S	to construct '*blepeng*'
heö	bean (*Dolichos lablab*)
herendienst D	statute labour
he roung S	to bring leaves and additional wood to a field for burning. The ash serves as fertilizer.
hikong S	corner of a *tana puäng* territory
hokot lēleng S	joint labour whereby the yield is divided evenly among the workers
hokot nane S	to work continuously
hokot seng S	group labour based upon the principle of mutual assistance
hokot uma S	to work the field
holo S	to burn
holo hening S	to burn for a second time
holo utung S	to burn for a second time
hutan cadangan I	protection forest
ide lepa S	to cover seed holes with rice grain by drawing coconut leaves over the field
ikan benteng I	milk fish
ina mae ama mae S	family (lit. 'father and mother')

jagung ontongan (=*jagung tongkoe*) I	maize cobs
kabor S	coconut
kabupaten I	district
kampung I	village
kapitan S	head of a *hamente* (district) similar in rank to a *camat* I (subdistrict officer)
karit S	to weed grass by slight hoeing
kawasan hutan I	forest reserve
kēke S	bamboo splinter for weeding
kepala desa I	head of a *desa*
kerajaan I	kingdom
kewe S	fixed lease in kind
kewe lage S	to lease
kloăng S	hamlet
kloăng klēreng S	clan house
koja S	canary tree (*Canarium commune*)
koli S	*Borassus flabellifer* palm
kongsi S (from Chinese)	see *hokot lēleng*
korte verklaring D	declaration of allegiance to the Dutch Crown to be signed by local leaders on Flores
kuat (wungung) S	founder clan
kursus gizi I	course in nutrition
kuwa lela S	sign traditionally erected by a *tana puăng* on a field which was worked longer than the allowed number of three years
kuwu S	distillery
ladang I	shifting cultivation
lageng S	gift by outsider to *tana puăng* for right to work a piece of land
'lago S	*Hibiscus tiliaceus*
lahar I	mud flow resulting whenever volcanic deposits are mobilized by the addition of water

lajang S	to shake grass sods in order to separate the roots from the soil
lako S	survey of a piece of land by a prospective peasant
lamtoro I	leguminous shrub (*Leucaena leucocephala*)
landbouwopzichter D	agricultural extension officer
landbouwvoorlicht-ingsdienst D	agricultural extension service
landschap D	district headed by a *raja* (king)
lega waang wong S	to weed young grass by hand
lelê S	maize
lelê borong S	maize roasted with fruit leaves
lelê daang S	young maize
lelê daran S	'dry maize' (= dry season maize)
lelê dolor S	maize planted at the periphery of the field
lelê hoong S	finger millet (= *cantal* I)
lelê lêlen S	wet season maize
lelê plalak S	maize planted in monoculture
lelê 'owak S	maize cobs
lelê ropo S	'fast maize' (early maturing maize)
lelê tubong S	maize planted near stumps of trees where the soil is particularly fertile
lepo S	house, subclan, lineage
lepo puang ramut S	clan house
lepo woga S	lineage house
letá S	group labour which does not imply reciprocity
ling weling S	bridewealth
lobat tubu S	ritual associated with planting and harvesting rice and maize and performed in the field
'luma S	small leguminous tree (*Sesbania grandiflora*)
maa ihing S	sharecropping
magang S	tilling of the soil locally only where maize or cassava are to be planted
mage S	tamarind tree (*Tamarindus indica*)
maha urung suurung rakang S	sacred spots in the grassland zone where offerings were performed to reconcile evil spirits

mamé S	see *pulamé*
mandur I	low ranking agricultural officer
mantri I	agricultural assistant ranking between the *landbouwopzichter* and the *mandur*
medang S	communally worked piece of land owned by several clans
mekot S	to store
miping S	to dream
moäng pulu S	'ten nobles' (= privy council of the *ratu*)
neni kare S	sharecropping of palms
neni plaa S	borrowing of land
ngiru (= *nyiru*) I	round tablet made of rice straw used for cleaning rice
niang reping goit, tana raeng raat S	forested slopes and escarpments
niha seng S	communally constructed fence around a *medang*
nitu S	spirits
noang S	spirits
nona S	to plant (rice or maize)
nope apur S	to burn limestone
noti gung S	first weeding on upland rice field with small dibble (*teeng kesik*)
noti waang dua S *noti waang nurak* S *noti wong* S	second weeding on field with upland rice
nuba nanga S	offering place on the beach
ohu S	yams (*Dioscorea* sp.)
ohu ai S	cassava
olang pireng S	sacred forest
onderafdeeling D	district corresponding with *kabupaten*
ongeng S	field with perennials (mostly coconut)
oring S	house
ou wua pata taa S	right to cut small branches and small trees in hill forest
pahe pare S	to drill holes for planting of rice seed
pajak rumah tangga I	household tax

papang S	to slug down grass sods
parang I	sort of machete
pare S	rice plant
pare ama S	unhulled rice
pare ropo S	fast growing rice variety
pare uma S	dry upland rice
pare werang S	hulled rice
pau waang S	to discard weeded grass
penghijauan I	regreening (outside forest reserves)
perahu I	boat
perintah keras I	strict order
porong ha S	0.71 hectare
posthouder D	postholder, head of an *onderafdeeling*
pripong nopok klageng S	to collect wood left after first burning at a certain spot of the field for a second burning
proeftuin D	experimental garden
pulamé S	special relationship between mother's brother and sister's child
pung gaer S	'mixed holding' of trees belonging to one person while the ground belongs to another
pupu bue S	to harvest green gram
pu tuäng S	obligation to plant fallow plants in order to restore a forest
putri malu I	*Mimosa invisa*
puuk heret (= *puuk mâteng*) S	'tuffstone'(lit.'stone easily disintegrating') disintegrating)
puuk moret S	marl (see *tana napang*)
puuk wura S	limestone
rape lelé S	to harvest maize
ratu I, S	king
reboisasi I	reforestation within forest reserve
rechtsgemeenschap D	territorial unit comprising several villages and hamlets whose members submit themselves to the rules set by the *tana puäng*
ri pare S	threshing of rice by stamping on it
reping S	to place grass and grass roots on the *blepeng*

resident D	head of a regency (equal to the province)
riabewa L	'lord of the earth'
rii S	*Imperata cylindrica* grass
rotang S	*Saccharum spontaneum* grass
rou leling S	malaria
rumah tangga I	household
ru supung S	perennial crop
sadang S	pledging
sadang mateng S	pledging with the understanding that in case the pledge giver cannot reimburse the pledge after two to three years, the pledge becomes the property of the pledge-taker
sadang moret S	pledging with the understanding that in case the pledge giver cannot reimburse the pledge after two to three years, the pledgetaker will have to pay for it
sako S	to hoe
sako seng S	hoeing through group labour on a reciprocal basis
sawah I	wet rice cultivation
siga S	carving of evil spirits symbolized by snakes, crocodiles etc. which are believed to punish the trespasser or the thief
Sikka natar	village of Sikka
sjahbandar I	harbourmaster
song porong S	ritual held on the eve of the rice planting
subur S	measurement for maize equal to about 40 maize cobs
supung sulang S	perennial crops
surat keputusan pemerintah I	official document showing land title
suwung rakang S	right to participate in hunting
swapraja I	administrative unit headed by a *raja*
taka S	metal-pointed dibble
taka hokot S	metal-pointed dibble
taling S	40 maize cobs tied together forming a ring
tana awung S	ash soil

tana boeng alang S	battle ground
tana buku batu S (= *tana woter*)	'purchased land'
tana dira ngang S	conquered land
tana dueng éong S	land not used for agricultural purposes
tana eba S	sandy soil (*eba* = shell)
tana ei lepo S	family land, clan land
tana gung S	hereditary family land
tana ihing S	humic layer of the soil
tana ika magang S	land acquired as a gift
tana ina S	land declared the property of the king
tana klaing S	land not bound to *adat* rules
tana lageng S	land tax
tana luma lago S	land under fallow planted with *Sesbania grandiflora (luma)* and *Hibiscus tiliaceus (lago)* to enhance restoration of soil fertility
tana lia goa S	caves (lit. *lia goa* = echo)
tana magat S	land worked permanently
tana mera S	red soil
tana mita S	black soil
tana nager S	land acquired as a gift (lit. *nager* = gift)
tana napang S (= *puuk mateng*)	marly land
tana napung wair ba howeng, tana wair matang S	rivers, creeks and springs
tana natar S	communally owned land - e.g. footpaths and village ground
tana ngalang S	conquered land given to a particularly brave man
tana niang urang puang, tana kowa natar S	forest land located on hill tops for protection of watershed
tana nuba nanga S	offering place at the coast
tana nura riwung S	conquered land given to commoners
tana pireng S	sacred land
tana puăng S	'origin of the land' (='lord of the earth')
tana puăng manuala S	second ranking *tana puăng*

tana puuk S	land with hard stones
tana retu lelet S	land opened in the sacred forest without punishment by the evil spirits
tana riwa hekong S	conquered land
tana ru supung S	land planted with perennials
tana tena sida wai S	sacred offering places
tana têten puket pak rabang S	communally owned beach (lit. *têten puket* = fishing with nets)
tana tuang pireng S	sacred forest
tana ui umeng S	communally owned land where markets are held (*ui* = shell; *umeng* = to be quiet)
tana uneng S	groundnuts
tana utang labu, tana patang paling S	land acquired as bridewealth
tana watu wura S) *tana wura* S)	pumice mixed with small white stones
tana woter S	purchased land
tana wura gewung mera S	pumice mixed with red soil
team pemberantas hama I	pest control board
team penanggulangan erosi I	erosion control board
teeng S	medium sized dibble
teeng doling S	digging stick
teeng kesik S	small dibble made of bamboo
teeng gete S	large dibble
tege puang klereng S	to cut grass on a field that escaped the first burning
tena S	boat
tepi S	to winnow
togo S	to thresh the rice by jumping on the panicles
tokang ai waing S	sticks driven into the ground to halt the *blepeng*
tongkat I	staff of office
tua S	alcoholic drink from the *Borassus flebellifer* palm (= *koli*)
tua bura S) *tua mi* S)	sugar palm milk (unfermented)

tua 'uta S	sugar palm (*Arenga saccharifera*)
tua waa habi S	sugar palm milk fermentation retarded by addition of bark from *habi* trees
tuka S	sweet potato
tuka pu̇ȧng lelé malor S	remuneration given in kind to voluntary harvest helpers; usually a portion of inferior quality
tumpang sari I	agroforestation program
tung piong S	sacrifice in the forest
tutu bue S	to beat green gram (*bue*) pods in order to dislodge the beans from the pods
tu hini S	to produce salt
uang badan I (= *hoang 'alang* S)	head tax
uang harta I (= *hoang tana kabor* S)	commodity tax
ua tépo S	voluntary group labour provided mainly by relatives for agricultural purposes
uma kabor gong S	field with annuals underneath coconut trees (*gong* = shade)
uma koli gong S	field with annuals underneath *Borassus* palms
uma lau detung S	field in the plain
uma leləng S	joint cultivation of a field, in which the yield is divided equally among the cultivators on the basis of labour input rather than land ownership
uma ongeng S	a field part of which is under fruit trees
uma reta iling S	field in the upland
uma rii rotang S	grass *ladang* field
uma tana S	land reserved for agricultural purposes
uma tuang S	forest *ladang* field
uma utur S	bush *ladang* field
uma weru S	freshly opened field (= first year under cultivation)
upeti I (= *upa* S)	tribute
urung S	grass

urung rii rotang S	grassland
waïng bou S	elephantiasis
wake lageng S	sales tax to be paid on all sales by non-members of a particular *tana puäng* at the market
warat S	northwest monsoon
watar S	sorghum (= *gandum* I)
watu ai S	offering stone in the forest where people used to hunt
watu kêbar S	corner stone of a *tana puäng* territory
watu mahe S	sacred stone used for rituals
wawi peping ara piong S	present given to a *tána puäng* after the latter had sacrified in the forest
wêhak pare S	to broadcast rice
weking geté S	large bamboo pole hung in a tree with ring of maize cobs serving as a granary
weking kesik S	small bamboo pole hung from a tree on which 10 to 20 rings of maize are placed serving as a granary and protected against rodents
wetang S	Italian millet (= *jawawut* I)
wewe S	cow pea (*Vigna sinensis*)
wewe tana S	groundnut
wisung S	quarter of a village
wisung wanga S	clan house
wolong S	hill
wolong blong S	'long hill' = ridge
wolong doi S	short narrow hill
wolong napung S	hill and ravine area
'wori S	to dry (e.g. *wori kureng* = to dry copra)
woter hokot seng S	group labour remunerated in cash
wulan daran S	dry month
wulan lelen S	rainy month
zelfbestuurer D	local ruler

Introduction

Since Geertz's noted discussion of ecological change in Indonesia it has become almost an axiom that shifting cultivation (*ladang*) systems are comparatively maladaptive to increasing population (Geertz 1963). For this type of agriculture population ceilings of 50 persons per square kilometre have been mentioned by van Beukering (1947:9) for humid parts of Indonesia. Even lower figures were calculated by Conklin (1957:146-7) for the Hanunóo of Mindoro/Philippines (48 persons/sq.km) and by Freeman (1955:134-5) for the Iban of Sarawak (20-25 persons/sq.km).

These assumed or calculated critical limits have long been exceeded in most parts of the Southeast Asian archipelago. The widespread occurrence of grassland climaxes and even badlands in many parts of the archipelago is a clear indicator of precarious ecological conditions. Such signs of land deterioration are particularly striking to a visitor to the eastern Lesser Sunda Islands of Indonesia (= eastern Nusa Tenggara) (see Ormeling 1955; Metzner 1976b, 1977a). Here in the archipelago's driest corner where rainless periods locally of up to eight months greatly reduce the recovery rate of the vegetation and hence the restoration of fertility after human interference, *ladang* systems seem to be more delicately balanced than under conditions of tropical rainforest. Lower population ceilings are therefore considered necessary for savanna climates.

Yet even under this itinerant type of agriculture population densities of several hundred persons per square kilometre can be measured in rural parts of these drylands. Although admittedly these densely populated areas are not completely devoid of erosion and flooding either, the degree of land deterioration in these places is, surprisingly, far from critical. Such areas do not fit the generally held belief of a population ceiling of 50 persons or fewer. Such a phenomenon encountered in eastern Nusa Tenggara leads us to rethink the issue of ecological stability of agricultural systems.

Since the terms 'agricultural system'[1] and 'ecological

[1]German readers should beware of the translation of the term 'agricultural system' into German. It stands for agricultural land use system. For discussion see Manshard (1968:77-81), Ruthenberg (1967:122-208; 1976:28) and Andreae (1977:105).

stability' play a pivotal role in our study they need to be defined. Such a clarification seems particularly necessary in view of the bewildering number of widely differing definitions used in the literature.

An *agricultural system* - as a specific form of an ecosystem - is distinguished here by the manner in which a particular piece of land is used to grow particular sorts of crops and to raise a specific type of livestock. Thus it is determined by the dependence on and place in nature (permanent, semi-permanent or impermanent) according to the crop grown. According to the implement used for cultivation and the technique of cultivation, all may be regarded as components of a given ecosystem. This definition is basically tantamount to those used by Harris (1966:3), Terra (1957 and 1958: 157), McDaniel and Hurst (1968:20-1), Brookfield (1968), Maude (1970:63), Benneh (1972), Janzen (1973), Boserup (1965:15), Gleave and White (1969:276), Spedding (1975:14ff. and 1979).

An agricultural system is considered *stable* when the manner of cultivation could be maintained in the long run without destroying the ecological base of the system. Visible environmental deterioration as well as decreasing yields are signs of instability. Hence ecological and economic stability are intimately linked. A quantitative definition of stability is attempted in Chapter 3. Attempts at defining the stability of ecosystems quantitatively have been made by May (1973:638) and Stöcker (1974:241).

Are shifting cultivation systems indeed as maladaptive to an increase in population? What determines the degree of stability? These are the questions to which this monograph seeks to give an answer. A deeper understanding of the forces controlling the stability of agricultural systems, in particular those of the wet and dry tropics, does not appear to be of mere academic interest. The practical relevance of this issue, for instance for Indonesia, is underscored by the highly skewed regional distribution of the population over the archipelago and the significance attached to large-scale projects of agricultural development (e.g. BIMAS, INMAS - see Mears 1970; Birowo 1975) including various forms of resettlement (*transmigrasi*, *transmigrasi lokal*, etc. - see Zimmermann 1975; Hardjono 1977; Metzner 1978b).

The simple relationship between population density and natural resources under a given agricultural system does not seem to suffice as a guideline for planning. It is for these reasons that it was found highly challenging to investigate the main forces that determine the stability of agricultural systems. Such an analysis was to be restricted to the study of the stability of various forms of dry-land cultivation. Hence wet rice cultivation (*sawah*), which is known for its capacity to support increasing population without necessarily leading to a rapid breakdown of the

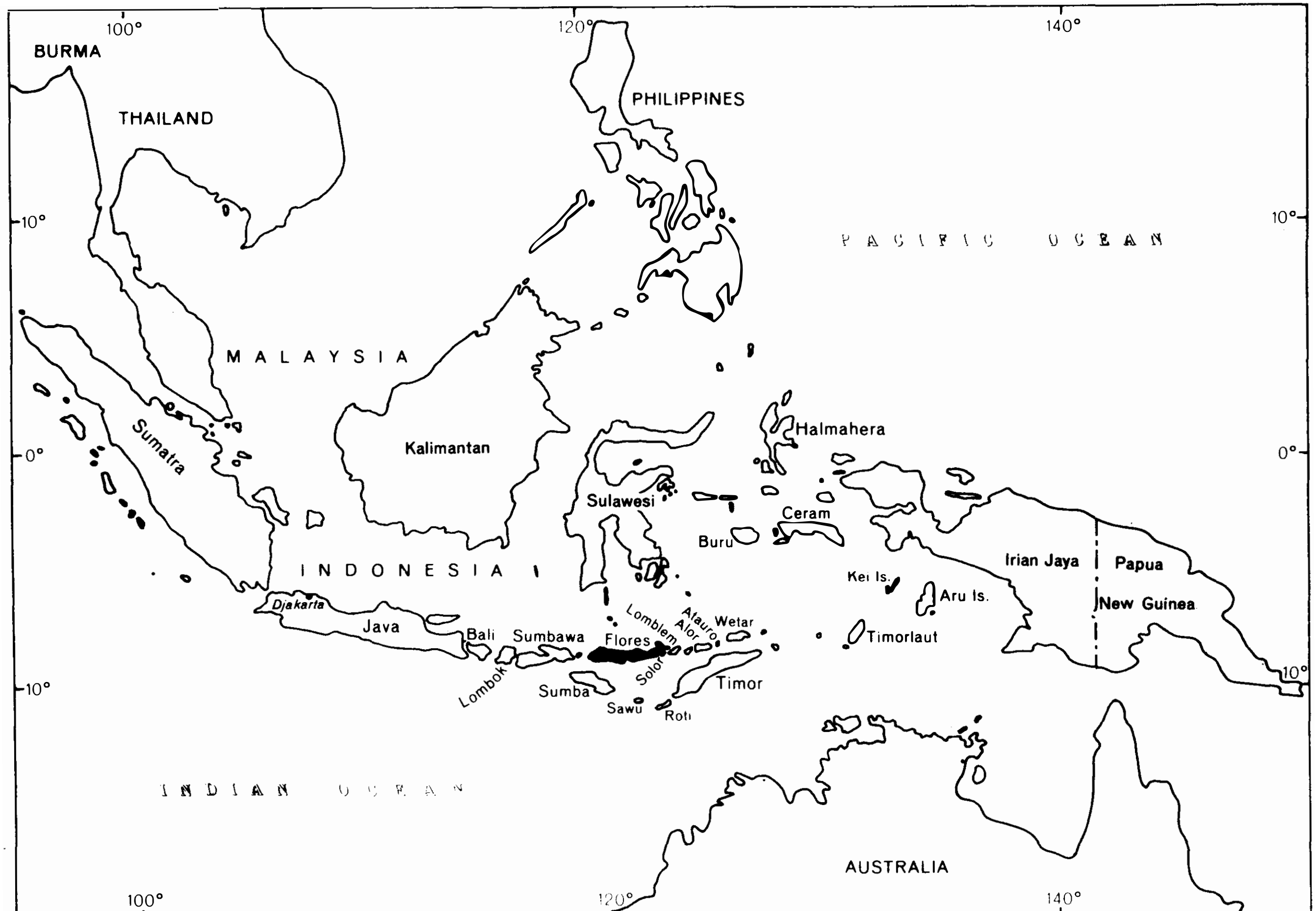

Fig.1 Location of Flores in Southeast Asia

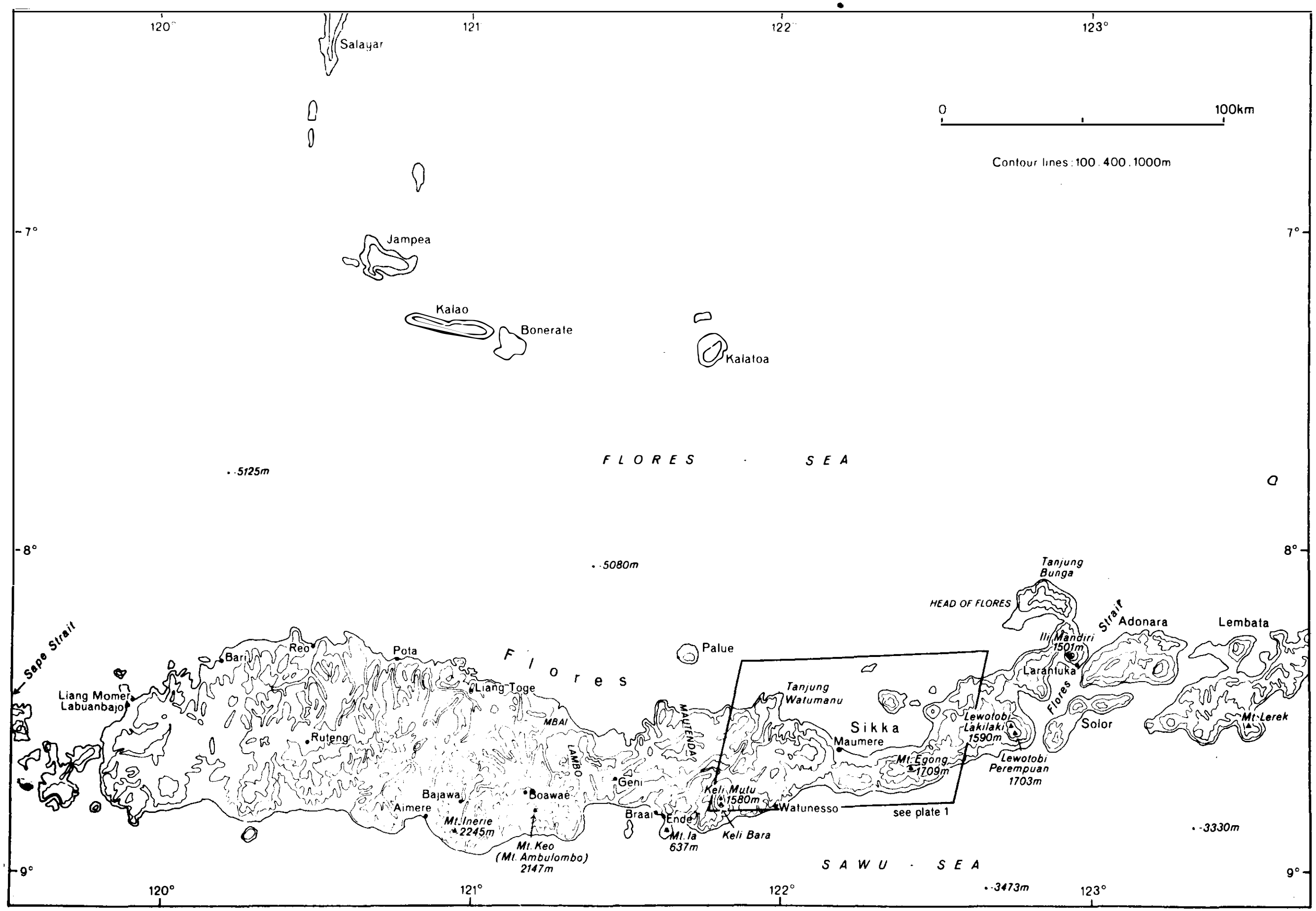

Fig.2 Isle of Flores and adjacent islands in the Flores Sea

system, was not considered. Neither was any form of livestock keeping. The stability issue refers to change over time so that longitudinal studies are ideally necessary to gauge agricultural modifications. Such a comparison was not feasible in the past, owing to a lack of detailed quantitative studies on agricultural systems. Alternatively, differences over space of agricultural intensity and productivity were considered at a given period so that cross-sectional studies could be made to gain insight into the relationships.

For the purpose of a detailed analysis Central Sikka on the isle of Flores was found to be most convenient on the following grounds (see Fig.3):

1. It is the most densely populated rural area of the eastern Lesser Sunda Islands with densities locally exceeding 500 persons per square kilometre.
2. The inhabitants of this portion of Sikka are practising solely dry-land agriculture - mainly various forms of shifting cultivation.
3. The area is located at the 'waist' of the island. Only 11 kilometres separate the north coast from the south coast between Geliting and Bola. In this comparatively small area of about 290 sq.km sufficient horizontal and vertical ecological variation was found as it comprised the volcanic cones of Mt Kimang-Buleng (1447m) and Mt Tarat-Egong (1600m).
4. Different portions of the study zone had been subjected to foreign influences: Portuguese, Dutch, Buginese traders from Sulawesi and the Catholic Mission.
5. Central Sikka's agriculture is characterized by a considerable degree of commercialization. The growing of cash crops impinges upon the cultivation of food crops for subsistence.
6. Since Sikka is a part of an island, the 'insular population' can be expected to be more aware of limited resources and to have developed adaptive strategies.
7. Last but not least the area was chosen for practical reasons. The comparatively dense net of tracks made fieldwork in the deeply dissected volcanic ridge and ravine country easier (Plates 50, 51). Moreover, fieldwork was greatly facilitated by the hospitality provided to myself and to my wife by the Divine Word Mission (Societas Verbi Divini) which had numerous mission houses in this section of Sikka.

Central Sikka is limited by the Flores Sea in the north (*tahi wai*) and by the Sawu Sea (*tahi laï*) in the south.[2] The

[2]In Sikkanese the name *tahi wai*, meaning 'Female Sea', is applied to the Flores Sea as it is relatively 'tame' in contrast to *tahi laï*, 'Male Sea', the term applied to the more stormy Sawu Sea.

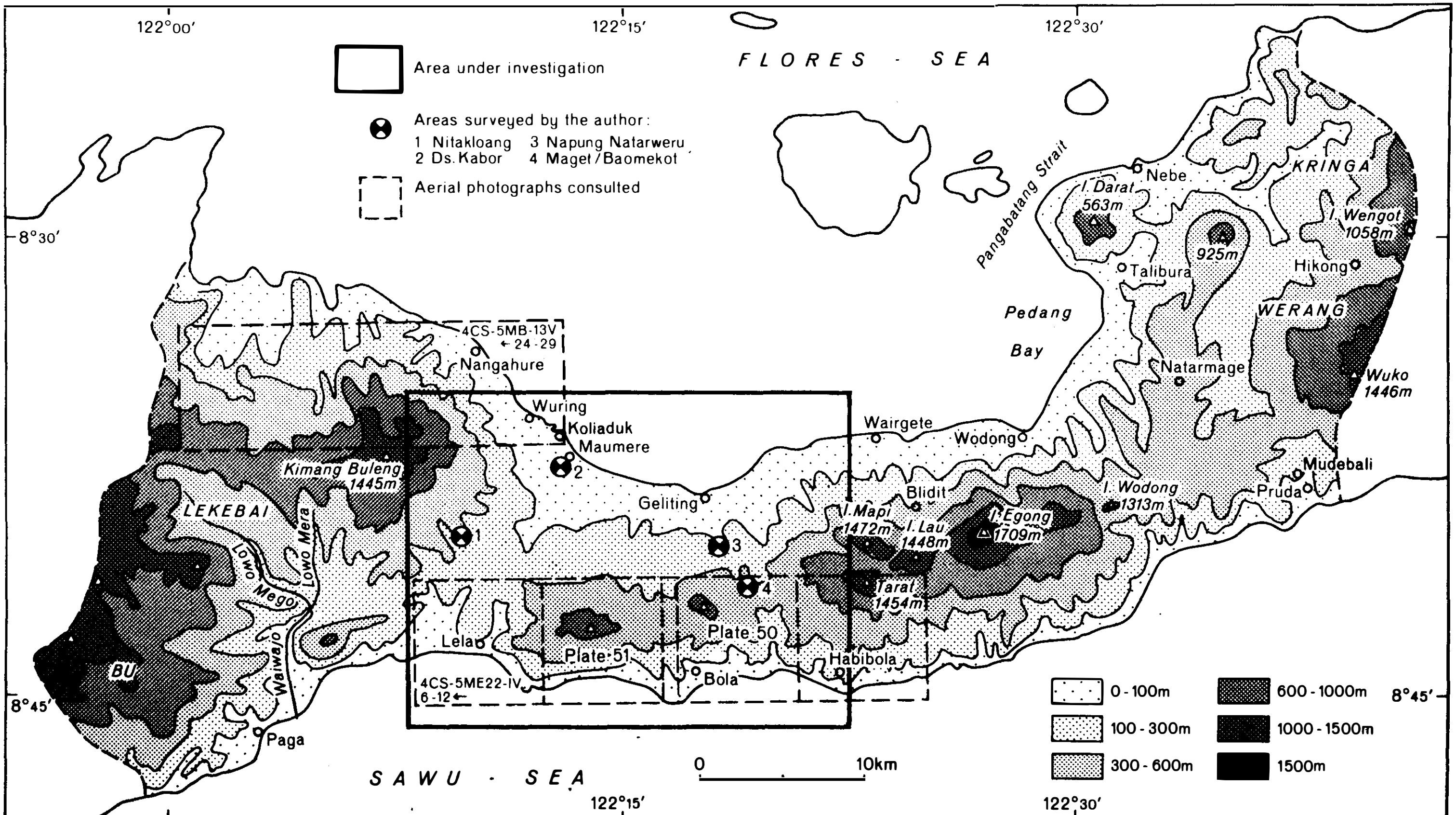

Fig.3 Kabupaten Sikka: orientation map

western limit is formed by a line roughly northeast-southwest from Wuring in the north to the mouth of the river Nangablo in the south. In the east the study area is limited by a line running roughly north-south from Wutung Koli (Cape Koli) in the north to Wutung Teping (Cape Teping) in the south. The study zone comprises roughly 260 sq.km between 122°08' and 122°23' E longitude and 8°35' and 8°45' S latitude.

The poor state of knowledge of the landscape ecology and more specifically of the agricultural systems not only of this part of Sikka but of Flores in general greatly impeded the analysis. Although the island has been known to missionaries since the very early days of European expansion in the eastern waters of the archipelago, until the present it is one of the least discovered portions of the Lesser Sundas.[3] The substantial number of published and unpublished titles on Flores and more particularly so on Sikka to be found in the bibliography of this monograph and to which a few more titles on other parts of the island could be added does not basically alter this assertion.

The sources on Flores which allude to our area of investigation may roughly be divided into those which originated before and after pacification, that is until and after the beginning of this century. Among those of the first category which were of some value to this study were rather general reports or travel journals of Roman Catholic missionaries (Cacegas 1767; Heynen 1876a, 1876b; Ijsseldijk 1890-99; Luijpen 1895, 1901; Timmers 1896), anthropologists (Wichmann 1891; Weber 1890; ten Kate 1894) and occasional visitors (Jacobsen 1890, 1896; Bickmore 1873; Buddingh 1861; Kleian 1891; Martens 1889; Vosmaer 1862; Vorderman 1888; de Vries 1886).

When in the first decade of this century the Dutch administration renounced its old policy of non-interference into affairs of the autochthonous population, Dutch civil servants entered the interior and collected material which contributed substantially to our knowledge of Central Sikka. This material was laid down in reports, so-called *Memorie van overgave*, by departing controleurs, gezaghebbers and residents to their successors to facilitate the work of the latter. These reports contained useful information to the geographer on the physical as well as ethnological, social, religious and economic life of their districts. Usually no more than five copies were written of these reports. Unfortunately of all districts of the regency of Timor en onderhoorigheden the onderafdeeling Maoemere (now called Kabupaten Sikka) is the least documented part as most reports were lost during World War II. Only a few reports could be unearthed from private sources in Sikka and in Dutch archives (Royal Tropical Institute in Amsterdam;

[3]What was known about Flores until the middle of last century has been summarized by Veth (1855, 1874b).

Algemeen Rijksarchief in The Hague); (Flores Memorie 1912; Hens 1916; Hagenaar 1934; Hangelbroek 1938; Symons 1935; Houwing 1928; Rusconi 1940a, 1940b; Rozari 1931; Seegeler 1932a, 1932b).

After pacification geologists were the first to take advantage of the opportunities offered. A detailed exploration until the second decade of the twentieth century brought an end to the legend of the island's mineral riches, above all tin. With the geologist van Rheden a series of investigations began (van Rheden 1912, 1913, 1919; Kemmerling 1926, 1927, 1929; Brouwer 1942, 1944; Drescher 1921; Ehrat 1925, 1928; de Jong 1942; Stehn 1940) lasting up to the present (Matahelumual 1961; Neve 1952). The geological structure of Sikka is, however, still not fully known. The results of various expeditions by Indonesian geologists from the Direktorat Geologi Bandung who visited Sikka several times between 1974 and 1975 have unfortunately not been made available to me.

Knowledge of the island has been greatly increased by missionaries, particularly since the end of the second decade of this century when the Divine Word Missionaries replaced the Jesuits on Flores. Studies were carried out by missionaries in the fields of linguistics, ethnology, history, physical anthropology, prehistory and biology.

Sikka's language has been studied by Calon (1890-91, 1893, 1895), Arndt (1931) and Meye (1964). Valuable observations on ethnic groups of eastern Flores were made by Father Paul Arndt (1932, 1933, 1938, 1940). His treatises on the mythology, religion and social conditions in Sikka rank as the most authoritative ethnographic studies of that part of Flores. Yet the manner in which the bulk of information collected in various parts of Sikka is presented is not satisfactory. The ethnographic material is said to stem chiefly from informants who were questioned during a short period only, and Arndt did not check the data in the field. Thus contradictory and unclear statements - particularly with respect to the precise location of the ethnic group to whom they apply - limit the value of his treatise. Other ethnographic studies were carried out by Heekens (1944), Brabander (1949), Tietze (1941), Vatter (1932) and ten Dam (1950b).

Studies on the physical anthropology of the island's population were carried out by Keers (1948), Bijlmer (1929), Glinka (1969) and Lehmann (1934), while investigations on the island's prehistory were done by Verhoeven (1952 to 1963), Vroklage (1940, 1941, 1942), Soeyono (1961) and Hooyer (1957). Contributions to the history of the island have been made by Petu (1969), Piskaty (1964), Piskaty and Riberu (1963), Rouffaer (1923-24), Velden (1911), Veth (1855, 1874b), Visser (1925), Asselbergs (1902), Biermann (1924), Bot (1955), Eerde (1923), Le Roux (1929, 1942), van Patot (1907) and Winokan (1960).

Comparatively little information is available on the island's physical environment other than its geology.[4] A few soil samples were collected in the thirties by Mohr (1934) and more recently by Direktorat Jenderal Kehutanan (1974), Fakultas Pertanian (1975), and Carson and Hidayat (1976). Yet up to now no soil maps of Flores have been produced. Apart from a few brief studies by Rensch (1930, 1931), Schmutz (1968), Teysmann (1874) and, more recently, by the Forestry Service of the Lesser Sunda Islands (DJKP 1972, 1973) no systematic inventory of Flores' vegetational pattern has been attempted. Thus Sikka's forest remnants have never been systematically investigated. The local Forestry Service has not even been able to map the forest reserves accurately.

After pacification private companies and governmental institutions experimented with the growing of cotton in several places along Flores' north coast. Sikka was one of the centres of cotton cultivation. Adverse ecological conditions, lack of expertise and deteriorating prices for cotton on the world market finally brought an end to this activity. But this development also underscored the rising need for an agricultural extension officer to be permanently stationed on the island. Demands of this nature were eventually complied with in the 1930s after an agricultural extension service was established in the regency of Timor en Onderhoorigheden in 1931 (NIJS BIK 1934:29). The so-called *adjunct-landbouwconsulent* of Flores stationed at Ende was assisted by a *mantri* in each district (*onderafdeeling*). His task was to combat erosion and to increase the level of agricultural production. The reports of these extension officers were, however, destroyed during the war. It is only for the postwar period that reports and *werkplanen* of these officers are available (Tomasoa 1947, 1953; Netja 1954a; van Doormaal 1948a, 1948b, 1950; Dinas Pertanian Flores 1948-54; Dinas Pertanian Rakjat Sikka 1947-75).

In the postwar years which were the final years of Dutch rule in Indonesia the government showed a growing interest in Flores' agriculture. This is documented by visits of several agronomists whose findings are laid down in official reports deposited at Bogor (Franssen 1948; de Haan 1948; Terra 1949; Unger 1950). None of these reports, however, contained any detailed information on Sikka's agricultural systems, on rural economics or on the impact of traditional beliefs (*adat*) on agricultural practices. A striking exception to this was ten Dam's detailed study of the relationship between economic development and social structure of the people of Nita and environment (ten Dam 1950b). Although the imprecise style of the Indonesian version of his study, which was the only one available to me, makes for tedious reading occasionally, it nevertheless is one of the major sources on which the present study could draw.

[4]The regional development study of eastern Indonesia carried out by the Canadian International Development Agency between 1974 and 1976 unfortunately contributed little to the knowledge of the physical environment of Flores (see Carson and Hidayat 1976).

The present study was seriously impeded by the virtual absence of reliable maps and aerial photographs. The only map available on Sikka is a sketch map (*Verkenningskaart*) of the Onderafdeeling Maoemere at a scale of 1:100,000 produced by the Dutch Topographical Service in Weltevreden in 1930. For detailed geoecological research this map was, however, useless, as neither the river courses nor the location of the few villages indicated on the map could be relied upon. Their actual location was frequently far removed from the point indicated on the map. As it turned out, the contour lines found on the map bore no relation to any actual heights. No theodolite had been used. The scale was often not in proportion to reality. Hence this sketch map cannot be compared to the 20-sheet series of the topographic map of West Timor at the scale of 1:100,000 which, despite its shortcomings, is still 'a marvel of precision' (Ormeling 1955:7).

For this reason I was compelled to construct a detailed map of place names of Central Sikka at a scale of 1:25,000. The result of this painstaking undertaking is presented on the orientation map of this study (Fig.53),[5] to which have been added contour lines blown up and transferred from the fairly reliable US Army map of Sikka 1:250,000, in order to convey at least an approximate idea of topographic conditions. I am convinced that this orientation map is by far the most detailed map of this part of Sikka. It contains over 360 place names, 240 names of rivers and creeks and 111 names of hills and ridges. Such a detailed inventory was necessary in this most densely populated rural part of the eastern Lesser Sundas to enable precise statements to be made as to actual regional distribution of the population and demographic development. Owing to frequent shifts of administrative boundaries comparison of demographic data was rendered impossible. For this reason recourse had to be made to the smallest units - villages and hamlets. Moreover, a very detailed map was required for the precise delimitation of agricultural systems.

Of some - however, limited - value for the elaboration of this map were aerial photographs at a scale of approximately 1:40,000 taken during World Ward II of Sikka's south coast as well as of some portions of the north coast by Allied Forces. Unfortunately Central Sikka's north coast has not been covered by these photos. Finally also an ERTS-satellite photograph of Sikka has been used on which the remnants of evergreen forests on Sikka's volcanic cones are clearly visible. The satellite photo also served to illustrate the shortcomings of existing maps as far as the coastlines are concerned (see Plate 1).

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[5] The original map was reduced to 1:50,000 for reproduction here.

The bulk of the factual content of this study including all but seven of the thematic maps was compiled from material collected in Sikka from October 1975 to July 1976. The fieldwork during which 26 soil samples from Central Sikka as well as 29 from Lekebai were collected was mainly carried out on foot and on horseback, while jeeps of the mission were used whenever larger distances had to be covered.

The core of this study consists of a questionnaire carried out between March and July 1976. During this period 950 farmers belonging to 19 *desa* (smallest administrative unit) were individually interviewed - 15 to 20 farmers per day. In order to obtain data that were as realistic as possible the names of the farmers were deliberately omitted and questions were put to volunteers only.

I carried out the interviews in Indonesian and Sikkanese myself.[6] This fact and a series of control questions increased the reliability of the data obtained. During the fieldwork I was greatly assisted by my wife as well as occasionally by local assistants who acted as translators. In order to check the validity of the information, control spots were surveyed with the aid of a theodolite at four locations indicated on Fig.3. The information from the owners of these fields was checked against actual evidence found during the survey.

The book opens with a brief discussion of the theoretical framework to which this study attempts to make a contribution. The elements of the Sikka ecosystem are then traced in the first chapter. It is shown that Central Sikka's ecosystem is shaped on one hand by unique physical factors quite distinct from those encountered in other parts of Sikka, Flores or on the islands of the outer arc of the Sunda mountain system which limits Asia to the south. On the other hand it is shaped by man who is considered as the chief agent in Central Sikka's ecosystem. As in my opinion the degree of stability of Sikka's agricultural systems is largely determined by the forces to which a particular region has been subjected in the past, Sikka's history is traced in considerable depth. In view of the absence of a comprehensive history of the island this section of the study was found to be particularly challenging. To my knowledge it constitutes the first attempt at analysing Sikka's history in full. A thorough understanding of Sikka's history - as far as this is possible to obtain in view of the sketchy bits of written and unwritten information available - was also found to be necessary in order to evaluate the impact of Dutch rule upon the present settlement pattern and the system of land tenure. A description of the area's chief agricultural

[6]My command of Sikkanese, although insufficient for conversation, was adequate for the interview. Help of the village head (*kepala desa*) or of village elders, however, was frequently drawn upon.

systems, their regional and temporal differentiation, concludes the first chapter.

In the second chapter the main forces that have caused changes of the Sikka ecosystem - and as such also of the agricultural systems - are traced. This leads directly to the discussion of the stability of agricultural systems (Chapter 3). The stability issue is viewed from different angles: a population-centred, a resource-centred and an economic perspective. Finally a comprehensive geoecological interpretation is attempted.

In the conclusion the results of this study are related to the theoretical framework outlined at the beginning. As I believe that the quest for general rules remains the main objective of detailed regional studies, it is hoped that the findings of this research will be of value for similar studies in other parts of the wet and dry tropics.

Theoretical framework

The problem of land shortage and population pressure has been a recurrent topic in geographical and anthropological literature (see for example Zelinsky *et al.* 1970; Spooner 1972). This topic is of particular relevance to islands with limited resources. In the Indonesian archipelago, Java's population problems above all have attracted the attention of researchers (Bryant 1973; Kuperus 1930 and 1938; Mohr 1938; Manderson 1974; Bennett 1957; van der Kroef 1953; McDonald and Sontosudarmo 1976), whereas only marginal allusion has been made to the problem of population pressures in the so-called outer islands. According to Geertz (1963), the latter are considered to be based essentially on a system of shifting cultivation (*ladang*) which is said to support far fewer people and under population pressure is believed to collapse. This is in contrast to wet rice cultivation (*sawah*), considered typical for Java, Madura, Bali and parts of Lombok, which has permitted far higher population densities. Geertz draws a sharp contrast between the fragile *ladang* and the flexible *sawah* ecosystem. When population increases, he believes that greater intensity in farming existing rice fields (e.g. improved water control) will bring about higher yields than the cultivation of additional land. Such an intensification of labour under a given agricultural system - which he calls 'agricultural involution' - is possible as *sawah* can be cropped perennially without noticeable declines in yield. In contrast, when in *ladang* ecosystems population pressure forces the people to return to cultivate a piece of land before soil fertility has had time to recover, the system is in danger of collapsing. Hence intensification of a given *ladang* system seems to be limited.

In terms of economic theory, Geertz shows that labour intensification in the *ladang* system is unrewarding because it leads to a rapid decline in marginal returns approaching and even falling below zero since the environment is destroyed through excessive utilization. The *sawah* system on the other hand is characterized by a far greater elasticity of response to additional input of labour and skill, so that marginal productivity remains above zero for a long time after average productivity has ceased to grow with additional inputs (see Fig.49, p.239). This facilitates the ingrowing process of 'agricultural involution' by which intensification of organization is carried to an extreme degree. Geertz considers this shared poverty typical of Java.

Geertz's thesis, which was based neither on quantitative nor on qualitative fieldwork, was not without its critics.[1] One of the comments was that his description of the *ladang* system has relevance for one place only - namely West Sumatra as described by Schrieke (1955). What he described was thus only one of many different *ladang* systems existing in the Malay Archipelago.

The actual demographic situation on a number of the so-called outer islands, however, does not seem to be in line with the above-mentioned picture advanced by Geertz. Thus high agrarian densities are also found outside Java, Bali and Lombok in areas where a form of shifting cultivation - though admittedly with short rotation cycles - constitutes the dominant form of agriculture. Such an area is Sikka on the isle of Flores, where population densities of locally over 500 persons/sq.km are to be found. High population figures have obviously been possible for a number of decades without leading to a collapse of the system.

The example of Sikka shows us two things. First, under certain conditions the ecological stability of *ladang* systems has obviously been underestimated, and consequently far higher population densities seem to be possible. Second, population pressure does not necessarily lead to intensification[2] of the agricultural system. This leads us to a central issue in the study of development, that is the relationship between population growth and agricultural systems. The questions to be asked are: To what extent do demographic factors determine the degree of intensity? And how is the ecological stability of agricultural systems affected by population pressure?

The study of the interaction of population growth and agricultural change has been a subject of considerable interest for researchers from various disciplines.[3] Broadly speaking there are two main theories. The first is based on the principles of Malthus (1798) who maintains that continuous population growth can only be generated through the introduction of technological change. The simplistics of Malthusian theory with its abrupt checks to further population growth once a capacity level is attained were refined, as we saw, by Geertz (1963).

[1]Geertz's concept of agricultural involution was critically examined by several authors (Levine 1969; Larkin 1971; Muijzenberg 1971; White 1973; Witton 1969; Polak 1972-73). Replies to White's criticism were written by de Walle (1973) and Geertz (1973).

[2]'Intensification of agricultural production' describes the additional inputs of capital, labour and skills against constant land. The chief purpose of intensification is the substitution of these inputs for land, so as to gain a higher production from a given area.

[3]Most economic growth models for the rural sector treat population as an exogenous variable (e.g. Harrod 1952; Solow 1956); also agricultural methods and the pattern of land tenure are treated as given.

The opposite standpoint is taken by Boserup (1965), a Danish economist, who inverts the Malthusian argument by maintaining that population is the independent rather than the dependent variable. The adoption of more intensive technologies of production (i.e. new production functions) is thus caused by population pressure on resources. Boserup maintains that historically the supply of agricultural production has been highly elastic in response to population pressure. This higher output per hectare, she argues, is due to more intensive labour input. The intensity of land use is measured in terms of length of fallow and is seen as a dynamic continuum from long forest fallow to annual and multiple cropping. The following is a condensed version of her scheme (Boserup 1965: 15-16):

1. Forest-fallow cultivation. This involves the clearing of spots which are cropped for short periods - a year or two - then allowed to revert to forest in order to allow soil fertility to be restored. This means that the period of fallow must be at least 20 to 25 years.
2. Bush-fallow cultivation. While cropping periods may last between 1 and 8 years fallow periods are shorter (6-10 years).
3. Short-fallow cultivation. Very short fallow periods of one to two years, so that only grass has time to grow.
4. Annual cropping. Cropping periods of a few months, usually with annual rotations.
5. Multicropping. Two or more successive crops are produced annually. Hardly any fallowing.

According to Boserup the succession from forest-fallow to multicropping is accompanied by a succession from simple agricultural tools - e.g. digging sticks - to sophisticated tools - e.g. ploughs, horses or tractors. Such development only occurs - she proposes - when forced by population pressure, because such intensification involves an increase in labour input and a decline in productivity per man hour. Only in a multiple cropping situation, Boserup claims, does a combination of a forced lowering of the level of subsistence and adaptation of more efficient tools and draught animals eventually also increase the product per man hour.

Boserup's approach and theory have generated a very fruitful discussion and stimulated further thought. Her theory received support from archaeology (Smith and Young 1972:62ff.) and studies of tribal agriculture (Netting 1968:115 in Nigeria; Seavoy 1973: 225 in Kalimantan, Indonesia; Clarke 1966:357 in eastern New Guinea; Lee 1972:329ff. in southern Africa). Other studies have encountered difficulties in applying her propositions and have suggested qualifications to her arguments (Maude 1970:63, 1973:181 in Tonga; Brookfield and Hart 1971:105ff. in Melanesia; Brookfield 1972:41 in the Pacific; Bronson 1972:190ff.; Waddell 1972:217ff. in eastern

New Guinea; Harris 1972:180ff.; Eder 1977:15ff. on the isle of Palawan, Philippines; Lea 1965:212ff. in eastern New Guinea; Sanders 1972:147ff. in Mesoamerica; Ekvall 1972:269 in Tibet; Vermeer 1970:314 in Nigeria, and recently Datoo 1978).

The widely differing views held with respect to the usefulness of Boserup's and Geertz's theses as guides to interpretation suggest that considerable uncertainty exists about the causal weight of population pressure in the process of agricultural intensification and thus also with regard to the ecological stability of agricultural systems. Their conceptions are certainly not borne out by research and may be considered as of heuristic value. They certainly cannot be a substitute for precise empirical studies to assess the nature and impact of the relationships between the relevant variables (Bennett 1976:230-1) whereby the quest for general principles will be paramount.

It was therefore found to be highly challenging to obtain a thorough understanding of what determines the degree of the stability of agricultural systems in one of eastern Indonesia's most densely populated rural areas where *ladang* cultivation is still the prevalent form of agriculture. The argument will be developed stepwise. Each major chapter of the study will be concluded with a discussion of our findings in Central Sikka as they relate to the issue of the stability of agricultural systems.

The approach will be inductive - that is detailed investigation in the field as basic to geoecological research. Such an approach proved to be highly rewarding in my previous studies on the isle of Timor (Metzner 1977a). In a north-south cross-section of about 60 km of eastern Timor between Baucau and Viqueque the intimate relationship between man and his environment was analysed. It was demonstrated qualitatively and quantitatively that environment had been destroyed for agricultural use at a number of places. The Timor study also showed that the simple relationship between natural resources and population density did not provide sufficient explanation for the degree of ecological stability of agricultural systems at a number of places in the area under investigation. For this reason I decided to pursue this issue in more detail in other parts of the eastern Lesser Sunda Islands, preferably under distinctly different ecological conditions and under high densities of populations.

To this end my wife and I made a reconnaissance trip to West Sumba where a preliminary inventory was made in a cross-section between Memboro in the north and Rua in the south, and eastern Flores (Kabupaten Sikka) from October 1974 to January 1975.

Actual fieldwork was carried out in Sikka from October 1975 to July 1976 and subsequently for two months in West Sumba. Owing to the preparations for general elections which were scheduled for

June 1977, however, a questionnaire similar to that which I carried out in Central Sikka could not be held in West Sumba as had been planned originally. Since the major elements for comparison could not be obtained from Sumba, I decided to restrict the analysis of the issue of stability to Central Sikka. Data collected on the geoecology of West Sumba will be presented in a separate study.

Chapter 1

Elements of the Sikka ecosystem

Physical characteristics of Central Sikka

Physiography and relief types

The isle of Flores (14.125 sq.km) is part of the Sunda Mountain System, a fracture zone of high crustal instability and strong gravity anomalies which shows the characteristics of the so-called 'Pacific Mountain Type' - i.e. Tertiary fold mountains with active volcanoes next to a deep sea trough. This fracture zone, which is considered one of the most seismic areas of the world (van Bemmelen vol.1a, 1949:3), skirts Island Southeast Asia from the Andaman Islands in the west to the Moluccas and the Philippines in the east. It consists of two arcs of islands running roughly parallel: the so-called non-volcanic outer arc to which belong the isles of Sumba, Sawu, Roti and Timor; and the volcanic inner arc consisting of Bali, Lombok, Sumbawa, Flores, Adonara, Solor, Lembata (formerly known as Lomblen), Pantar, Alor and Wetar. Characteristic are the considerable differences in altitude between the mountain ranges and the adjacent deep sea troughs which in the area of the Lesser Sunda Islands reach their greatest depths at 5,125 m in the Flores Sea (Flores trough) and 3,473 m in the Sawu Sea (Sawu trough) (see Fig.4). Our knowledge of the geology of Flores is still insufficient. All we have is a geological sketch map (Ehrat 1928) summarizing the state of knowledge in 1925. Since then three memoirs of the Volcanological Survey in the Netherlands Indies have been published on the volcanoes of Flores and the neighbouring islet of Palue (Kemmerling 1929; van Padang 1930; Stehn 1940). Significant contributions were later made by Brouwer (1942, 1944) and de Jong (1942) who carried out fieldwork in Central Flores in 1937 as members of the geological expedition of the University of Amsterdam to the Lesser Sunda Islands. The present poor state of knowledge is somewhat surprising as rumours of the existence of large deposits of tin ore lured a good many geologists to the shores of the island as early as the last decades of the nineteenth century (Ehrat 1925:222).

Despite a few expeditions across the Manggarai in West Flores by J.P. Freijss (1860) in 1855, A. Colfs (see Vorderman 1888) in 1880 and controleur J.W. Meerburg (1893) in 1890, the island's interior remained *terra incognita* and consequently beyond

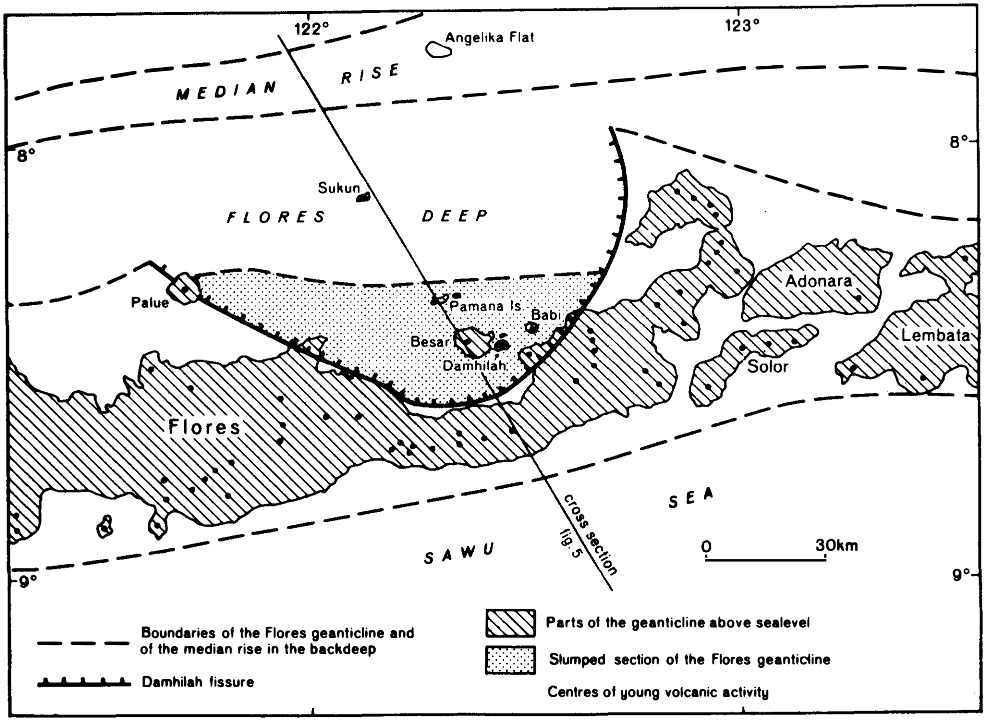

Fig.4 Structural sketch map of East Flores (after van Bemmelen 1949 vol. Ia:495)

administrative control until the first decade of this century. Hence geological research was limited chiefly to the shores.[1] An official geological expedition of the Government of the Dutch East Indies led by van Schelle (1890a, 1890b) to the Roka district of Ngada where large deposits of tin ore were expected had to give up despite heavy military protection because of resistance by the native population. It was thus only after the pacification of the island's interior in 1907-8 that a new effort was made to

[1]Because of lack of security Arthur Wichmann, a professor at the University of Utrecht, did not succeed in studying the geology of Flores, the main object of his expedition sponsored by the Royal Dutch Geographical Society (Koninklijk Nederlandsch Aardrijkskundig Genootschap) between 1888 and 1889. Frequently the soil was considered sacred by the natives. For instance, when Wichmann arrived on the isle of Palue (north of Flores) in 1888 and started to collect rocks, the natives - however friendly when he arrived - compelled him to leave the rocks in their place and to leave the island at once (Wichmann 1891:101-2).

investigate the mysterious tin ore deposits - with negative results, however (van Rheden 1910, 1911, 1919). After the issue of presumed tin deposits was dropped in the early twenties (Ehrat 1925:223) only sporadic geological investigations were made by Kemmerling in 1924 (1929), Brouwer in 1937 (1942), de Jong in 1937 (1942) and Stehn (1940) in different parts of the island. For over thirty years from 1940 to 1973 hardly any geological work was carried out on the island. Since 1974 geologists from the geological department (*Jawatan Geologi*) in Bandung under the leadership of engineer Kusumadinata have repeatedly visited the island to investigate. However, the results of this research have not been published and thus were not available for the present study.

Flores consists of an east-west oriented anticline which runs the length of the island over a distance of 350 km. This geoanticline is characterized by a general eastward plunge and consists of Tertiary sediments - Miocene limestone and marls - which are considered the oldest (known) geological formation of the island (Ehrat 1928:276). Two series can be distinguished: an older (old-Neogene) so-called 'Reo-formation' (van Rheden 1911:208ff.) attaining a thickness of at least 2,000 m in West Flores, on top of which we find another series of young Neogene origin of some hundreds of metres. These sediments are exposed on the northern flank of the anticline while a row of volcanoes have built up on the crest and on its southern flank during the Quaternary. Some of these volcanoes have continued their activity until the present time, while others became extinct in the course of the Quaternary (van Bemmelen vol.la 1949:497). According to Ehrat (1925:277ff.) the eruptive period during which basic as well as acidic rocks were formed must have started during the lowest part of the Miocene, as is testified by intrusive rocks (granite, quartzdiorite and gabbro; see also Brouwer 1942) and extrusive rocks (rhyolite, dacite, andesite and basalt) which are found in between the sedimentaries.

Severe tectonic activity occurred in Flores at the end of the Neogene as a result of which the geoanticline was severely folded and warped up. Volcanic centres are arranged along tectonic lines - that is deep fault lines running in various directions in western and central Flores but turning to a northeast-southwest direction in the eastern part of the island (Ehrat 1925:287ff.). Since the Pliocene a continental uplift has taken place in abrupt stages - which was particularly severe during Pleistocene and Recent times and gave rise to a series of terraces of raised reef limestone and coral reefs. Raised coral reefs, which have been located up to 550 m above sea level in the northwestern part of the district of Ende (Ehrat 1925:265), are to be found chiefly along the entire north coast of East and Central Flores as well as occasionally along the south coast. Only the south coast of Manggarai in West

Flores is devoid of those terraces.[2] As a result of this continental uplift the geoanticlinal belt which is found throughout the inner arc of the Lesser Sunda Islands broke into a number of isolated blocks separated by deep faults and obtained its present appearance of islands separated by straits (van Bemmelen vol.1a, 1949:495). In the case of Flores these are the Sape Strait in the west and the Flores Strait in the east. In eastern Flores it was only after the uplift that saddles between the volcanoes emerged, for example the saddle of Nita between Maumere and Lela (Kemmerling 1929:78).

The turbulent geological past gave rise to a complicated relief characterized by V-shaped valleys, knife-edged, highly dissected ridges running in all directions. A prominent feature of the island is the juxtaposition of active volcanoes and older forms of volcanism. A fine example of the latter is the caldera of Kelimutu in Central Flores with its three-colour lakes. Only in Java and Sumatra do we find a greater number of active volcanoes than in Flores with its fourteen volcanoes at least in fumarolic stage, most of which have erupted in historic times (Kemmerling 1929:3). The latest eruptions took place in 1938 at Mt Lewotobi Perempuan in East Flores (van den Ende 1954:4), Mt Lerek on Lembata in 1948 and 1951, and in 1969 at Mt Ia near Ende (Direktorat Djenderal Kehutanan 1969). Evidence of the high degree of crustal instability are the earthquakes hitting the island every year (see for instance Djawatan Meteorologi dan Geofisik 1961).[3] While the spurs of the

[2]While according to van Bemmelen (vol.1a 1949:496) these raised terraces are notably absent along the south coast, a recent study strongly based on the interpretation of satellite photographs by Morton (1975) has arrived at a different conclusion (see Fig.6).

[3]The epicentres of these earthquakes are located along fault lines which run northeast-southwest across the island and for the Sikka section of Flores are illustrated in Fig.6. One of the heaviest earthquakes which also caused widespread damage in Sikka (Document no.263 from government archive of Sikka, *Daftar kerugian bencana alam di Daerah Sikka, Maumere 29.3.1961*) occurred on 16 March 1961. Its epicentre was about 60 km off the north coast of Flores (off Cape Watumanu). The principal earthquake movement occurred along a fault line connecting the town of Ende in the south with the epicentre in the north. The locations of the faults on Flores, although not yet fully checked in the field, have been depicted for the first time by Morton (1975). A comparison of his geological sketch map with the map of the Flores earthquake of 1961 by the Djawatan Meteorologi dan Geofisik (1961) strongly substantiates the above statement.

As these structural lines are only encountered as far west as Ngada on Morton's sketch map, a striking similarity occurs with the trendlines of the Young-Mesozoic Timor Orogene presented on a map by van Bemmelen (vol.1a 1949:538 and plate 24, fig.250). The impact of the latter structural lines on the alignment of present fault lines in central and eastern Flores has to my knowledge never been analysed.

volcanoes plunge rather steeply into the sea on the south coast, the central mountains slope somewhat more gently to the north coast where they form a few embayments (Mbai, Mautenda, Magepanda). Yet these few more level portions which make up less than 5 per cent of the entire area cannot basically alter the highly mountainous character of the island.

This general geomorphic pattern of a central upland, in which volcanic cones are prominent features, flanked north and south by foothill spurs and a few embayments on its north coast, can also be distinguished in our area of investigation. From the particular shape of Central Sikka, however, where the Flores Sea is separated from the Sawu Sea by only 11 km, a certain geological structure can be surmised. The elevated northern section of Sikka where raised terraces are to be found is bordered by the bay of Maumere, in the middle of which lies the Damhilah fissure. This fissure is believed to run in a wide crescent from the isle of Palue in the west through Talibura and Nebe and finally to bend northeast (see Fig.4) (van Bemmelen vol.1a 1949:495-6). Here in Sikka where the island is at its narrowest, the northern flank of the Flores anticline is believed to have slumped and to have been submerged by what is now the bay of Maumere. At the northern side of this bay we find again raised coral reefs in the Pamana Islands before the Flores anticline plunges to the Flores Deep. The isle of Sukun forms the summit of another isolated volcano, 55 km north of Maumere. Its extinct cone rises from a base of more than 2,000 m below sea level (Fig.5). It occupies an intermediate position

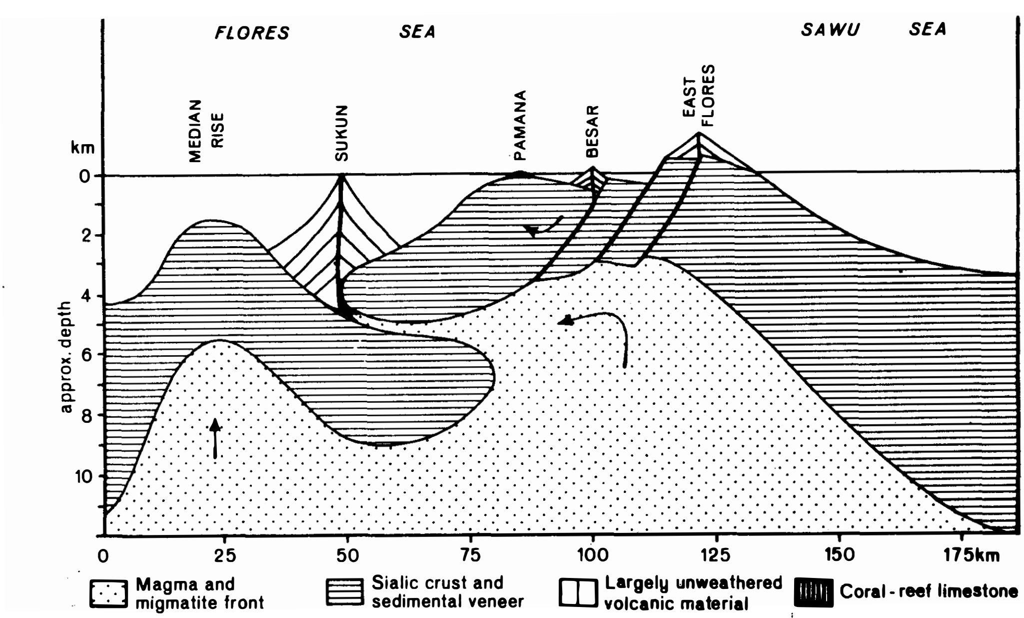

Fig.5 Geological cross-section across East Flores (after van Bemmelen 1949 vol.Ia:496)

between the Flores anticline and the Angelika Flat situated on a submarine ridge, called 'median rise' by van Bemmelen (vol.la 1949:491 and 495), of the Flores Deep (= Flores trough).

The cross-section (Fig.7) illustrates the specific geological situation of Central Sikka roughly between the coral islets of Pamana in the north, through the Tolawair ridge which forms the watershed and further to the Sawu Sea in the south. In this portion of Flores - between Lio and Talibura - the Neogene sediments do not reach the surface. Instead a layer of mainly basic volcanic debris consisting of tuffs, basalts and andesites[4] of several hundred metres covers this area. On the north coast, east of Maumere, raised coral reefs are to be found. In the north, the volcanic material slopes gently to the sea where a wide coastal plain is formed, whereas it descends rather abruptly to the Sawu Sea. Here volcanic ridges abut in cliffs. In this zone a series of small discontinuous fault planes (called *breukvlakken* by Kemmerling 1929:81) are conspicuous, resulting from slumping of layered volcanic material. Wherever tectonics gave rise to small benches - e.g. at Hokor - they became sites for settlements.

After this brief description of the characteristics of Central Sikka's relief we are now in a position to divide the study area into the following six major physiographic zones (Fig.8):

I. Volcanic cones
   a. Kimang-Buleng
   b. Tolawair
   c. Dobo
   d. Tarat-Egong

II. Northern slopes of Kimang-Buleng and Tarat-Egong volcanoes
   a. Northern slopes of Kimang-Buleng
   b. Northern slopes of Tarat-Egong

III. Saddles in between volcanoes
   a. Saddle of Nita
   b. Saddle of Blatatating
   c. Saddle of Baomekot

IV. Northern ridge and ravine zone (100-600 m)

V. Northern coastal plain (0-100 m)

VI. Southern volcanic escarpment.

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[4]Although Sikka's andesites have not been studied in detail, they may be assumed to consist chiefly of pyroxenandesites as were found in east Flores (Mt Ili Mandiri and Mt Lewotobi Laki Laki) by Brouwer (1944) and in central Flores (Geni, Mt Keli Mutu and Mt Keli Bara) (see Fig.2) by Elbert (1911). Elbert's rock samples were analysed petrographically by Rack (1912) in a doctoral thesis.

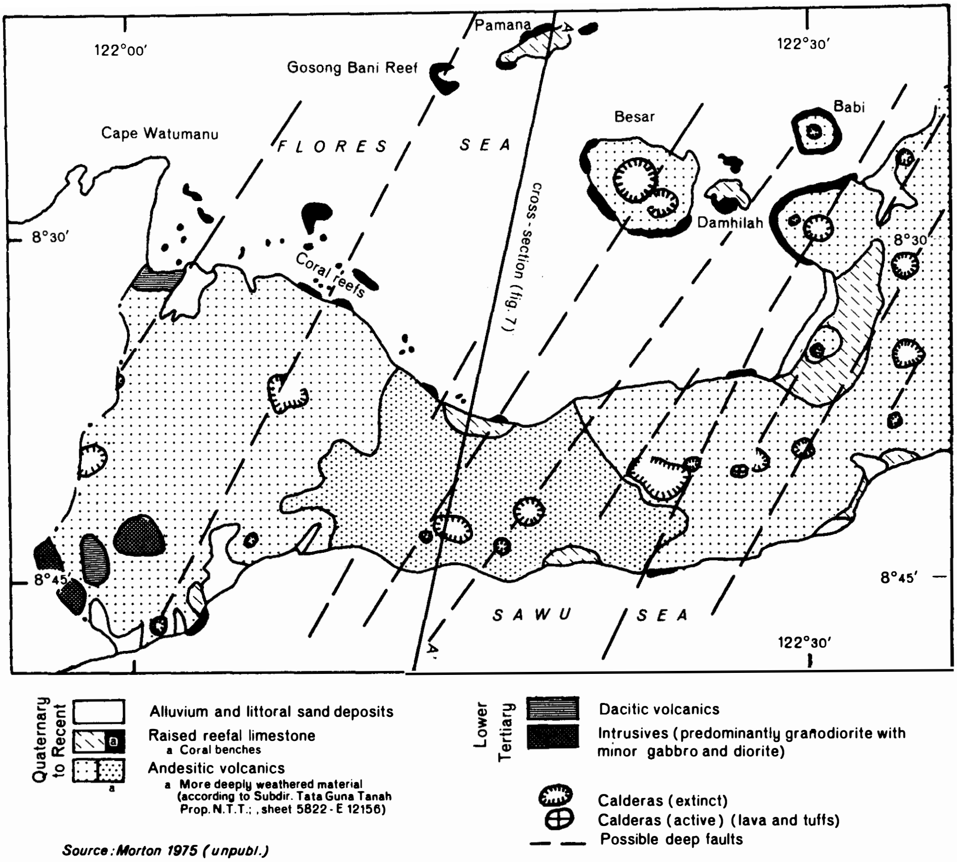


Fig.6 Sikka: geology

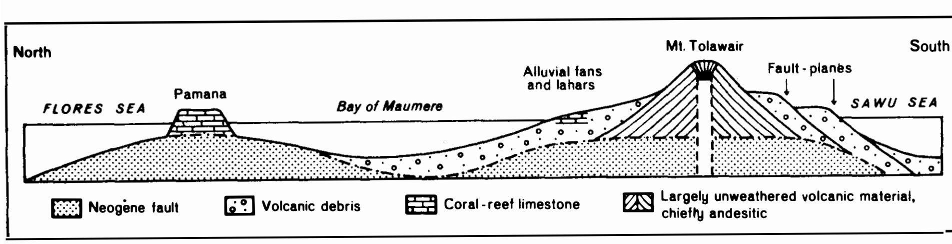


Fig.7 Schematic geological cross-section across Central Sikka (without scale) (after Kemmerling 1929:81)

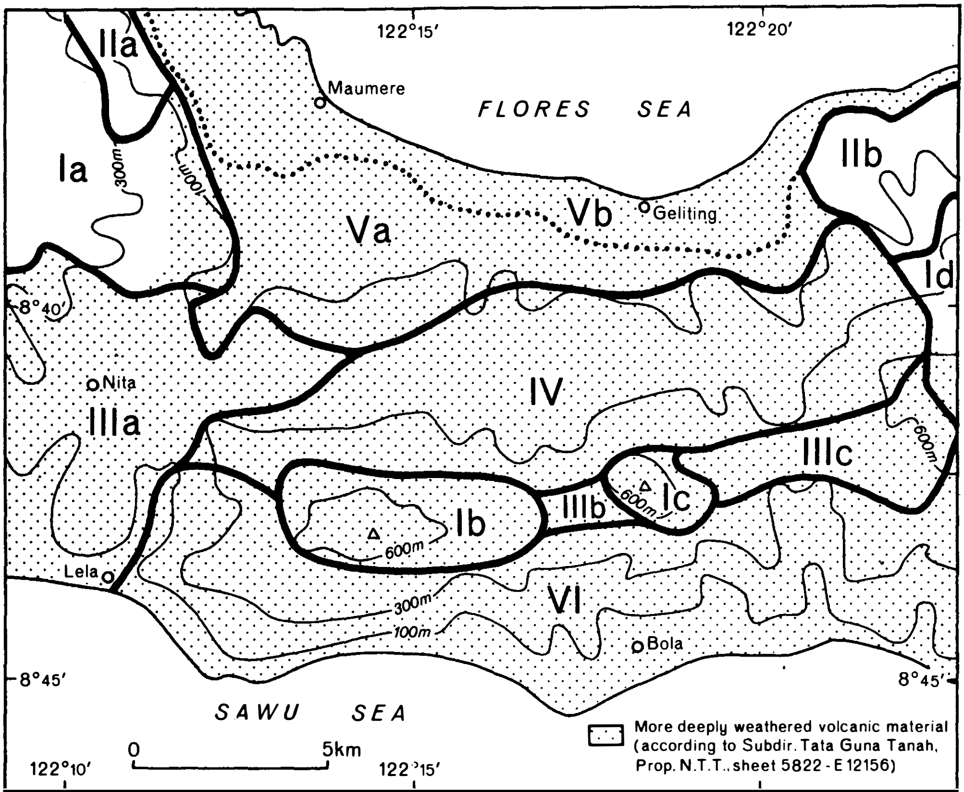


Fig.8 Central Sikka: physiographic zones

I. Volcanic cones

This physiographic zone comprises the Quaternary volcanoes which are prominent landmarks in Central Sikka. Four volcanic zones can be distinguished:

a. Kimang-Buleng volcano (1446 m) (Plate 5), which has been dormant as far as recorded and which consists of two craters, one of which is filled by a lake. Although deeply eroded particularly on its northern and eastern slopes the slope of a volcanic cone is still clearly visible from Maumere while it loses the character of a volcano when seen from the south.

b. Tolawair ridge.[5] The crest of this prominent row of peaks (I. Gai 909 m, (Plate 15), I. Pigang 956 m, I. Tolawair 944 m, I. Jele 785 m), located in between the Nita saddle in the west and the saddle of Blatatating in the east are believed to have once formed the northern portion of a huge crater (Kemmerling 1929:78).

[5]Since no general term exists for the row of volcanoes, I decided to name it after one of the peaks (I = Ili:mountain), also occasionally termed Dolawair.

c. Dobo, an old eruptive cone consisting of three peaks (Ili Dobo 810 m, I. Ladan 797 m, I. Hawoat or I. Doi 800 m). This row of peaks (Plate 4) is believed to form the remnants of a volcano which built up upon the saddle linking the Tolawair ridge in the west with the Tarat-Egong complex in the east.

d. Tarat-Egong (Plate 2) consists of three spine-like peaks east of the saddle of Baomekot. Here the island widens markedly and the peaks are less clearly visible as compared to the previously described cones. These three peaks form a triangle with I. Tarat (1454 m) (west) and I. Lau (1448 m) (east) at the base and I. Mapi (1472 m) at the apex.[6] Kemmerling (1929:30) believes that once a crater must have been active in this triangle which forms a huge caldera (see Fig.6). These peaks are linked to the Egong volcano (1703 m) which is in the solfataric stage. Although this volcano must have been more active in historically recent times, accurate information is hard to come by. Vosmaer (1862:149), Heynen (1976a:33) and Wichmann (1891:105) report that this volcano was active in 1860 and 1888. The degree of activity, however, is not clear. The last eruption is reported to have occurred in 1907 (Matahelumual 1961:10). Its crater is said to be at least seasonally filled with water (Kemmerling 1929:83; Neve 1952:7).

II. Northern flanks of Kimang-Buleng and Tarat-Egong volcanoes.

This zone is characterized by presumably more recent eruptive material as compared to Central Sikka which is situated on gentle and moderate slopes. It is immaturely weathered (often less than 30 cm) and an impermeable pan is formed in the soil profile.

This zone is covered by *Imperata cylindrica* grass, *Heteropogon contortus*, *Botriochloa* sp., *Polypogon* sp., *Sorghum* sp. *Koli* palms (*Borassus flabellifer*) which once must have covered the entire zone are still found in isolated specimens (Plate 2). A number of ephemeral rivers (except for the Wairgete which flows throughout the year) have cut through this zone. Locally structural control by hard lava beds has led to steep-sided gorge-like valleys. Alluvial fans have been formed at the foot of the volcanoes. From the

[6]The naming of mountains has obviously been a problem in Sikka ever since this part of Flores was visited by Europeans. Hence widely differing names for the same mountain or different locations for the same name can be found in reports. Things are rendered particularly complicated by the native population who use various names for the same mountain or river depending on the angle from which it is viewed.

existence of huge rocks in the eastern portion of this zone Kemmerling (1929:81) concludes that cold *lahar* (Indonesian for mud flows resulting whenever volcanic deposits are mobilized by the addition of water) must have spilled over the floodbeds and been deposited in the foothill zone of the volcano. These *lahar* were locally covered by lava (e.g. 5 km west of Wairgete) which protected the underlying material against erosion and consequently protrudes from the rest of this zone.

III. Saddles in between volcanoes

Three saddles have been differentiated in this zone which rises in altitude from west to east: saddle of Nita 320 m, saddle of Blatatating 420 m and saddle of Baomekot 450 m (Plate 4).

IV. Northern ridge and ravine zone

Owing to intense fluvial erosion in the loose volcanic material a radial drainage pattern of V-shaped valleys with knife-edged ribs (the Sikkanese refer to these as *wolong* meaning simply 'hill') between them has been formed.[7] These ravines often originate at the rim of the volcanic cones while shorter valleys originate on the middle and lower slopes and appear to be inserted between the larger valleys. This zone covers most of Central Sikka's northern foothills from 100 to 600 metres. In contrast to the southern flanks of volcanoes the northern spurs slope down more gently to the Flores Sea at no more than 25 per cent.

V. Northern coastal plain

This zone consists of an alluvial plain (Plates 5 and 9) which encompasses level land consisting of a sandy strip no more than one kilometre in width (zone Va) (Plate 6), and a slightly rolling zone (zone Vb) which rises to 100 m. To the north this zone is bordered by fringing reefs. The action of the water has led to the formation of at least one beachridge.

VI. Southern volcanic escarpment

This zone consists of rather steep flanks deeply incised by rivers and plunging rather abruptly into the sea (Plates 3, 8 and 27) as seen on the schematic cross section (Fig.7). It is similar to the northern ridge and ravine zone and displays characteristics of 'parasol-ribbing' (Plates 50 and 51). Small bench terraces formed by slumping as well as steep cliffs of andesite conglomerate are conspicuous (Plate 7). Locally wave-cut notches have been observed in these cliffs (e.g. west of Bola near Watu Krus - Plate 39).

[7]To this special volcanic landform the term 'parasol ribbing' is applied (Ollier 1969:113, 119).

As we have seen, the loose andesitic and basaltic material has been severely eroded by a maze of rivers from their upper catchments to the sea. Owing to the particular topography the watershed runs nearer to the south coast in Central Sikka. None of the rivers in our study area, however, can be called perennial. Because of the porous soil percolation is rapid and rivers dry up quickly. Only after heavy rains does the water reach the sea. Thus the availability of water is one of the greatest problems for the Sikkanese. Water is, however, encountered near to the surface along the northern littoral zone because of less permeable conglomerates. It is from these wells that Central Sikka's mountain dwellers have to carry drinking water in bamboo poles on their shoulders or on horseback to their distant abodes.

Moreover agriculture is severely handicapped by the dynamic relief. In the absence of a large-scale topographic map the 'parasol ribbing' character of the topography associated with a radial drainage pattern could unfortunately not be illustrated. The broad distribution of four slope classes (Fig.9) may, however, convey an approximate idea of Sikka's dynamic relief. Flat to slightly rolling land (slope gradient: 3-16 per cent) which is suitable for farming without restriction makes up only 13 per cent of the area. It is restricted to a narrow fringe of a few hundred metres along the north coast. The next slope class (slope gradient: 17-26 per cent) comprises one-third of the area and consists of the lower reaches of the foothill spurs. Since this zone is frequently scarred by gullies, even higher gradients occur which further limit its agricultural possibilities. Almost half of the study area of Central Sikka is made up of slope class four having gradients of over 51 per cent. Here farming is severely restricted. It is surprising, however, that this latter zone shows the most intensive degree of cropping. Here bush fallowing - the chief form of farming in Sikka - was observed on slopes with up to 90 per cent gradient near Dokar (Desa Umauta), 400 m east of Mt Hawoat. Sheet and gully erosion have become a common phenomenon in most of Central Sikka (Plate 23). It seems to have affected the steep southern flank (physiographic zone VI) more than the area north of the watershed.

By comparison with the eastern and western part of Sikka and, for that matter, with the rest of Flores, Central Sikka's relief displays certain advantages for purposes of communication. This portion of Flores can be considered as one of the most accessible regions of the island. The saddles afford comparatively easy access to the opposite coast. It is thus not surprising that the trans-Flores road (620 km) built in the 1920s, which links Reo in the west with Larantuka at the eastern end of the island, crosses the island between Lela and Maumere. Only further east does the road turn again to the south coast. The road was built chiefly for the purpose of facilitating administrative control of Flores' interior, as is reflected by the fact that it is usually built

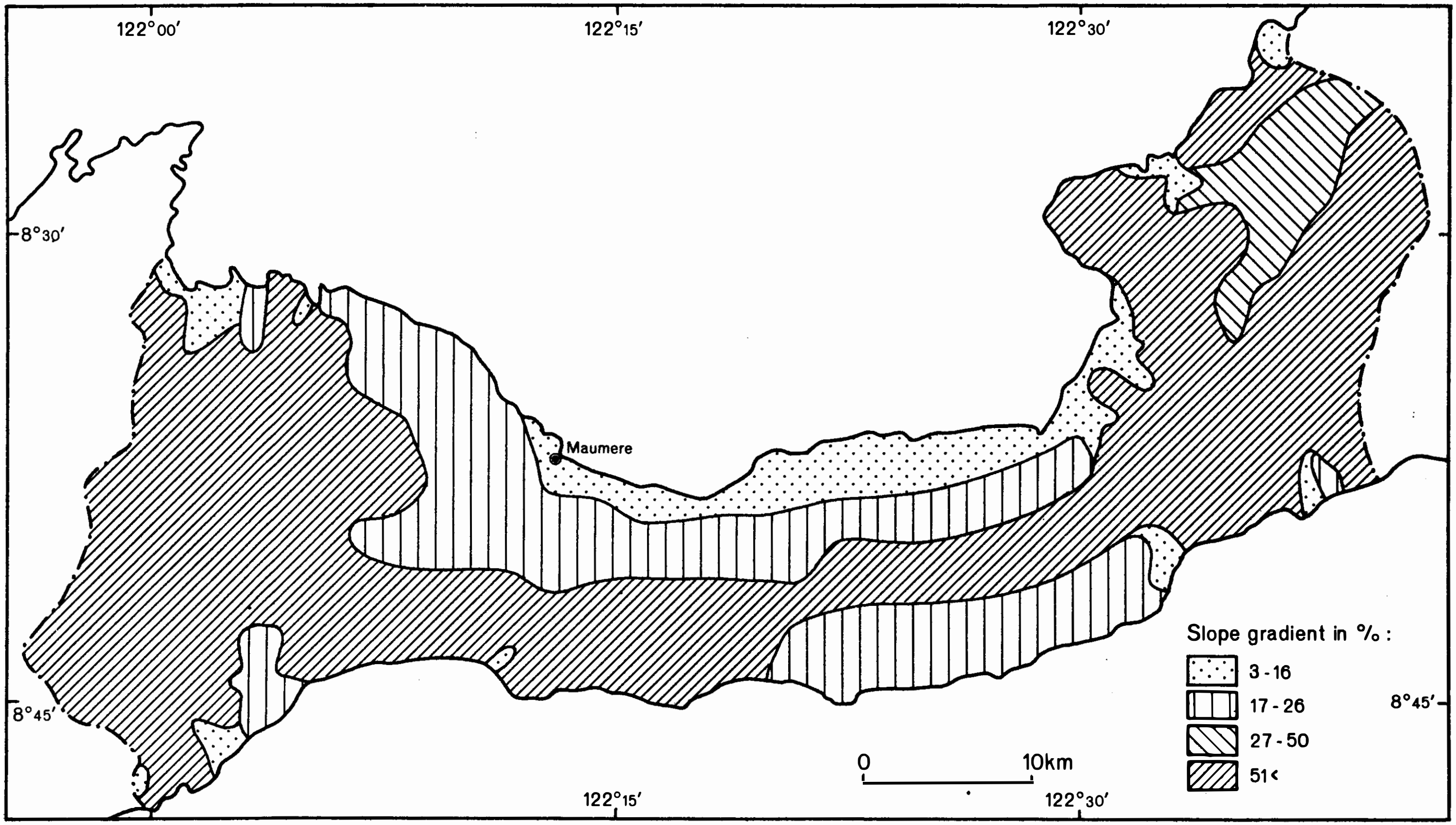


Fig.9 Sikka: slopes (after Carson and Hidayat 1976: map V, 4a)

away from the coast. Only in a few sections does this road also fulfill economic purposes. Such sections are between Lela and Maumere across the densely populated Nita saddle and between Geliting and Maumere, two commercial centres on the north coast.

The 'road network'[8] was extended after independence and particularly since the end of the sixties. Most *desa* can be reached by some sort of 'road'. The *wolong*-character of the relief renders road construction very difficult. Thus most gravel roads/paths leave the main Maumere-Larantuka *Floresweg* at a right-angle to the south and follow the crests of the *wolong* on which the settlements are located. The construction of roads linking the *wolong* is rendered impossible because of deep ravines and limited financial resources. For this reason there are virtually no roads along the south coast. Owing to severe gully erosion roads have to be repaired for most of the year. In the lower reaches of the rivers large amounts of silt and rubble are deposited in the riverbeds and thus cause regular flooding - for example the Napung Seda near Kewapante or the Nangalimang which runs through Maumere. Here disastrous flooding has been a common phenomenon during the fifties and sixties before the riverbed was temporarily stabilized by the construction of embankments which were reinforced by stone walls. However, in the course of less than five years the riverbed has filled up with rubble and sand originating from the mountainous hinterland of Maumere (Plate 24).

Soils

Over two-thirds of Flores is covered by recent volcanic material of varying depth (see geologic sketch map of Flores by Ehrat 1925). This material, as we have seen, consists of acid (tuffs, dacite and liparite) as well as alkaline effusives (basalt). In the absence of a comprehensive and detailed geological investigation and subsequent mapping of the island no regional differentiation of these effusives has been possible so far. With the exception of the Mbai plain in north Central Flores (van der Voort, van Es and Haantjens 1951) no part of the island has been the subject of detailed soil surveys. All we were able to draw upon for Sikka was a general description of soils in Flores by Mohr (vol.II, 1934) and chemical analyses of eleven soil samples collected by various institutions. In order to gain a more comprehensive idea of the pedological conditions of the area I collected twenty-five soil samples of eleven profiles (Table 1, nos 13-23). Seventeen of these samples were analysed chemically

[8]The term 'road' is applied here to denote tracks which frequently turn into quagmires during the rainy season thereby rendering them impassable for motor vehicles, even for four-wheel-drive jeeps. Only a few kilometres from Maumere to Geliting and from Maumere 8 km south towards Nita were macadamized in 1976.

Table 1

Mechanical and chemical analysis of soil samples collected in Sikka

Profile No.	Depth cm	Sand %	Silt %	Clay %	pH H_2O	pH KCl	In 100 g moisture free soil (105°C)							m.e./100 g moisture free soil (105°C)						
							Organic matter Carbon g	Nitrogen g	C/N	P_2O_5 mg	K_2O mg	Phosphorus ppm	$CaCO_3$ g	Ca	Mg	K	Na	Total bases (S)	Cation exchange (T)	Base saturation (V) %
13	0-15	37	40	23	6.2	4.8	2.75	0.26	11	43	64		0.08	6.1	1.5	0.9	0.2	8.7	22.6	38
	15-200	60	27	13	6.2	4.4	0.69	0.07	10	49	21		0.08	5.1	0.5	0.3	0.6	6.5	15.9	41
14	0-20	33	46	21	5.9	4.5	2.65	0.28	10	23	42		0.23	8.5	1.6	0.6	0.2	10.9	26.8	41
	20-40	32	46	22	5.9	4.5	1.04	0.14	7	12	41		0.20	6.9	1.4	0.8	0.2	9.3	22.4	42
	40 <	36	38	26	6.0	4.5	0.62	0.08	8	11	16		0.14	9.1	1.3	0.2	0.4	11.0	19.8	56
15	0-10	38	40	22	6.1	4.7	2.09	0.17	12	16	82		0.12	7.9	1.8	1.5	0.2	11.6	21.8	53
	10-25	43	37	20	6.2	4.6	0.76	0.09	8	10	73		0.18	7.1	1.5	1.6	0.3	10.5	20.3	52
	25 <	24	52	24	6.2	4.5	0.43	0.05	9	13	31		0.18	10.7	2.0	0.7	0.8	14.2	23.5	60
16	0-30/40	56	24	20	6.2	5.0	0.67	0.08	8	32	62		0.17	8.0	2.5	0.7	0.1	11.3	15.6	72
	30/40-120	63	21	16	6.5	4.6	0.07	0.04	2	64	38		0.17	7.6	2.6	0.5	0.2	10.9	13.9	78
17	0-5/10	60	26	14	6.3	5.3	2.31	0.18	13	28	39		0.00	13.4	2.7	0.5	0.1	16.7	20.0	84
	5/10 <	71	26	3	6.7	5.4	0.07	0.04	2	67	20		0.13	5.5	1.4	0.2	0.1	7.2	7.8	92
18	0-20	40	36	24	6.4	5.3	2.37	0.20	12	39	68		0.17	16.3	3.4	1.2	0.1	21.0	29.6	71
	20-40	53	34	13	6.6	5.3	0.85	0.09	9	56	97		0.14	7.7	1.8	2.2	0.9	12.6	18.1	70
	40-200	37	41	22	6.6	5.4	0.34	0.05	7	8(?)	33		0.14	14.3	2.7	0.8	0.7	18.5	22.6	82
19	0-20	55	32	13	6.6	5.6	1.17	0.12	10	57	94		0.09	8.8	1.9	1.7	0.1	12.5	17.0	74
	20-50	67	24	9	6.7	5.7	0.62	0.05	12	69	36		0.05	7.9	2.6	0.4	0.1	11.0	11.0	100
	50 <	32	53	15	6.9	5.8	0.74	0.10	7	39	30		0.08	12.9	2.9	0.3	0.2	16.3	19.2	85
20	0-10	35	29	36	6.6	5.5	1.02	0.13	8	8				4.1	1.8	0.5	0.1	6.5	13.7	47
	10-100	47	30	23	6.7	5.1	0.47	0.34	14	5				4.3	5.5	0.3	0.2	10.3	15.9	65
21	0-15/20	52	26	22	7.0	5.8	1.00	0.11	9	4				4.1	1.3	0.6	0.1	6.1	11.3	54
22	0-15/20	73	22	5	6.8	5.9	0.85	0.07	12	52				2.9	0.4	0.4	0.1	3.8	7.4	51
	20 <	65	29	6	7.0	6.0	0.49	0.04	12	74				3.5	0.5	0.1	0.2	4.3	6.9	62
23	0-15	61	29	10	6.5	5.3	1.29	0.13	10	9				2.4	0.6	0.5	0.1	3.6	11.0	33
	15-50	93	6	1	6.7	5.6	0.16	0.02	8	24				0.7	0.2	0.4	0.1	1.4	3.2	44
	50 <	50	33	17	6.8	5.4	0.37	0.04	9	10				2.5	0.9	0.6	0.1	4.1	6.9	59
24	0-36	65.1	23.8	11.1	6.5	5.5	0.94	0.06	16			18.4		10.7	2.7	0.4	0.3	14.1	18.2	77
	36-75	48.8	37.3	13.9	6.8	5.5	0.62	0.03	21			9.8		10.8	3.0	0.4	0.5	14.7	17.8	83
	75-99	75.1	23.2	1.7	7.4	6.0	0.17	0.01	17			9.6		7.8	1.7	0.2	0.4	10.1	13.7	74
	99-117	94.3	5.7	0.0	7.7	6.4	0.08	0.01	8			12.2		3.8	0.6	0.3	0.8	5.5	9.2	60
	117-133	88.3	11.6	0.1	7.1	5.4	0.23	0.01	23			14.4		10.6	2.3	0.3	0.4	13.6	17.6	77
	133-150	42.5	47.1	10.4	6.8	5.5	0.21	0.01	21			14.0		10.4	3.8	0.5	0.2	14.9	24.1	62
25	0-24	75.9	19.0	5.1	6.6	5.6	1.83	0.12	15			108.0		10.4	5.0	1.4	0.3	17.1	17.2	99
	24-42	96.8	1.5	1.7	7.1	6.1	0.82	0.03	28			31.6		9.3	1.7	1.1	0.1	12.2	17.0	72
	42-111	96.6	3.4	0.0	8.1	6.9	0.19	0.02	10			73.0		3.2	0.8	0.4	0.4	4.8	5.6	86
	111-150	56.9	32.8	10.3	7.4	6.3	0.39	0.03	13			17.0		8.8	4.0	0.3	0.7	13.8	19.9	69
26	0-28	61.1	30.1	8.8	7.3	6.2	1.09	0.09	12			111.0		11.1	4.7	2.9	0.2	18.9	18.9	100
	28-97	88.1	11.8	0.1	9.1	7.7	0.33	0.02	17			37.2		3.8	2.2	5.2	0.8	12.0	12.3	98
	97-150	58.3	30.5	11.2	8.6	7.3	0.27	0.03	9			32.8		4.0	0.3	9.0	1.5	14.8	22.6	65
27	taken from top layer only	75.4	24.6	0.0	6.8	6.3	0.33	0.09	4	43	21									
28		53.7	41.9	4.4	6.5	5.4	0.95	0.09	11	60	10									
29		17.2	67.6	15.2	5.15	4.2	1.72	0.15	11	21	15									
30		26.2	60.9	12.7	5.6	4.6	2.10	0.30	7	29	18									
31		56.5	40.7	2.8	6.2	5.0	0.51	0.04	13	17	29									
32		25.9	58.8	15.3	6.1	4.7	0.77	0.07	11	27	20									
33	0-12	38.0	44.0	18.0	6.8	5.5	1.2	-	-	-	-		0.1	13.4	3.6	0.2	0.2	17.4	27.6	63
	12-30	5.0	18.0	77.0	6.6	5.6	0.4	-	-	-	-		0.1	49.1	9.1	0.1	0.2	58.5	71.0	82
34	0-20	32.0	59.0	9.0	7.0	6.1	1.3	-	-	9	87		0.2	11.2	2.4	2.0	0.1	15.7	20.3	77

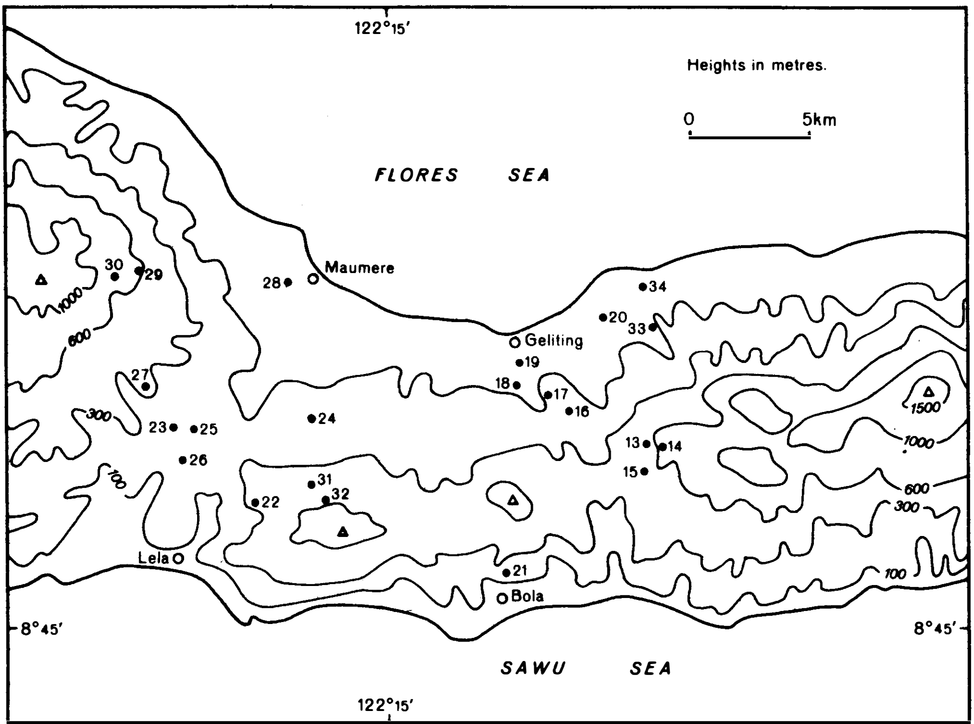


Fig.10 Central Sikka: location of soil samples

by the Soils Research Institute in Bogor (West Java) while the remaining eight samples (from profile nos 20-23) were analysed by Joachim Esenwein in the chemical laboratory of the Department of Geography, University of Heidelberg.[9] Thus we were able to draw upon information based on the following soil samples (Fig. 10, Table 1; described in Appendix II):

Profiles 13-23:	sampled by the author.	
Profiles 24-26:	Source:	Fakultas Pertanian; Institut Pertanian Bogor (1975).
Profiles 27-32:	Source:	Direktorat Jenderal Kehutanan (1974).
Profiles 33-34:	Source:	Carson and Hidayat (1976; profiles E1-2).

[9]Because of lack of facilities in Heidelberg, the analysis of nitrogen was carried out at the laboratories of the Tropen Institut, Institut für Pflanzenbau und Pflanzenzüchtung at Giessen. Grateful acknowledgement is given for the help provided by Prof. J. Alkämper, Prof. N. Atanasiu and their staff.

Soil types

1. Andosols. On Central Sikka's loose tuffs and andesites so-called 'andosols' - by far the most common soil type in the area - have developed, a term derived from the Japanese, meaning dark soil. As its definition is by no means clear in the literature (see Mohr and van Baren 1959:465), we shall differentiate these soils according to their stage of development, whereby topography has a major impact. A typical andosol catena is shown in Fig.11.

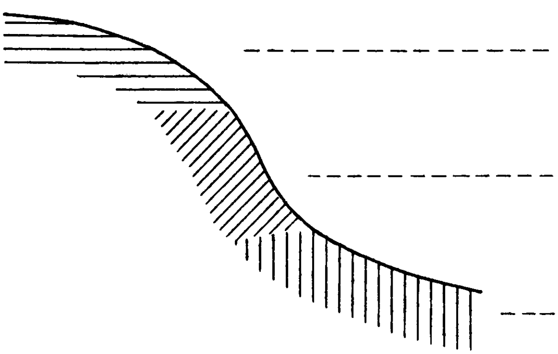


Fig. 11 Andosol catena

Note: It should be pointed out that there is a contradiction between the comparatively low fertility of this soil and the meaning of the word *tana wura* meaning 'fat soil' in Sikkanese.

a) Fully developed andosols (Lessivé stage).

A_h - B_v - C - profile; see profiles 14, 15, 18, 23, 24, 25, 26.

b) Immaturely developed andosols (Ranker stage).

A_h - C - profile; see profiles 13, 17, 21, 22 (with characteristics of lithosol - see lithosol); and 29, 30, 32, for which only top soil layer was collected. This soil type is characteristic for much of mountainous Central Sikka (Plate 20). Its very thin soil layer consists of small tuffaceous stones (*tana wura*) and larger stones (*watu wura*). This soil is very porous.

For soil types (a) and (b) Mohr (vol.II 1934:71) uses the Dutch term *grauwbruinige tufzandboden*.

(c) Juvenile andosols.

A - C - profile; see profiles 16, 27 (top layer only); this soil assumes an intermediate position between lithosols ((A) - C - profile) and Rankers (A_h - C - profile).

2. Colluvium. A_h - B_v - (A_{f2}) - A_{f1} - profile; no soil samples collected. This soil type which, for instance, occurs south of Maumere, either consists of dark soil mixed with small stones (see Mohr vol.II 1934:81; and vol.I, 1934:Fig.30) or may have a high clay content locally. The cultivation of tobacco is rendered possible on the latter type of soil because of its greater water-holding capacity (see also Mohr vol.II, 1934:71).

3. Alluvial soils. Brown and grey mottled sands; see profiles 19, 28. This soil type includes relatively unstable soils, which have no profile development apart from the presence of an organic surface layer. They are derived from waterborne sediments and are, or were, subject to irregular flooding. They occur throughout the coastal plain (physiographic zone V), particularly near river beds - e.g. Nanga Limang, Napung Seda.

4. Regosols. ((A) - C - profile); see profile 34 (top layer only). Called *tana eba*; developed on sand at the coast, or on volcanic ash - e.g. at Hokor (south coast) - called *tana awung*.

5. Lithosols. ((A) - C - profile); see profiles 20, 31, 33. Characteristic for soils developed north of Kimang Buleng and Tarat-Egong volcanoes (physiographic zones IIa and IIb). If the soil contains a lot of rocks, the Sikkanese call it *tana puuk*, or *tana napang* if it consists of a hard conglomerate. These soils are shallow and show no profile development apart from a thin, loamy surface horizon. In many cases they are associated with rock outcrops. They consist of a thin (10-15 cm) brown to dark brown humic loam to heavy clay (10-30 cm) overlying weathered rock (C_v) that passes into hard rock (C) at 30 cm. Following international nomenclature soils with a solum of less than 10 cm overlying bed rock are called lithosols. The transition to the Ranker stage is, however, gradual. Such transitional profiles are 33 and 22.

6. Red friable clay soils. (Plastosol) (A - B - C - profile) (*tana mera*) derived from siliceous material - e.g. near Delang (Ds. Watugong); no samples collected of this soil type; very limited distribution; because of high water holding capacity its agricultural value is considered high.

7. Terra rossa soils (A - B - C - profile) (*tana wura gewung mera* = 'stony soil mixed with red') derived from coral reef limestone (*puuk wura* = limestone). No samples collected from this soil type. These soils have well developed A and B horizons and merge into weathering coral at depths varying from approximately 30 cm to 60 cm - e.g. east of Maumere near Waioti; very limited distribution.

The Sikkanese judge the land by the type of soil as well as by plant indicators. The distinction in soil types made by the Sikkanese is based on easily distinguishable properties which are of relevance to cultivation. As water shortage affects agriculture most in this part of Flores those soils having a high water holding capacity rank first in the eyes of the local population. This group comprises red clay soils (*tana mera*) - e.g. near Delang (Ds. Watugong) - and black colluvium (*tana mita*), which is found chiefly in an altitudinal belt between 100 and 200 m on the northern flank of Central Sikka. Cultivation of these soil types is relatively easy and usually done by means of a small dibble (*teeng*). Because of its much sought-after qualities - higher water retention capacity and comparatively high natural fertility - all known cultivars of Sikka can be grown on these soils.

Next in rank are those soils having lower water holding capacities. To this category belong developed and immaturely developed andosols (*tana mita* and *tana wura*).

Of even lower water holding capacity are *tana eba* (i.e. Regosol) and *tana awung* (grey ash soil) which can be found, for instance, near Hokor. These soils can be worked for no more than two successive years after which they have to be fallowed. Tubers (sweet potatoes, cassava, depending on altitude) do comparatively well on these soils.

Of lowest agricultural value in the eyes of the Sikkanese are lithosols, frequently found on top of volcanic ridges, which they differentiate according to type of rock, hard conglomerate (*puuk napang*), limestone (*puuk wura*), and tuffstone (*puuk moret* or *puuk heret*).

As will be shown later, the Sikkanese used to work each soil type according to regulations set by the community (*Adat - Rechtsgemeenschap*). For instance, on loose soil in the mountains (*tana wura; tana awung*) it was strictly forbidden to work the land with the help of digging sticks (*teeng doling*) or hoes (*sako*) (Plate 13) which were likely to engender soil erosion. Instead only a small dibble (*teeng*), about one metre long, was used in mountainous regions.

It is surprising - at least at this stage of our analysis - that the colluvial and alluvial soils at the foot of the northern volcanic ridges, which are of high fertility, remained largely unworked until the second decade of this century. Grass savannas with scattered *koli* palms covered this zone until that time, according to reports by earlier visitors (e.g. ten Kate 1894:214), above all missionaries. From time immemorial the Sikkanese have concentrated their agricultural activities in the mountains of Central Sikka. Over centuries they have acquired a wealth of knowledge as regards the utilization of their environment. Generally speaking no indication of severe mismanagement and breakdown of the agroecosystem was evident at that time. It is only after World War II that their environment begins to show signs of stress. For the study of the stability of agricultural systems detailed descriptions of land classes, cultivated plants and agricultural practices are particularly useful when related to local concepts. An attempt is therefore made to investigate the Sikkanese agricultural systems in a cognitive way - that is on their own terms. Such an approach would subsequently enable us to find out in what way the Sikkanese have adapted their agricultural methods to the potentialities of the land and in what way they deviate from them.

Climate

As has been pointed out already, of all environmental factors, climate, particularly rainfall, affects agricultural activity in Sikka most strongly. The island's climate is that of a typical monsoon area. It is conditioned by the seasonal latitudinal movement of air masses to and fro across the equator. The movement of these air masses in conjunction with Flores' particular orographic conditions influences the incidence and distribution of rainfall.[10] The year can be roughly divided into two seasons. The period of the northwest monsoon lasts from December to April and prevailing winds are from the west or northwest. As the higher mountains - volcanoes - are located at a considerable distance further inland, most of the moisture is carried over the coastal areas to the mountains. During the period of the southeast monsoon, June to September/October, owing to a short trajectory across the sea, comparatively drier currents of air reach the island's southern flanks and central mountains where the moisture is dropped again leaving the coastal area on the leeward side of the mountains (i.e. Flores' north coast) with hardly any rainfall. August and September are usually dry throughout the island - that is on the south coast as well. The two seasons are separated by intermediate months (November and May) when winds may come from any direction.

[10]For other climatic elements no data are available for Flores.

The island's rainfall pattern thus enables us to distinguish three major zones:

1. The dry north coast with less than 1000 mm of annual rainfall (e.g. Maumere, Reo) and one relatively short rainy season (December to March).
2. The central mountains - particularly volcanic cones with over 2000 mm of annual rainfall (e.g. Bajawa) and two long rainy seasons (November to April; May to July).
3. The southern flanks of the mountains which benefit from a bimodal rainfall due to the southeast monsoon - 1000-2000 mm of annual rainfall.

This north-south differentiation is further modified by an east-west humidity gradient which is conspicuous for all of the Lesser Sunda Islands of the Inner Arc. As a rule rainfall is heavier in the western portions of the islands while longer dry seasons are conspicuous in the east.

This general rainfall pattern is also reflected in a rainfall map based on the classification developed by Schmidt and Ferguson (1951) (Fig.12). According to this classification the type of climate is based on the quotient of the average number of dry months (i.e. a month with less than 60 mm rainfall) and the average number of wet months (i.e. a month with more than 100 mm rainfall). A month with a precipitation between 60 and 100 mm is considered 'moist'. This division into wet, moist and dry months is based on findings by the soil scientist Mohr (1933, I,1:107) who relates precipitation to evaporation in tropical soils, particularly those of Indonesia. Although such a general approach does not fully satisfy - particularly not for all soil types - it seems to serve well as a guideline for agricultural purposes.

The small number of rainfall stations on Flores certainly constituted a major handicap for the preparation of the map. The help of regional experts was therefore drawn upon (Schmidt and Ferguson 1951:9). By far the wettest spot on the island - and for that matter of the eastern Lesser Sundas - is Ruteng in West Flores (elevation: about 1200 m), with only two dry months (20 years of observation). This contrasts sharply with the dry north coast for which Maumere's rainfall pattern is typical. It is the driest station on Flores with an average of 6.6 dry months and 3.5 wet months.

Owing to local topographical conditions Central Sikka's rainfall pattern deviates considerably from the general rainfall pattern outlined above for the island as a whole. A major handicap for detailed climatological work as is required for an analysis of agricultural systems in a place like Sikka is the small number of rainfall stations with long periods of observation. While rainfall

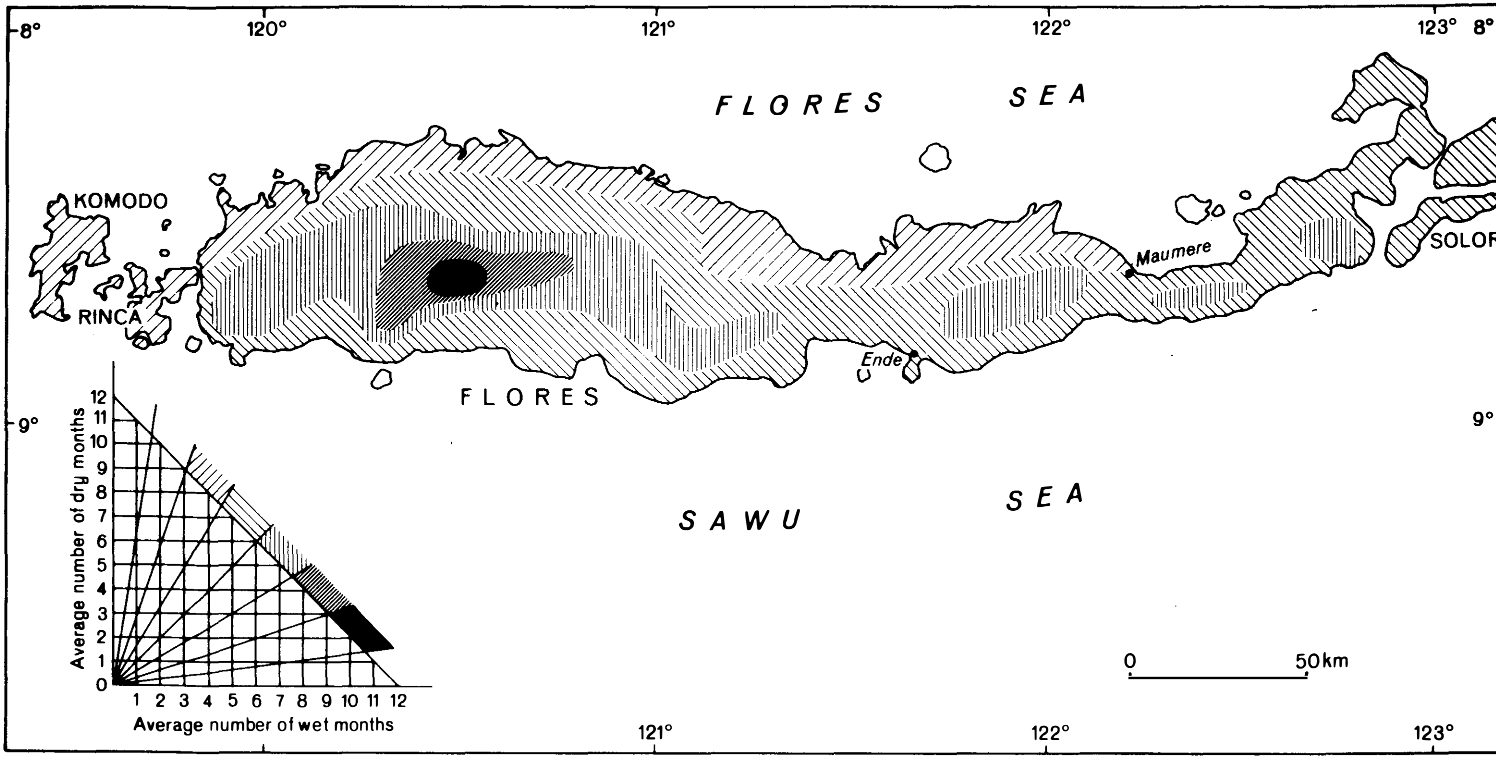


Fig.12 Flores: classification of climate according to Schmidt and Ferguson (1951)

data have been recorded at twenty stations at some time or other, entries for rainfall were made over more than ten years at only four stations (Maumere, Lela, Ledalero and Nangahale). Figure 13 shows that not only the number of years of records but also the actual periods of observation differ widely between stations. Thus comparison is rendered difficult. Although the monthly data for Sikka are far from being sufficient for a detailed rainfall analysis in this mountainous part of the island, from observation of vegetation and agricultural practices the following general pattern emerges: the lowest rainfall incidence is recorded at the north coast between Nangarasong in the west and Wairgete in the east, a region encompassing Maumere and Kewapante.

Particularly dry are those portions of the north coast which are bordered to the south by high volcanic cones, especially the coastal stretch from Nangarasong to Maumere by Mt Kimang-Buleng (1446 m) and the portion of the north coast between Kewapante and Wodong by Mt Tarat-Egong (1709 m). Here the impact of a local wind makes itself felt during the southeast monsoon when moisture is dropped as conventional rain on the southern flanks and in the mountains. On the north coast the southeast monsoon arrives as a dry Föhn-like wind, locally known as *borok* (or *aning borok* meaning 'strong wind') which may cause heavy damage to agriculture (da Cunha 1974:12).

Humidity increases considerably on the north coast further east from Wodong and reaches an annual average of 1415 mm at Nangahale. This increase in humidity is caused - during the northwest monsoon (*warat*) - by convectional rains forced up by mountains which rise near to the coast and which the northwest winds hit almost at a right angle.

Rainfall is somewhat more evenly distributed over the year along the south coast (Lela, Sikka). Owing to the southeast monsoon this part of Sikka also receives rainfall during May and June/July. Rainfall incidence increases with altitude. The saddles between the volcanic cones are particularly favoured as evidenced by rainfall figures of Ledalero (200 m) in the west (Nita saddle) - 1257 mm; and Watublapi (450 m) in the east (saddle of Baomekot) - 1853 mm (1975-77).

From this brief discussion and on the basis of the seasonal distribution of mean monthly rainfall three major climatic zones can be distinguished:

1. The northern coastal zone from Nangarasong to Wairgete with a monomodal rainfall pattern, precipitation between December and March/April and a severe, mostly uninterrupted dry season for the rest of the year. Rainless periods of six to seven months are not exceptional.

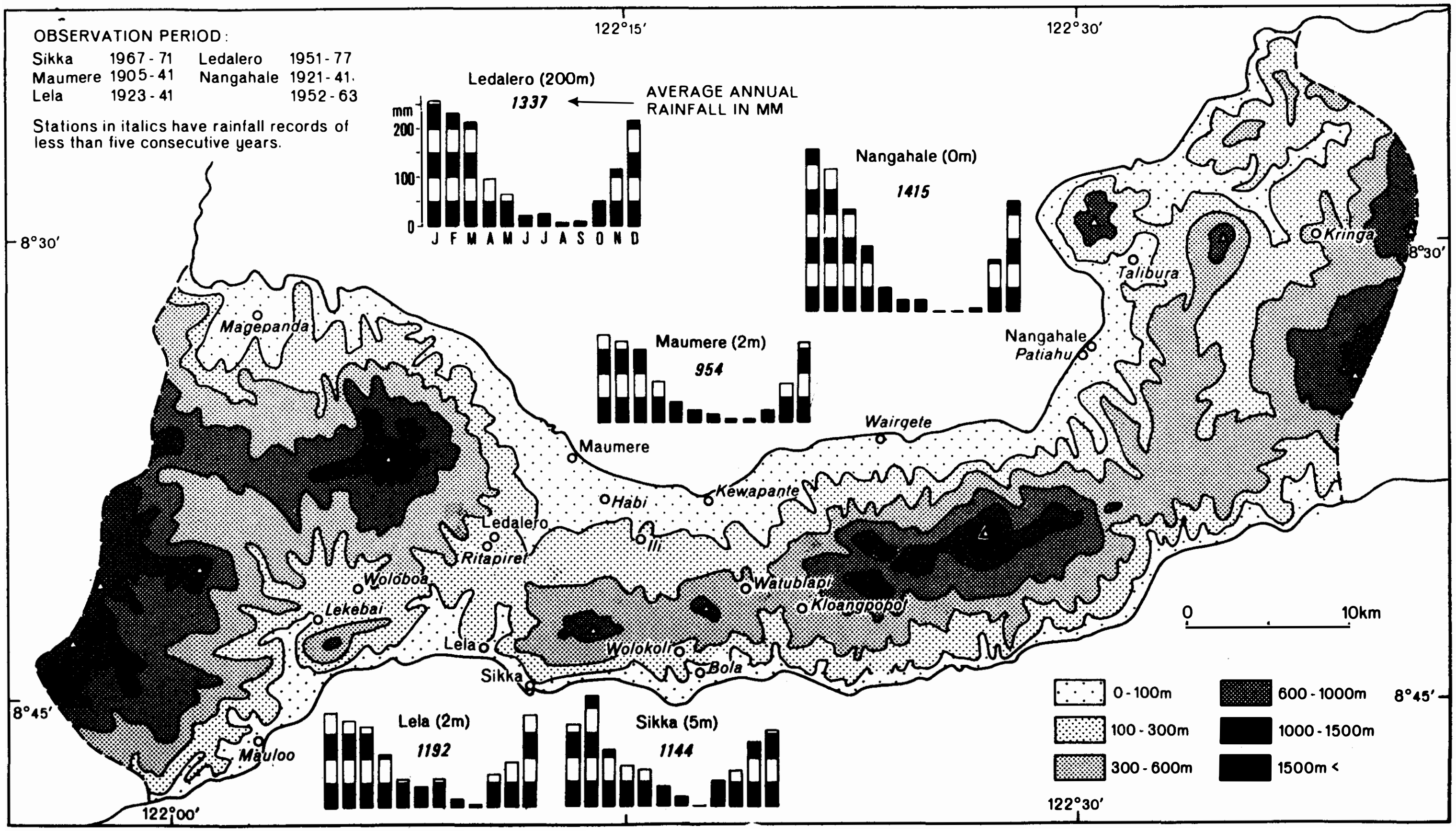


Fig.13 Sikka: rainfall at selected stations

2. The central mountainous section of Sikka above 400 m which is characterized by a significantly higher rainfall - approximately from 1800 to 2000 mm (e.g. at Watublapi) which falls from October/November to May, i.e. eight wet months.

3. The southern flanks up to 400 m encompassing the saddle of Nita with rainfall of between 1000 and 1400 mm and a rainy season from November to April (thus about two months longer than on the north coast), i.e. five wet months.

This rather rough differentiation of Sikka's rainfall pattern shows that rainfall incidence is largely contingent upon altitude and exposure to rainbearing winds. From the histograms of the few stations for which rainfall data are available, the strong seasonal contrasts - although with different degrees of intensity within the study area - are typical for Sikka as a whole.

Besides the pronounced seasonality Sikkanese peasants have to face a high degree of variability expressed in the total amount of rainfall from year to year, in the utter unpredictability of monthly rainfall and likewise the length - the beginning and the end of the rainy period. Figure 14 shows the deviations from the annual average for Maumere, Ledalero, Nangahale and Lela. For Maumere these deviations range from 496 mm below to 645 mm above the average. The greatest deviations occurred at Nangahale: from 701 mm below to 1756 mm above the average. From these figures it can also be concluded that years of drought seldom occur simultaneously in all regions. For instance, drought years at Maumere were 1918, 1930, 1935, 1940; at Nangahale - 1924, 1934, 1935, 1940, 1941; and at Lela - 1927, 1931, 1940. This point is of significance for agriculture.

Variability of monthly rainfall is markedly higher than that of annual precipitation. Thus great differences exist with regard to the beginning and the end of the rainy period as well as to dry spells during the wet season. Rains normally begin in October/November when the intertropical convergence passes Flores on its way south. However, it is not unusual for these months and sometimes even December to remain rainless apart from a rainy spell of a few days in October. These irregularities which are illustrated on Fig.15 significantly affect the agricultural activity of the Sikkanese. From the dispersion diagram the interannual variation of monthly rainfall becomes evident. It is greater during the months December to March and comparatively small in the months of August and September. Coefficients of variation for monthly rainfall increase, however, with decreasing rainfall (Table 2). The drier the month the higher the rainfall variability.

Excess water also constitutes a hazard for both agriculture and the landscape. As precipitation often falls in short but heavy spells, surface run-off followed by erosion is a widespread phenomenon, given Central Sikka's dynamic topography and loose

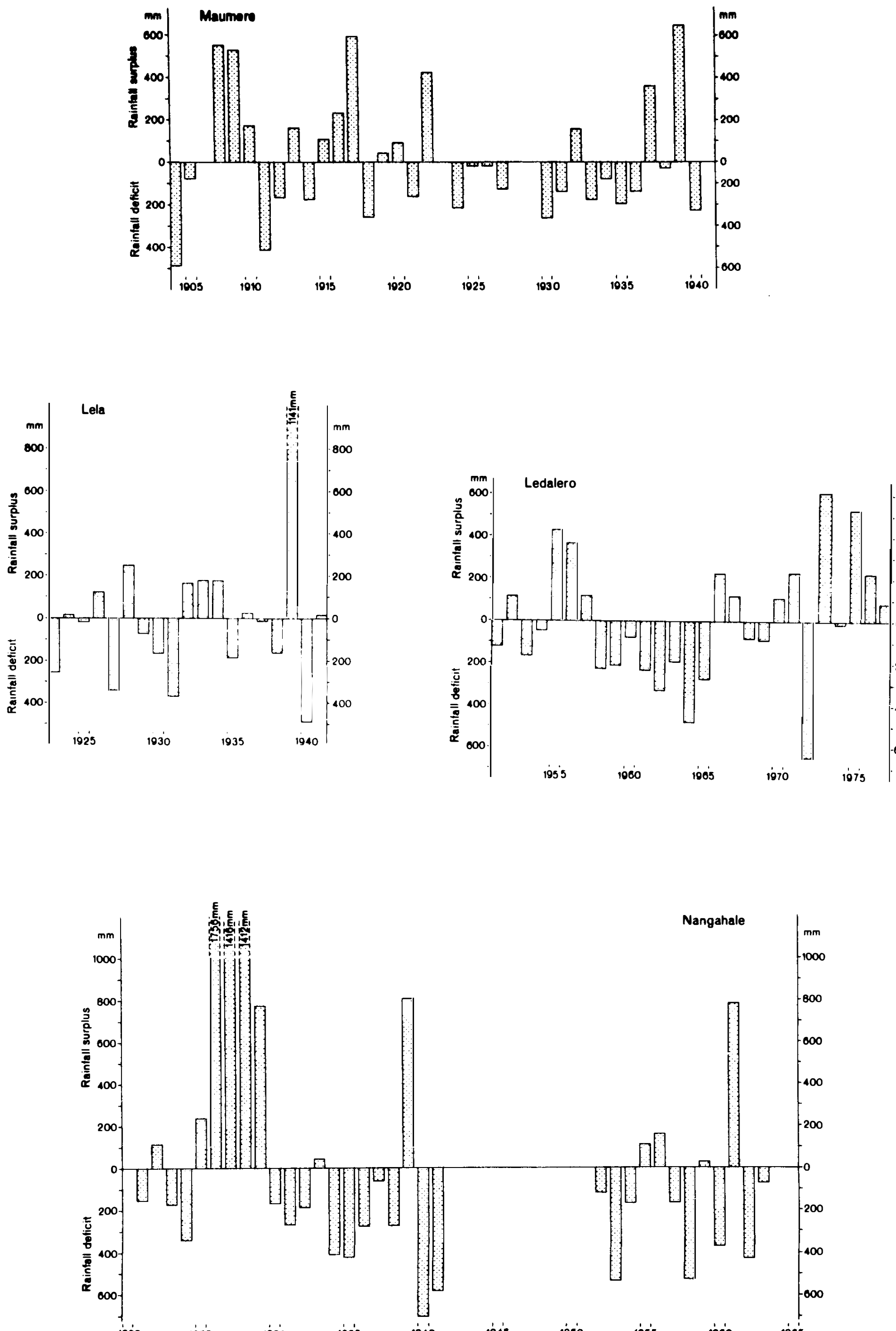


Fig.14 Variations of annual rainfall totals at Maumere, Lela, Ledalero and Nangahale

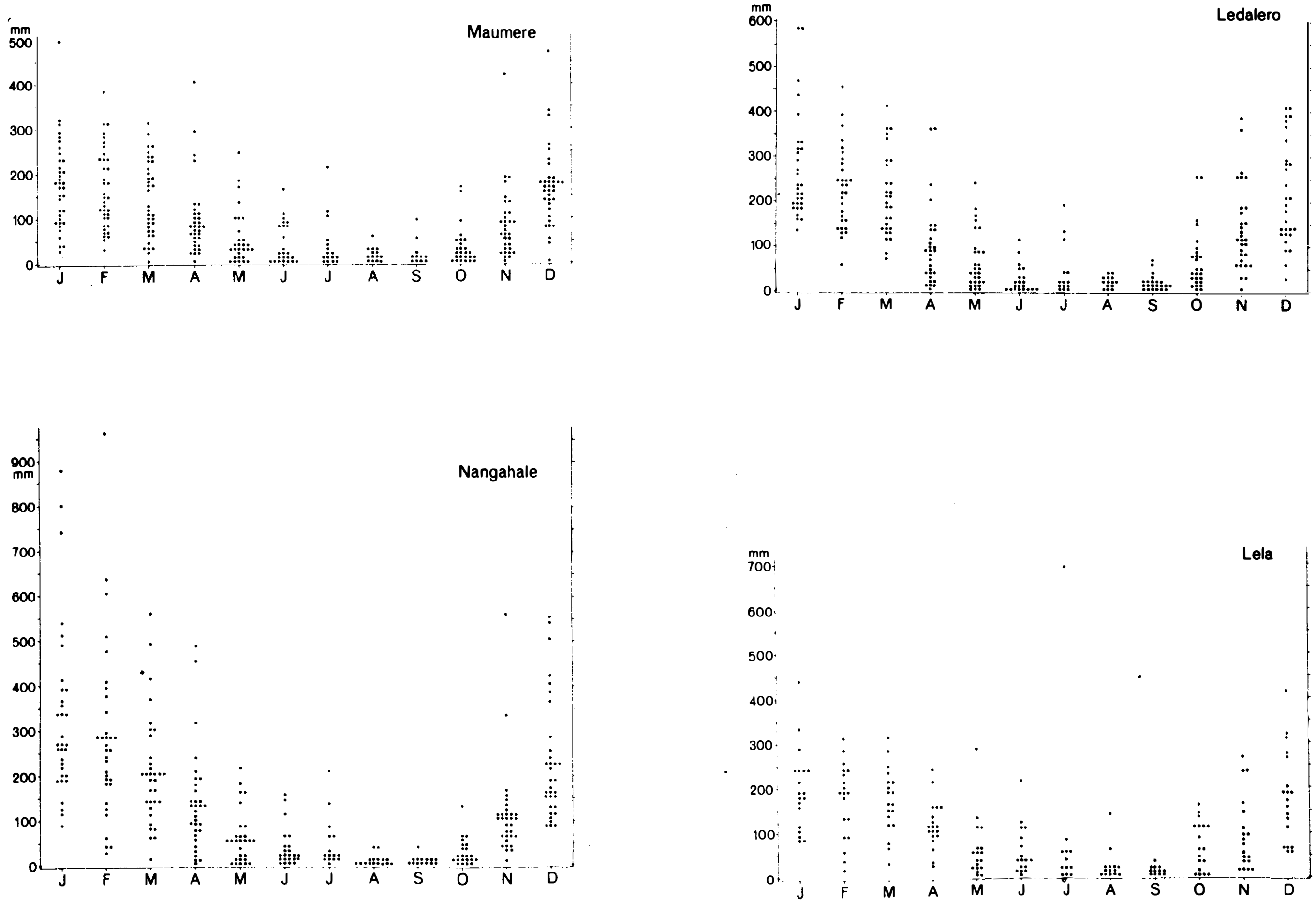


Fig.15 Dispersion diagram of monthly rainfall at Maumere (1905-41), Ledalero (1951-77), Nangahale (1921-41, 1952-63) and Lela (1923-41)

andosols. Rainfall intensity of a few stations may be gauged from Table 3.

The high degree of unpredictability in Sikka's rainfall regime is caused to no small degree also by tropical cyclones which originate in the Banda and Arafura Seas from December to April. They normally take a southwesterly course and hit the Timor-Flores area with a frequency of at least one per year. Although most of them bypass the islands, on occasions the centre of the storm with its strong winds hits Sikka. Exceptionally strong winds and deluging rainfall ensue, thereby causing floods, destruction of crops and, invariably, famine. Reports by district officers (*camat*) concerning hunger resulting from cyclones are by no means rare and can be traced in Sikka's governmental archives. An area that seems to be particularly affected by cyclones is the western part of the district of Sikka - what is now Kecamatan Paga (for instance, on 20 to 24 January 1961 and February 1962 in Bu; on 29 April 1973 and January 1978 in Lekebai and other parts of Kecamatan Paga). Although precise rainfall data for the time the cyclones reached Sikka are not available, the impact of these tropical winds

Table 2

Coefficients of variation of monthly and annual rainfall (in %) at selected stations

	Maumere (1905-41)	Ledalero (1951-77)	Lela (1923-41)	Nangahale (1921-40, 1952-63)
January	53.5	39.6	43.6	55.3
February	52.3	38.2	46.9	65.5
March	58.7	41.8	40.8	57.2
April	88.9	92.1	44.5	84.0
May	128.7	92.1	109.8	103.8
June	150.1	146.2	103.7	153.3
July	232.5	208.2	271.5	166.7
August	487.1	147.8	189.7	203.1
September	268.8	131.3	120.9	212.6
October	151.3	101.9	82.4	128.5
November	100.4	66.0	83.9	91.9
December	50.5	48.6	56.4	59.0
Annual	29.7	21.4	28.0	40.0

Table 3

Maximum rainfall intensity within 24 hours at selected stations

Station	Date	Amount (mm)
Habi (54 m)	25.1.1977	102
"	22.3.1975	110
Watublapi (450 m)	9.4.1977	102
"	15.1.1976	128
"	26.3.1976	105
"	7.12.1976	117
Ili (220 m)	22.3.1975	174
Kloangpopot (500 m)	15.1.1976	133
Patiahu (0 m)	24.2.1977	100
"	15.2.1975	111
Nangahale (0 m)	22.1.1961	125
"	23.1.1961	105
"	13.2.1958	138
"	17.1.1960	122
"	17.4.1954	153
"	19.3.1952	139
"	Jan. 1939	180
"	Jan. 1938	151
Ledalero (± 200 m)	4.1.1977	101
"	16.1.1976	105
"	27.11.1974	130
"	30.4.1973	183
"	July 1939	158
Maumere (2 m)	Feb. 1932	143
"	Oct. 1934	109
"	Jan. 1936	126
"	Apr. 1908	259
"	Feb. 1938	163
"	Feb. 1937	118
Lela (2 m)	Oct. 1934	109
"	Dec. 1936	147
"	July 1939	313
Bola (± 50 m)	Jan. 1939	142
"	Mar. 1940	113

may be gauged by the large-scale destruction of Lekebai's wet-rice fields along the rivers Lowo Mego, Lowo Mera and Wai Wajo in April 1973 (see Fig.3). Alarming reports of famine in Kecamatan Paga caused by a prolonged dry season and a subsequent cyclone have drawn attention to the plight of thousands of families in Sikka (see *Dian* (Ende), vol.5, no.12, 10 April 1978).

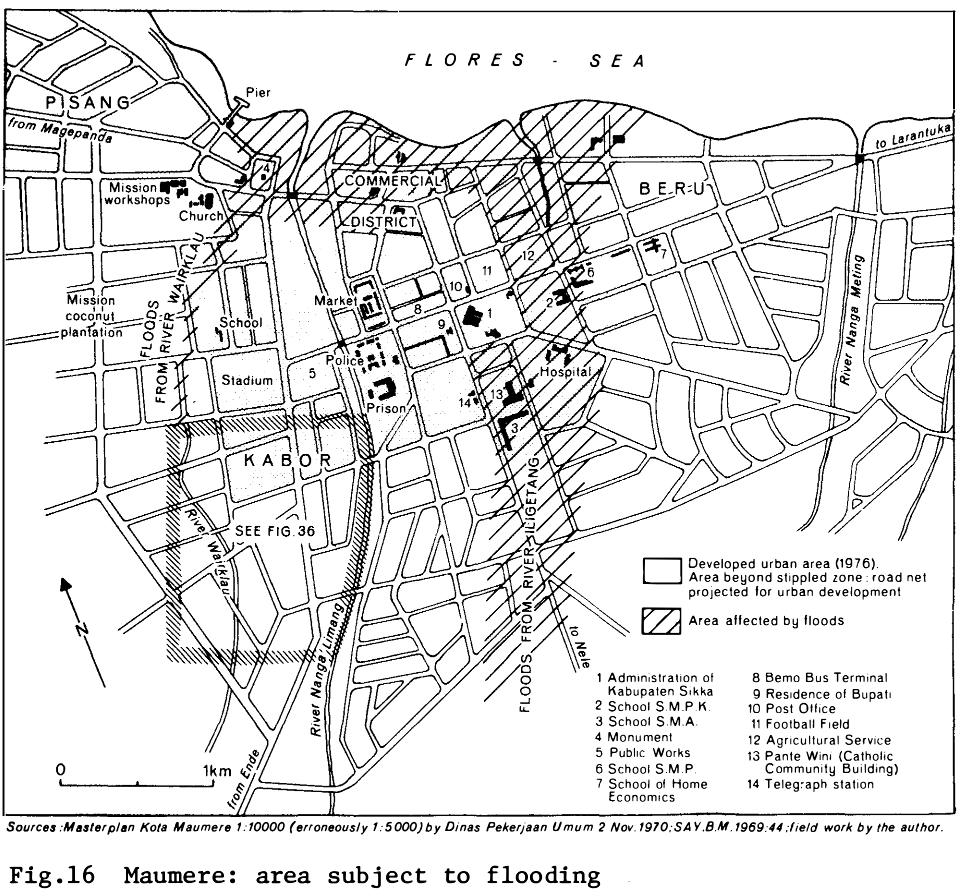
Of less vehemence - though still constituting a menace to agriculture - are strong winds from the south that occur suddenly between January and April - i.e. during the northwest monsoon period. These winds, called *aning tahi laï*, may destroy upland rice and maize. For this reason farmers try to plant these crops as early as possible in order to ensure that the plants have reached flowering stage well before these winds occur. Newly opened fields - called *uma weru* - which tend to have a higher water holding capacity than other fields, are usually worked last - that is, after the latter have been planted. *Uma weru* are therefore more likely to be affected by these southerly gales.

Climate and landscape

The strong contrast between a short wet (*wulan lelen*) and long dry season (*wulan daran*) becomes evident from the above brief description. This seasonality is reflected, of course, in the landscape. During the dry season the northern littoral in particular becomes very dusty and the landscape is parched. During this part of the year infections of the lungs due to the dust are common (Rusconi 1940a:15). As the loose and erodible tuffaceous material is highly porous all but a few rivers in Sikka are ephemeral. This is indicated by the name *napung*, meaning valley, whereas rivers which have or have had a perennial flow of water, have the name *wair*, meaning water. In Central Sikka there are only a few rivers that bear the name *wair*, as indicated on Fig.53 (see inside back cover). At present none of the rivers of Central Sikka can truly be called perennial from the source to the sea. At most we find here rivers having water in a portion of their course during the dry season. These are located south of the central watershed: Kakiwair (Ds. Kloangpopot), Wairdahi (Ds. Umauta), Wairuri (Ds. Hokor), Wairterang (Ds. Bola, Batikwair (Ds. Lela) (Plate 25).

The shortage of water throughout the year - thus also during most of the so-called wet season - affects the Sikkanese and their agricultural activity most. The water problem is obviously not of recent origin. The catastrophic impact of droughts on agricultural activity was mentioned in reports by visitors to Sikka in the nineteenth century. When maize and upland rice did not yield, people resorted to cassava (Jacobsen 1896:60), provided the growing of the latter was not tabooed as in Tanahai. In 1916 water is said to have been brought by trucks in large quantities from the rivers Wairpelit and Batikwair, north and south of the saddle of Nita. Both rivers were reported to have had at least a trickle of water throughout the year (Hens 1916 II:34). Controleur Rusconi (1940a:48) also mentions the shortage of water in his report in 1940 for Nita and Koting in the saddle between Maumere and Nita.

Until the fifties a number of rivers were also reported to have reached the sea even during the dry season, for instance the river Wairita, with its source in the Egong-Tarat complex, which now only has a trickle of water at its spring (pers. comm. from a teacher, Wilibordus Woga, 13 March 1976). Also the river Wairpelit (also called Wairkoting), the main tributary of the Nanga Limang which flows through Maumere, is reported once to have flowed the whole year round in its upper and middle course. Three to four kilometres from the sea the river infiltrated into the porous ground, as was observed by Civiel Gezaghebber Kleian who visited Sikka in June 1875 (Kleian 1891:522-3). About fifty years ago local sailing boats (*perahu*) are said to have come inland as far as the present bridge which spans the riverbed near the police station, roughly one kilometre from the coast (see Fig.16).



Sources: Masterplan Kota Maumere 1:10000 (erroneously 1:5000) by Dinas Pekerjaan Umum 2 Nov.1970; SAY.B.M.1969:44; field work by the author.

Fig.16 Maumere: area subject to flooding

During the dry season people in the mountains particularly are hit by the shortage of water. In the absence of reservoirs water has to be carried in large bamboo poles (*togang*) on the shoulder (Plate 26) or fastened, one bamboo to each side of a horse, over large distances either from one of the few springs - e.g. Wairdahi (Ds. Umauta), Wairterang (Ds. Umauta) or else (mostly) from wells located in the northern coastal zone. At some places Sikkanese dig holes in the sandy river beds in search of water (e.g. Maumere - see Wichmann 1891:106). Here subsurface aquifers are found at a depth of less than 10 metres. The water deficiency has forced the Sikkanese at places - for example near Ili - to avail themselves of the water stored in banana stems. These they cut about 80 cm above the ground. Water from the plant tends to accumulate at the fresh cut. Every day these stems have to be cut anew. Two cups of water may be derived from a banana stem by this method. After less than a month, however, this source of water is exhausted. Because of the water shortage possibilities for keeping large livestock have always been limited.

With the onset of the rain in November or December the landscape turns green almost overnight. Because of the high rainfall intensity - about which the scanty data convey only a sketchy idea - wholesale surface run-off and gully erosion take place. The V-shaped valleys, cut deeply into the tuffs and andesites, bear witness to the action of water erosion (Plate 23). In the lower reaches of the streams the rivers' load of stones, gravel and finer material is deposited according to size and, not surprisingly, the riverbeds have silted up (Plates 24, 25). Flooding is therefore a common phenomenon along Central Sikka's north coast from Kewapante Geliting to Maumere and even further west to Koliaduk during the rainy season. Maumere, the administrative and commercial centre of Sikka, has been particularly hit by floods (e.g. December 1953, January 1961, December 1968:Fig.16) for which three ephemeral rivers, Wairklau, Nanga Limang (Plates 24 and 28) and Nanga Iligetang were responsible. Reports indicate that such floods were unknown in Maumere until the fifties (Messakh and da Silva 1953). In places the water tends to stagnate because of beach ridges and sand bars, thereby forming swamps. These are restricted to the north coast of Sikka, for instance at Koro, Magepanda, Nangarasong, Bebeng, Koliaduk (Plate 29), Maumere (until the beginning of this century), Talibura and Nebe. In addition, mangroves are found at a great number of sheltered bays. These specific ecological conditions have attracted anopheles mosquitoes, which have caused Sikka's north coast to be given a bad name for its high degree of malaria and elephantiasis endemicity (Plates 46, 49 and Table 17, p.109).

Large variations as regards the annual amount of rainfall as well as its seasonal distribution have a strong impact on agriculture in Sikka given the low stage of development of agricultural technology. Quite often rains start too early and fields are not yet ready for planting (e.g. at Kokor (Ds. Pogon) in 1975) with the result that they sometimes cannot be worked at all during the year in question.

Vegetation

On account of intensive human interference, primary vegetation which once covered the area has mostly been depleted and is now restricted to a few forest reserves chiefly surrounding the peaks of the volcanoes. In Sikka these reserves comprise 32,084 ha (= 19 per cent of the district's area of 1,655 sq. km) (DKS 1975: 8). If one considers, however, that of this area roughly one-fifth (= 6,715 ha) is not even under forest but under grass (*Saccharum spontaneum* and *Imperata cylindrica*) or without vegetation (*tanah gundul*(I)) (DKS annual report for 1966:10), the magnitude of the anthropogenic impact becomes evident.[11]

Fire has been the chief agent for man's modification of the vegetational pattern. Most of these fires are made intentionally, either to open up a new *ladang* field or to prepare the ground for pastures. Every year during the dry period old unpalatable grass (sward) is burnt off to allow the growth of new grass which is eaten by cattle, buffaloes and horses. Frequently fire is also used for driving game during hunting. This was for instance the case on Sikka's north coast until the twenties of this century. Uncontrolled burnings and grass fires set by 'match happy' Florinese - e.g. in north Lio, as I observed in October 1975 - have become more common since the fifties. The careless attitude evidenced by these fires has been the result of weakening ties of the farmers to their *adat*, as will be shown in Chapter 3.

Here it may suffice to draw attention to the fact that only sacred forest or groves (*tuang pireng*), frequently located around the peaks of volcanoes, have been spared from these fires (Plate 16). Such groves are also known from other parts of the Lesser Sunda Islands (see Vatter 1932; Ormeling 1955:86; Metzner 1977a:92). In Sikka most of the upper reaches of the volcanoes were considered sacred - e.g. Kimang-Buleng, Wolong Keling (eastern flank of Kimang-Buleng), Dotat near Natarwulu (Ds. Nitakloang), Ili Dobo (see Metzner 1977b:271), Ili Goran at northern flank of Tolawair Mountains, Iling Dat (near Moro, Ds. Jantena). In addition some sacred forests were located at lower elevations chiefly near springs - e.g. at Bei (Ds. Blatatating), Wolometang, Hewotkloang, Wolokoli, Liangtahon (Ds. Kokowahor) (Arndt 1932:202-4), Tuat

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[11]For comparison the following figures are given for 1953: of Sikka's forest reserves of 31,484 ha roughly 22 per cent (=7000 ha) were not under forest but either under tall grass (mainly *Saccharum spontaneum*) (= 4,981 ha), low grass (mainly *Imperata cylindrica)* (= 1,969 ha) or completely devoid of vegetation (= 50 ha) (DKS annual report for 1953).

(west of Geliting), Boabale (near Nita), and Ritapiret until World War II (Father Piet Petu, 20 February 1976, pers. comm.). But most of these forests have gradually been destroyed by man and given way to new agricultural land. This development indicates a change of values among the local population. Only near Hewotkloang (northern slope of Mt Ili Dobo) and at Natarloar (Ds. Mekendetung) (Plate 16) was I able to find remnants of these forests, while a few others were said to exist in Ds. Kloangpopot (Wair Tanat, Wair Kedi, Wuwu Glarat, Wair Puat, Ru) and Ds. Waihawa.

With the exception of the sacred groves all other vegetation in Sikka has to be considered secondary. No systematic botanical inventory of Sikka's forests has ever been made. Only a few botanists ever visited the island (Teysmann 1874, Rensch 1930). Father Verheijen and Father Schmutz (1968), both stationed in Manggarai, West Flores, made plant collections in parts of Flores, and these were deposited with the Rijksherbarium at Leiden.

In a plant geographical analysis of the flora of the Lesser Sunda Islands Kalkman (1955) arrived at the conclusion that on the basis of genera there is no difference in distribution between the volcanic and non-volcanic islands. In addition, the flora of these islands is predominantly Asian in character although the percentage of Australian elements increases as one approaches the Australian continent. On the basis of an analysis of 480 species, 92 of which occurred on Flores, Kalkman shows that the island has the lowest percentage of endemic species (3.3 per cent) of any part of the Lesser Sunda Islands as compared with an average of 12.3 per cent for these islands as a whole. About one-third (35.9 per cent) of the species has a wide distribution occurring both in Asia and Australia; 21.7 per cent have their centre of distribution in Asia, 29.3 per cent in Malaysia (= insular Southeast Asia) with some outposts in Australia and Asia while only 9.8 per cent of all species have their centre of distribution in Australia.

Two eucalypts are found in the Lesser Sunda Islands, *Eucalyptus alba* and *Eucalyptus urophylla*. The latter is restricted in its natural distribution to these islands, thus it does not occur in Australia. And, for reasons still unknown *E. urophylla* can only be found as far west as Sikka. Martin and Cossalter's (1975-76) elaborate study of the eucalypts of the Lesser Sunda Islands revealed that *E. urophylla* was only found on Mt Egong above 400 m in conjunction with *E. alba* and *Albizzia procera*. It was not clear whether pure stands of *E. urophylla* at higher elevations had to be considered as secondary, the result of the destruction of dense primary forests due to volcanic eruptions (Martin and Cossalter March-April 1976:7).

While recent agricultural studies have been carried out by Indonesian foresters in a number of forest reserves in western

Flores (Manggarai) (DJKP 1973), the data regarding the botanical composition of these forests cannot readily be drawn upon for analogy in our area as that part of Flores is considerably moister than Sikka. All that can be stated at this stage is that the remnants of Central Sikka's forests are similar in structure to three types of forests which were distinguished in eastern Timor (Metzner 1977a):

1. Medium altitude moist evergreen forest occurring in Sikka between 1000 and 1400 m (e.g. Mt Tarat-Egong, Mt Kimang-Buleng).
2. Slightly deciduous forest 300-1000 m (e.g. Natarloar, forest at Mt Ili Dobo).
3. Strongly deciduous forest, only found north of the central divide, up to 250-300 m (e.g. east of Wairita (Ds. Waibleler) along the coast and near Potet (Ds. Seusina) consisting of *Tamarindus indica, Schleichera oleosa*.

Far more extensive than the remnants of forests are grasslands, for instance north of Mt Tarat-Egong and Mt Kimang-Buleng. These grassy plains have to be considered fire-climaxes. Their origin is probably recent, for, surprisingly enough, on a drawing of Geliting by Veth (1874b) found on a map of the isle of Flores (scale 1:900,000), the port's hinterland along the coastal zone was covered with dense forest while the adjacent mountains to the south lacked this type of vegetation. Although Veth's drawing was based on second-hand information, as far as the coastal vegetation is concerned, it strongly confirms reports by local elders (e.g. Moang Bapa Mekeng of Kewapante) who maintain that this zone once supported a tree vegetation consisting of *koli (Borassus flabellifer), habi (Schleichera oleosa)* and particularly *mage (Tamarindus indica)*.[12]

This zone was rapidly deforested in the second half of the last century when the Sikkanese were taught by immigrant Buginese from southern Sulawesi how to use the wood of the *koli* palms for house construction. These palms were still mentioned

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[12]Tamarind must have abounded in this zone and in the adjacent foothill zone judging also from the high export figures of *asam* from Sikka as early as 1860 when Vosmaer (1862:152) visited Geliting. *Asam* accounted for the second most important export product (8000 *pikul* (I), equal to about 492 tons). A similarly high export figure (456 tons) was also achieved in 1915 (Hens 1916 II:101). Although prices for *asam* even increased, export figures sharply fell in the thirties presumably because many trees were felled along the northern littoral. The decreasing production is reflected in the following export figures (van den Ende 1954:34): 1931 - 300 tons; 1937 - 168 tons; 1938 - 215 tons; 1939 - 213 tons.

by Wichmann (1891:109) who visited Sikka in 1888, and by missionaries (de Missie van Midden-Flores in Vogelvlucht 1901:51) along the north coast of Central Sikka, particularly around Maumere until the beginning of this century. In 1916, however, Hens (1916 I:200) mentioned these palms only for the northern littoral east and west of Central Sikka, that is, north of Mt Tarat-Egong and Mt Kimang-Buleng. Today only a few scattered palms remind the visitor of this period. They are used for the production of *tua* (juice from the *koli* palm) which is the base of various alcoholic drinks (Plates 2 and 33).

Trees were replaced by grass savannas not only as a result of indiscriminate felling of *koli* palms and *mage* trees but also because of traditional hunting practices of the Sikkanese whereby fire was the main agent. These grasslands formed a broad zone, up to 4 km in width, which followed Sikka's north coast from Talibura in the east to Koro (northern Lio) in the west (Fig.32, p.112). While the central portion of this zone, roughly between Kewapante and Wuring, has been transformed into dry fields since the twenties (see p.115), grassy plains are still characteristic of the remaining portions of Sikka's northern littoral zone. On Fig.17 the extent of this zone and its individual names, as far as information was available, are indicated. The general name given to these grassy plains (Plate 49) (or slightly sloping terrain) by the Sikkanese is *urung rii rotang (urung* = grassy plain; *rii* = *Imperata cylindrica; rotang* = *Saccharum spontaneum*) indicating the main grass species, besides which *Heteropogon* sp., *Sorghum* sp., *Botriochloa* sp., *Polypogon* sp. occur.

While *Imperata cylindrica* occurs throughout the area, *Saccharum spontaneum* is only found in places with a high groundwater table - in particular, for instance, near the north coast.

A number of introduced plants occur in Sikka's vegetational pattern of which some have had beneficial effects, such as the legumes *Leucaena leucocephala (lamtoro)* and *Mimosa invisa (putri malu)* (Plate 32). The latter is said to have been introduced from Bogor in 1925 in order to combat *Imperata cylindrica*. It is highly esteemed by the Sikkanese particularly at the saddle of Nita where it is planted as a fallow crop under coconut trees. *Lamtoro* has probably been known in the eastern Lesser Sunda Islands for several hundred years and is said to have been brought to the archipelago by the Spaniards from Central America. In Sikka efforts before and after World War II aimed at popularizing this legume for farming purposes failed. Only at the beginning of the seventies did *lamtoro* meet with an outstanding response on the part of the farmers. This will be dealt with below in the analysis of Central Sikka's agricultural pattern (see also Chapter 2).

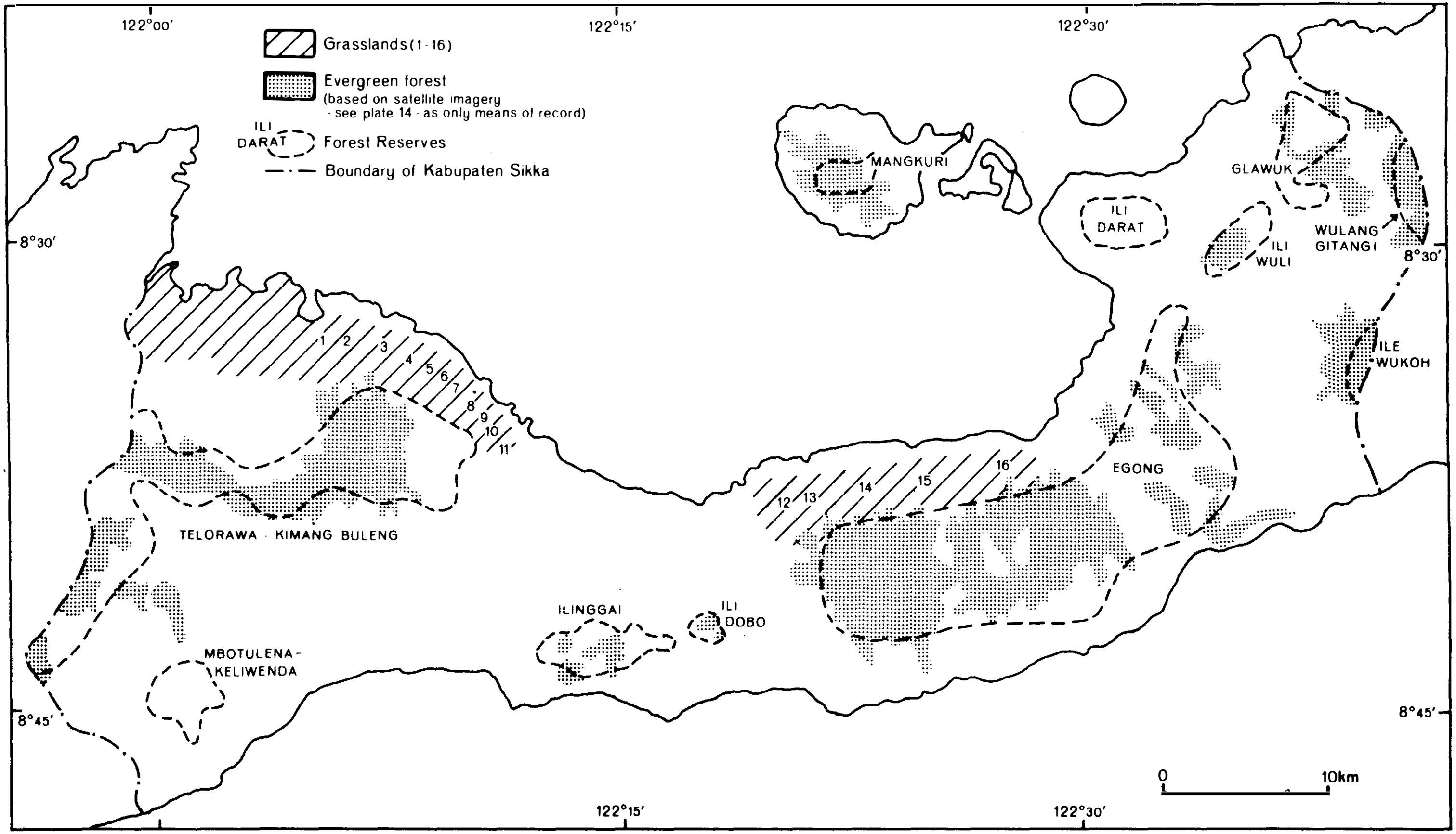

Fig.17 Sikka: grassland, evergreen forest and forest reserves. Names of grassland (*urung*): 1. Nangadelang 2. Nangarasong 3. Wairrii 4. Patisomba 5. Ojang 6. Nangahure 7. Belang 8. Wairliti 9. Wolomarang/Waidoko 10. Bebeng 11. Wuring 12. Hoder 13. Dulagete 14. Watuapi 15. Pigang 16 Detut

Of doubtful value for agriculture is the Compositae *Eupatorium odoratum (rumput sensus* (I)), a pioneer plant which has already covered large areas of western and central Flores (eastern Lio since 1943) and which reached northern Lekebai in western Sikka at the beginning of the seventies. Here it forms dense thickets, about 2-3 m high, mostly along paths and rivers. Although it defeats *Imperata cylindrica* and rapidly increases organic matter of the soil, it turns the soil highly acid if not kept at bay (see also Kollmannsperger 1971).

The speed with which Sikka's natural vegetation has disappeared is alarming. The few forests outside the forest reserves will have vanished within a few years. But even the forest reserves are in danger. Most of them were created in the thirties by the Dutch administration (Table 4). As a consequence of the creation of these reserves an unknown number of villages were moved from the uplands to new sites further downhill in the thirties (see p.183). During World War II the forests within and outside the precincts of the reserves were badly depleted. This development could not be brought under control after the war owing to the shortage of personnel able to enforce the regulations concerning the protection of the forests. Therefore a regulation passed by the Flores Council of *Rajas (Dewan Raja Raja dalam Daerah Flores)*, dated 8 July 1947 which, among other things, banned burnings of vegetation in Sikka, was of no avail. In case burnings on whatever type of vegetation (forest or grassland) occurred, the district head (at that time called *kepala hamente*) was required to have every male taxpayer of his district - i.e. not only the culprit - plant twenty-five young trees. For this task guidance would be provided by the forestry service. The examples of reported illegal burnings which constitute but a fraction of all illegal burnings bear witness to the fact that Sikkanese farmers pay little attention to these regulations (Table 5).

Illegal burnings have been a constant preoccupation of administrators on Flores (see for instance Bosch 1938:61). Trials aimed at enforcing forest regulations through collective responsibility of an entire community were first made in Manggarai (West Flores) (Nijs Bik 1934 cited by van den Ende 1954:21). This practice was extended to the whole of Flores - i.e. also to Sikka - after 1947 (based on: *Penetapan raja-raja di Flores tanggal 8 Juli 1947 No.4 tentang pembakaran alang-alang dan lain-lain tumbuhan dihutan dalam kerajaan Flores* - see DJKP 1973:91).[13] It failed, however, when the Dutch administrative authority came to an end.

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[13]A number of additional regulations was issued which remained, however, ineffective owing to lack of active enforcement (DJKP 1973:70):

1. Regulation aimed at protecting the main road *(Peraturan Daerah Flores No.8 tahun 1954 tentang perlindungan jalan raya)*.

(continued p.57)

Table 4

Forest reserves in Kabupaten Sikka

Forest reserve	Registered officially under number (RTK)[a]	Created (year)	Size (ha)	Estimated extent of grassland with *Imperata cylindrica* + *Saccharum spontaneum* (ha)	Estimated extent of grassland consisting of other grasses (ha)	Without vegetation (ha)	Total of non-forested land (ha)
Telorawa II	57	1935	6,000	400	200	-	600
Kimang-Buleng	59	1935	5,514	120	600	20	740
Mbotulena/ Keliwenda	58	1936	670	135	200	-	335
Ili Darat	44	1941	700	140	-	-	140
Iling Gai	60	1938	1,500	970	-	5	975
Ili Dobo	61	1932	360	72	72	-	144
Ili Wuli	64	1939	900	90	45	-	135
Glawuk	65	1934	300	30	15	-	45
Wulanggitang I	66	1939	1,200	120	60	-	180
Ile Wukoh II	67	1937	1,140	114	114	-	228
Pulau Besar (Mangkuri)	134	1947	400				
Egon	107	1947	13,400	2,680	670	25	3,375
a) Egon	62		(8,100)				
b) Ili Medo	63		(900)				
c) Ili Tera	34		(4,400)				
			32,084				

a. RTK - *Register Tanah Kehutanan.*

Source: Data provided by DKS in May 1976.

Table 5

Examples of forest lost through illegal fires in Sikka

Year	Forest reserve or outside	Locality	Area destroyed (ha)	Remarks
1952	Ilinggai RTK 60	Mahat, Iling Bekor, Iling Newa, Kojapadu, Rait, Nurang, Sikka	Approx. 50	73 trespassers (32 from Puho Wukur, Sikka, Bidara, Tanaling, Wuu, 9 from Wutik, 15 from Kode Tadabliro, Delang, Detung, 16 from Hokor, Bora, one from Hubing)
	outside forest reserve	Watunuhung (Wolomarang), Wairleber/Nilo (Ds. Nitakloang)	150	
	"	Iligetang (Ds. Nele Urung/Ds. Beru)	100	
	"	Nagablo) Ds. Dobo	100	
	"	Woloone)		
	"	Nangahaledoi, Hoder (Ds. Waibleler)	50	
	"	Wodong, Lua, Pigang (Ds. Egon)	1000	
	"	Waturedu, Palugahar (Ds. Wolomarang)	1500	
	"	Kolisia, Kolit, Koro (Ds. Magepanda)	2000	
	"	Ilinewa (Ds. Sikka)	50	
	Ilinggai RTK 60	Ivutik, Kode, Delang (Ds. Koting D)	100	
	outside forest reserve	Manuwaing (Ds. Hokor)	40	
	"	Korat/Wukrukut (Ds. Wolokoli)	100	
	"	Wolomapang (Ds. Runut, Kecamatan Talibura)	100	
	"	Glak (Kec. Talibura)	100	
	"	Loiwair	50	
	"	Tada Kea/(Kringa), Wainio	100	
	Wulanggitang I RTK 66		50	
1960	outside forest reserve	Haminte Nita a) from Belang to Wairdoko,	500	
		b) other parts of H. Nita	57.9	
	"	Haminte Wairgete a) Hoder, Halar, Wolonbuer,	36.2	
		b) from Mageramut to Wairgete	600	
		c) other parts of H. Nita	4.6	
	"	Haminte Nele	9.4	
	"	Haminte Ili/Wetakara	27.3	
	"	Haminte Wolokoli	2	
	"	Haminte Werang	25	
	Ili Dobo RTK 61	Haminte Hewotkloang	26	
1973	Kimang Buleng RTK 59	Kecamatan Nita	30	illegal opening of *ladang*
1974	Egon RTK 107		15.1	illegal opening of *ladang*
	Kimang Buleng 59	Kecamatan Nita	7	
	Ilinggai RTK 60	Kec. Maumere	10	
	Egon 107	Perwakilan Kec. Talibura	132	illegal fires
	Iliwuli 64	Talibura	10	
	Ilinggai 60	Kec. Bola	0.3	
1975	Egon 107		5.5	illegal opening of *ladang*
	Egon 107		12	
	Ilinggai 60	Kec. Kewapante	3	illegal fires
	Kimang-Buleng	Kec. Nita	6	

Sources: 1952: Dinas Kehutanan Sikka (from archives).
1960: Panitia Penilaian KOGM (*Komando Operasi Gerakan Makmur*) *takun 1960 Daerah Tingkat II Sikka* (Govt Archives Sikka No. 147).
1973-75: Data provided by Dinas Kehutanan Sikka in May 1976. Data on loss of forest outside forest reserves unfortunately not available.

The scattered location of forest reserves in Sikka indicates that not even the watershed could be wholly protected. Various attempts at enlarging present forest reserves and thereby affording a more effective protection of Sikka's watersheds at least were unsuccessful. Hardly any additional land was placed under protection of Sikka's forestry service after independence. Population pressure and fiercely defended claims on land have been in the way of realizing plans conceived in 1953 of joining various forest reserves (see Table 6).

Table 6

Forest reserves to be joined in Sikka

Forest reserves	New number reserved for by official register (RTK)	Additional area to be protected (ha)
Iling Gai No.60 + Ili Dobo No.61	124	625
Egong No.107 + Ili Wuli No.64	125	625
Glawuk No.65 + Wulang Gitang I No.66	126	630
Ili Wuli No.64 + Glawuk No.65	No data	
Mbotulena No.58 + Keliwenda	No data	

Source: DKS (1971:4-5).

The only two forest reserves which have been joined so far are those of Telorawa II and Kimang-Buleng (additional area: 200 ha) in sparsely populated western Sikka. Protection of forests was not significantly improved after 1959, either when Sikka was given a forestry service of its own. Formerly there was only one forester in eastern Sikka whose headquarters were in Larantuka. The forestry service seems to wage a losing battle

[13] (continued)

2. Regulation aimed at protecting steep valleys and gorges *(Peraturan Daerah Flores No.4 tahun 1955 tentang perlindungan jurang)*.
3. Regulation aimed at halting the felling of *kayu manis (Cinnamomum burmani)* and *kayu kuning (Cudrania javanensis)* *(Peraturan Daerah Flores No.2 tahun 1954 tentang penghentian pemungutan kayu manis dan kayu kuning)*.
4. Decree aimed at protecting forests (*Keputusan dari raja raja di Flores No.8 tahun 1947 tentang peraturan perlindungan hutan-hutan)*.

against rapid degradation of Sikka's forest remnants. Not even the state forests are completely free from *ladang* farmers. Six hundred people of Desa Egong (Kampung Tanah Hikong, Runut, Wolomapa and Napung Biri Gunung) are still living within the precincts of forest reserve Egong No.107 (see DKS 1971:5).

The futility of the present reforestation program, called *tumpang sari*, which was started in Sikka in 1966, could not have been more clearly demonstrated than by an observation during my visit to Hokor in April 1976. Here in the forests on the southern flanks of Mt Iling Gai and Mt Ili Lorat (Plate 14), which are part of the Iling Gai forest reserve, *ladang* farmers had cut the trees irrespective of slope gradient (even exceeding 60 per cent). The irony of this event was that at the same time the government was making an effort to reforest the grass-covered slopes on the northern flanks of the reserve. The extent of this scheme is shown in Table 7. While between 1969 and 1975 roughly 413 ha were reforested within the reserves (*reboisasi*) and 360 ha outside (*penghijauan*), more than 230 ha were reportedly lost through uncontrolled fires and illegal bush fallowing between 1973 and 1975 alone. The actual hectarage (i.e. including the unreported loss) of forests lost because of fire is unknown. I have observed increasing large-scale encroachment upon forest reserves where farmers lose control such as Egong No.59, Telorawa No.57 and Kimang-Buleng No.59 at Ds. Kloangpopot, Ds. Pogon (Koker) and Wolondoi as well as in Lekebai (Ds. Parabubu, Ds. Liakutu) in Kecamatan Paga. Such encroachment is often facilitated by the ill-defined course of the reserve's boundaries and not infrequently by the silent consent of the foresters.

Sikka's forests have not yet been commercially used, chiefly because of the unusual relief. The *tumpang sari* reforestation aims at introducing commercially valuable trees (Plate 15). According to this agro-forestation scheme farmers on Flores are given the opportunity to cultivate plots of land under supervision of the forestry service which provides the farmer with seed of maize, upland rice, cassava, peanuts, taro and sweet potatoes. Should the need arise and crops fail, money will also be given as an incentive (*prangsang*(I)) to tide the cultivator over to the next crop. During a period of three to five years the farmer is entitled to keep all yields.[14] During this period, however, he is

[14] As an example, in 1966 the following yields were obtained at the two selected *tumpang sari* projects at Hoba I (15 ha) and Hoba III (22.5 ha) - i.e. total of 37.5 ha:

dryland rice	11,630 kg
maize	15,145 kg
cassava	10,075 plants
sweet potato	1,199 plants
taro	218 plants
tobacco	1,120 kg

Source: DKS Annual Report 1966:11).

Table 7

Government reforestation scheme (*tumpang sari*) 1970-75, within forest reserves

Year	Area (ha)	Number of partici-pants	Desa of origin of partici-pants	Reforestation project	Forest reserve
1965-66	8.25			Wairlebeng	Kimang-Buleng No.59
	15.00	no data		Hoba I	Ilinggai No.60
	22.50			Hoba II	
1967-69			no reforestation		
1969-70	30.75	120	Blatatating	Hoba IIIa-b	Ilinggai No.60
	9.75	39	Waibleler	Wairita	Egong No.107
	10.00	40	Ilinggai	Tanah Ratu I	Ilinggai No.60
1970-71	10.00	40	Ilinggai	Tanah Ratu II	Ilinggai No.60
	5.00	12	Nitakloang	Lado Gahar I	Kimang-Buleng No.59
1971-72	10.00	40	Ilinggai	Tanah Ratu III	Ilinggai No.60
	30.00	120	Tekaiku	Wolon Bulir	Ilinggai No.60
	12.50	18	Nitakloang	Lado Gahar II	Kimang-Buleng No.59
1972-73	5.00	20	Bu	Wolosoko I	Telorawa II No.57
	5.00	15	Nitakloang	Lado Gahar III	Kimang-Buleng No.59
	5.00	20	Ilinggai	Tanah Ratu IV	Ilinggai No.60
	10.00	40	Koting D	Wolon Mahet	Ilinggai No.60
	15.00	60	Nele Wutung	Wolon Kolit	Ilinggai No.60
	15.00	60	Nele Urung	Wolon Huwur	Ilinggai No.60
	5.00	20	Waibleler	Wairita II	Egong No.107
1973-74	10.00	40	Bu Utara	Wolosoko II	Telorawa II No.57
	15.00	25	Nitakloang	Lado Gahar IV	Kimang-Buleng No.59
	10.00	40	Bu Utara	Wolon Delang	Ilinggai No.60
	11.00	44	Koting D	Wolon Mahet	Ilinggai No.60
	17.00	52	Nele Wutung	Wolon Kolit	Ilinggai No.60
	3.50	14	Tekaiku	Wolon Bulir	Ilinggai No.60
	5.00	20	Iantena	Rotan Eba	Ili Dobo No.61
	6.00	24	Waibleler	Wairita III	Egong No.107
	11.00	no data	Egong	Wairgete	Egong No.107
	11.50	"	Egong	Wawileten	Egong No.107
1974-75	36.00	no data	Egong	Wairgete/Urun Pigang	Egong No.107
	10.00	11	Hikong	Hikong	Wulanggitang I No.66
	10.00	40	Liakutu	Wolowatu	Telorawa II No.57
	5.00	8	Nitakloang	Lado Gahar V	Kimang-Buleng No.59
	17.00	68	Ilinggai	Lodo Detut	Ilinggai No.60
	3.50	11	Koting D	Wolon Mahet	Ilinggai No.60
	12.50	50	Nele Urung	Wolon Huwur	Ilinggai No.60
	6.00	24	Waibleler	Wairita	Egong No.107
1975-76	5.00		Liakutu	Wolowatu II	Telorawa II No.57
	7.50		Ilinggai	Tana Ratu	Ilinggai No.60
	7.50	no data	Nele Wutung	Wolon Kolit	Ilinggai No.60
	5.00		Egong	Wairita II	Egong No.107
	5.00		Hikong	Hikong/Pilek-edang	Wulanggitang I No.66

Source: Information provided by Dinas Kehutanan, Kab. Sikka.

obliged to plant trees - for instance *johar* (I) *(Cassia siamea)*, *ai suli*(I) (*Acacia oraria*), *ai hepang*(I) (*Caesalpinia sappan ai dulun*(I) (*Cudrania javanensis*) - in between his crops and *lamtoro* (*Leucaena laucocephala*) in rows along contour lines about 4 to 5 metres apart, depending upon the slope gradient. When the field is abandoned, the plot reverts to forest and the farmer's contract expires. Only grassland will be recultivated by *tumpang sari* farmers. In contrast to Java where for a long time the *tumpang sari* scheme has been carried out on the basis of share cropping whereby costs and profits are split equally between the government and the farmer, the Flores type of *tumpang sari* has to be considered a modified version. It leaves almost the entire risk to the government and should therefore be more appropriately called 'semi-*tumpang sari*'.

Physical environment and land use

The lower the state of development of agricultural techniques, including the state of socio-economic organization, the greater will be the impact of the physical environment on man's activity. It is for this reason that it seems useful to summarize briefly the chief physical characteristics of Central Sikka and how they relate to land use. Of the three environmental factors - topography, soils and climate - it is the last that exerts the strongest influence upon Sikkanese agriculture. In Central Sikka three major climatic zones were distinguished. By comparison to the northern flanks and coastal zone the central upland and the southern flanks of the volcanoes seem to benefit from higher annual precipitation as well as from a more even distribution of rainfall over the year. The climatic advantage of the latter two zones is, however, more than offset by the highly precipitous relief. The southern flanks seem to be particularly affected by erosion. Northern and southern (including the centre) zones are thus both disadvantaged by either climate or topography.

Edaphic conditions are, however, not unfavourable. Central Sikka's soils are of high natural fertility - particularly rich in minerals from the loose basic volcanic debris - and of good texture. As chemical analyses revealed, however, most soils are characterized by a deficiency in nitrogen and organic matter. This is the result of erosion which is enhanced by a precipitous relief and the present forms of agricultural activity. Moreover, as Mohr (1934 vol.II, 1:71) pointed out, the high inherent fertility of Sikka's soils is considerably impaired by the lack of water[15] which limits the agricultural potential of that part of Flores.

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[15]Despite the scarcity of water, until quite recently people shunned certain springs considered sacred in the vicinity of their villages. Instead they carried the water from distant waterholes (Weber 1890:6).

Such impediments may be overcome through capital-intensive techniques. However, to what extent the Sikkanese have made use of their environment without such techniques will be the subject matter of the pages that follow.

Discussion

In trying to relate the physical characteristics of Central Sikka to the basic issue of this study - that is the relationship between demographic pressure and ecological stability of agricultural systems - we can state that to a certain degree physical factors tended to favour human occupation in this part of Flores. Thus shifting systems on low fertility kaolisols of the ever-wet tropics (Kalimantan and parts of Sumatra) are not fully comparable with *ladang* systems on volcanic soils (Central Sikka) which are of considerably higher inherent fertility. If these volcanic soils are managed wisely and fallowed for at least three years (as was customary until the 1950s) they give satisfactory yields. It might even be argued that moderate denudation may have a beneficial effect inasmuch as new minerals are exposed and made available to plant growth (Weischet 1977:26).[16] Here cultivating the soils under bush fallow systems at varying levels of intensity seems possible without setting in motion a collapsing spiral. Thus contrary to Geertz's belief rotation systems seem to exist which are far more flexible; Central Sikka is a case in point. Such a built-in flexibility of Central Sikka's agricultural systems (particularly in the densely populated saddles) might at least partly account for the disinclination of the Sikkanese to adopt new agricultural techniques under population pressure.

The analysis of the physical factors of Central Sikka highlighted that the three saddles (physiographic zones III a, b, c) seem to be comparatively more suitable for agricultural purposes because of a more evenly distributed annual rainfall, a slightly undulating terrain (except for the saddle of Baomekot) and deeply weathered andosols. Population densities have always been higher on these saddles while labour intensity has not. Land degradation is severe on the slopes of Mt Tarat-Egong and particularly so south of the central divide. The desa on the southern slopes are comparatively poorly endowed by nature. Relief and edaphic conditions do not seem to lend themselves readily for farming or livestock keeping. On the deeply eroded, less fertile andosols

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[16]According to Weischet (1977:26) tropical mountainous regions are frequently more suitable for agriculture than tropical plains characterized by locally developed kaolisols which had undergone severe impoverishment after a long genesis. The latter conditions were considered typical for the so-called Outer Islands by Geetz. However, in this respect Central Sikka forms an exception although the potential of Sikka's soils is considerably restricted by the low and erratic rainfall.

(Ranker type) and grey ash soils found south of the central divide agricultural yields remain extremely low, in spite of a comparatively higher labour input, as will be demonstrated later. Although erosion is severe hardly any anti-erosion devices were applied by the population in this portion of Sikka in sharp contrast to the saddles and area north of the central divide. A further disadvantage of the south coast is its limited accessibility as compared to the gently sloping northern slopes. This contrast is worth mentioning as it will have a bearing on the central issue of ecological stability.

On the basis of an analysis of the physical factors alone we cannot adequately assess either agricultural intensity or population pressure in Central Sikka. For a fuller understanding of this relationship we will have to look into Central Sikka's cultural history and socio-economic conditions in more detail.

Human background

Flores and Sikka in their historical setting

Of all ecological agents man has beyond doubt exerted the most pronounced and lasting impact upon the landscape of the study area. This has repeatedly been evidenced in the discussion of erosion, floods and the present vegetational pattern. Extremely high population densities, locally exceeding 500 persons/sq.km, are conspicuous for Central Sikka. It is by far the most densely occupied region of the eastern Lesser Sundas.

This exceptional situation cannot be explained by physical factors alone, even less so as climate and topography are not all that favourable. In order to gain a fuller understanding of the present settlement and land use patterns - hence of man's impact on the island ecosystem - it seems mandatory to outline briefly the historical guidelines of human settlement of the isle of Flores as these are hardly investigated even by historians of Southeast Asian history. In the absence of a regional history of the island recourse had to be made to bits of information scattered in a number of published but mostly unpublished sources. Following this outline the special role Central Sikka played in the island's history will become apparent. This as well as an account of Sikka's social and political organization will provide us with a more detailed explanation of the present settlement pattern as well as of the forms of land utilization which will be dealt with in full in the final section of this chapter. It is on this basis that we shall analyse the temporal and regional distribution of the population of this part of Flores as well as the dynamics of population growth and migration.

Until the beginning of this century Flores and the islands of the Solor group (Adonara, Solor, Lembata) belonged to the least explored parts of the archipelago (see Veth 1855:153-4) and in 1874 Veth (1974b:95) wrote of Flores:

> *Hoe lang zullen wij nog dulden dat in het midden van den Indischen Archipel en groot eiland ligt dat in naam aan ons gezag is onderworpen, maar waar van ons het binnenland even wenig bekend is als het betrekkelijk klein gedeelte dat nog, na de volhardende pogingen van zoovele reizigers, van de befaamde witte plek in Afrika's binnenlanden is overgebleven!*
>
> [How much longer should we still have to accept that there is a large island in the middle of the Indian Archipelago which is nominally under our control but whose interior is hardly better known to us than the relatively few areas which, after persistent efforts of so many travellers, still remain of the famous blank spots in Africa's interior.]

In 1889 the Royal Dutch Geographical Society entrusted a number of scholars with the scientific exploration of the island: R.van den Broek with a topographic survey, A. Wichmann with a geological-zoological study and H.F.C. ten Kate with a study of the ethnographic-anthropological situation (KNAG 1889; N.A.Broek 1890). Yet in 1932 Vatter (1932:23), who carried out ethnological fieldwork in the Solor islands including eastern Flores, concluded that scientific exploration of this region in any discipline was still in its infancy. This poor state of knowledge is somewhat surprising since it is this part of the archipelago with which Europeans established contacts at a very early stage of colonial history - namely in the sixteenth century.

The cultural history of Flores is but insufficiently explored. Archaeological evidence, local myths and linguistic divisions of the island convey a rather heterogeneous picture. Recent findings by archaeologists at Liang Momer and Liang Toge (see Fig.2) have shown that Flores must have been associated with a younger palaeolithic culture (see Verhoeven 1953, 1958). Neolithic axes found on Flores suggest Malay (quadrangular axe) as well as Melanesian (round axe) cultural characteristics (Verhoeven 1952). A number of bronze artefacts - including a dagger found at Bajawa (Ngada) which is considered one of the oldest metal instruments in Indonesia, three bronze axes found in a tomb at Maumere and a model ship made of bronze - are believed to originate from Dong-Son (Verhoeven 1963:120). These artifacts suggest some connection between Flores and mainland Southeast Asia.

Vroklage (1936) was able to show that the *prau* symbol, found in megalithic cultures, originated from a culture based on bronze or iron which spread from mainland Southeast Asia throughout Indonesia about 200 BC. In this bronze or iron culture the village community was symbolised by a *prau*(I). This typical cultural element can be traced throughout the isle of Flores (Vroklage 1940). During a visit to Sikka in 1888 Jacobsen saw coffins which were traditionally made in the form of a *prau* (see Jacobsen 1896: 68-9). A miniature *prau* made of bronze, venerated by the local population, can still be found at Dobo (Ds. Iantena) today. Also the layout of the village often reminds us of the *prau*, for instance at the old village of Nita (Arndt 1933:96-8), a point to which we shall come back when we discuss the settlement pattern.

Flores' population is of mixed ethnic origin. In Sikka the physical anthropologist Keers (1948:47) distinguished a strongly mixed, enterprising, well-educated people living along the coast and a dolichocephalic group which he found in an almost pure state in the mountains of Maumere (Plates 11, 30 and 31). This group which Bijlmer (1929:18) called *Kroënese* and Wichmann (1891:151) *'ata kroë* and which is known today as *krowe* or *'ata krowe*[17] is likely to be of Melanesian origin (Keers 1948:47, 75, 145).[18] Similar observations as to the existence of two distinct racial groups in Sikka were made by Weber (1890:5) and ten Kate (1894:220, 227) during their visits to Central Sikka in the last decade of the nineteenth century.

The extensive mingling of the coastal population seems to have been particularly strong in eastern Flores. From time immemorial the Strait of Flores between east Flores and the Solor islands has been an important north-south trade route frequented by Malay seafarers. Hence the coasts along this passage became the scene of strong racial mixture.[19] The same was true for

[17]These hill people, *'ata krowe*, are locally known as *'ata gerong* around Ili/Kangae; *'ata iwang* around Kloangpopot, Hale and Hebing, *'ata iwang gete* around Hewotkloang, Baomekot and Ohe. There is however much confusion in the literature on Flores about the meanings of these terms. Hence also in Sikka we encounter the typical pattern of hill-dwelling groups and lowlanders as is found throughout Southeast Asia. The hill people in Sikka are looked down upon by the *'ata Sikka*. The term *'ata iwang (ata* = man; *iwang* = hill) is alluded to in the title of the book by Vatter (1932), *Ata Kiwan*, in the Lamaholot language of eastern Flores and the Solor archipelago.

[18]This is substantiated by a recent survey of anthropometric data of 227 Indonesian and 41 Philippine ethnic groups processed by computer. This survey yielded striking affinities between the *'ata krowe* and the Kemak, Marai and Belu of West Timor. Hence the *'ata krowe* seem to be less closely related racially to the Sikkanese and the people of Kringa (Glinka 1978:99).

[19]Although predominantly Malays from Sulawesi, Portuguese also mixed freely with natives. Their descendants are to be found in Larantuka and Maumere (see also Jacobsen 1896:61-2).

Maumere and the isthmus of Flores (saddle of Nita) where the coastal people are called *ata Sikka* or *ata Alok*. The mixed coastal population never penetrated far into the interior; for example in the mountainous Head of Flores (see Fig.2) the native inhabitants live quite separated geographically but only a few kilometres from the coastal population which is of mixed stock (Bijlmer 1929:18).

More is known of the island linguistically. According to Salzner (1960) all of the five main languages spoken on Flores are Austronesian. This huge family of languages which extends from West New Guinea to Madagascar is divided into a western and an eastern group. The dividing line between the two groups runs through Flores: Manggarai, Ngada and Lio belonging to the western group (Bima-Sumba subgroup) while Sikkanese and Solorese (also called Lamaholot) belong to the eastern group (Ambon-Timor subgroup). The ethnic differences between the immigrant Sikkanese-proper and the native Krowe population is not reflected in linguistic differences. Sikkanese, as the main language spoken in the district, is found throughout Central Sikka, thereby comprising a portion of the Krowe population. Sikkanese has made considerable inroads into Sikka's remaining linguistic regions: Lionese in the west, the language of Tana Ai in the east which shows dialectal differences from Sikkanese, and finally Lamaholot (locally called *Muhang* in east Sikka) at the border with Larantuka. Figure 18 shows that the Sikka language has infiltrated into the Tana Ai linguistic province, particularly along the north coast up to the alluvial plain of Nebe. Sikkanese is also to be found in a few small alluvial plains in the southeast and in the northwest of the district. Finally the languages spoken by a small number of immigrants from southern and southwestern Sulawesi (Buginese, Makassarese, Butonese, Bonerate language, Salajerese and Bajau (probably from Kalimantan)) have to be mentioned. The role these immigrants play in Sikka's economic life will be taken up later.

Flores is first mentioned in the Javanese epos *Negarakertagama* written in 1365 which describes the history of the Hindu empire of Majapahit. Flores was one of the colonies of this empire under which it was referred to as *Solot*, a name also used later by the Dutch in the seventeenth century (Vatter 1932:23). Vestiges of that Hindu period are found throughout the island and even in its languages (Vroklage 1941; Le Roux 1942; Arndt 1938:34ff.). With the rise of Islam the Majapahit empire collapsed. In the eastern part of the archipelago it was succeeded by the Islamic states of Goa in southern Sulawesi and of Ternate in the northern Moluccas. During the fifteenth and sixteenth centuries Flores became a colony of these two states: western and central Flores under Goa; eastern Flores, Solor and Alor under Ternate (Le Roux 1929:14, note 2).

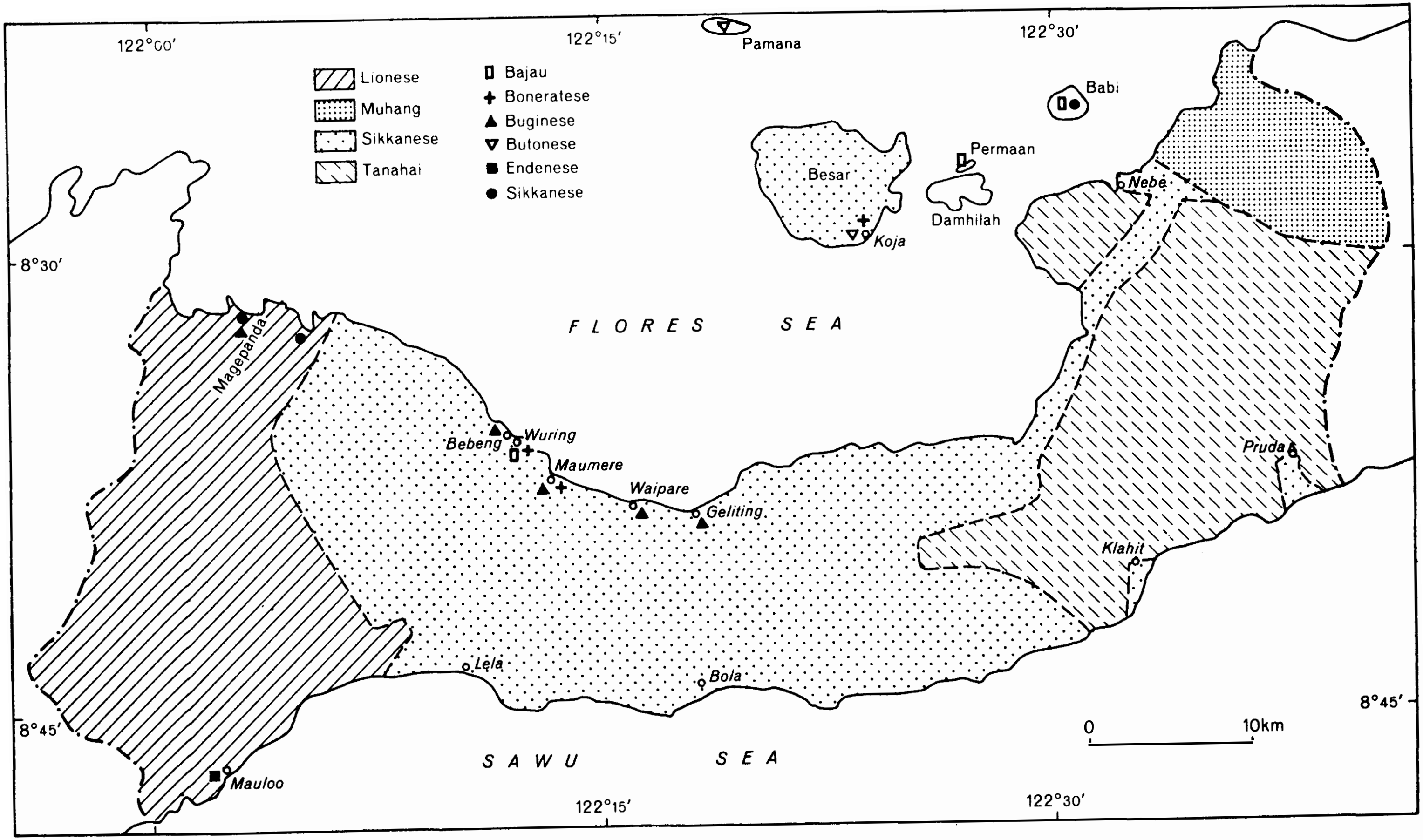

Fig.18 Sikka: regional distribution of languages

The island's present name - Flores - is believed to stem from the Portuguese who were the first Europeans in this part of the archipelago and who named the easternmost cape *Cabo das Flores* [Cape of Flowers] or *Tanjung bunga* in Indonesian. While the name of this cape was later applied to the whole of the island, the Portuguese themselves used the terms *Solor novo* for Sikka, Larantuka and Solor, and *Solor velho* for the region around Ende (Minutoli 1855 II:366). A native term for the entire island is unknown, which underscores the fact that only small political units can have existed on the island.

With the advent of the Portuguese in the eastern portion of the archipelago in the first half of the sixteenth century Flores moved into the orbit of the Europeans. The first European who passed and subsequently mentioned the island was the Portuguese Antonio de Abreu who sailed to the Moluccas in 1512 (Leitão 1948: 25ff.). Although no exact date can be ascertained the first Portuguese landing on the island is believed to have occurred before 1550 (Piskaty and Riberu 1963:9). All we know is that Portuguese merchants, who soon after the discovery of the Moluccas participated in the lucrative trade in sandalwood from Timor, regularly stopped at the isle of Solor where they found shelter against the monsoons. Timor's coasts, which lack bays and inlets, could not provide such protection.

In 1561 the Portuguese Dominican priest, Antonio de Taveira, established a mission at Solor which became the centre for early missionary work in the Lesser Sundas (Biermann 1924:16). From here Dominican priests evangelized along the coast of eastern Flores where by 1575 they had founded twenty missions (see Fig.19).[20] On the islet of Ende and on Solor the Portuguese had fortresses built. Despite several trade agreements and defence alliances, however, their political influence was only very slight and confined to the coast. The native rulers remained largely independent.

Missionary activity did not remain unchallenged. After 1592 attacks by local rulers who had accepted Islam, by the king of Goa as well as by pirates, impinged upon the Solor mission and caused heavy losses among the priests and their followers (Piskaty 1964:42). Though the remarkable number of 50,000 indigenes is said to have been converted to Christianity the decline of the mission on Flores could not be halted. Eventually all of the stations on the south coast of Flores had to be given up. The fate of the Solor mission was formally sealed by the advent of the Dutch who in 1613 destroyed the Portuguese settlement and fortress at Lawajong on Solor. Portuguese priests had to flee to Larantuka. Finally in 1637 the Portuguese fortress on the island

[20] The village of Sikka was first mentioned by the Dominican brother Fr Luis de Cacegas (1767:287) as one of 18 places on Flores, Solor and Adonara where churches were founded. In the sixteenth century, 13,000 Christians were reported for the entire region.

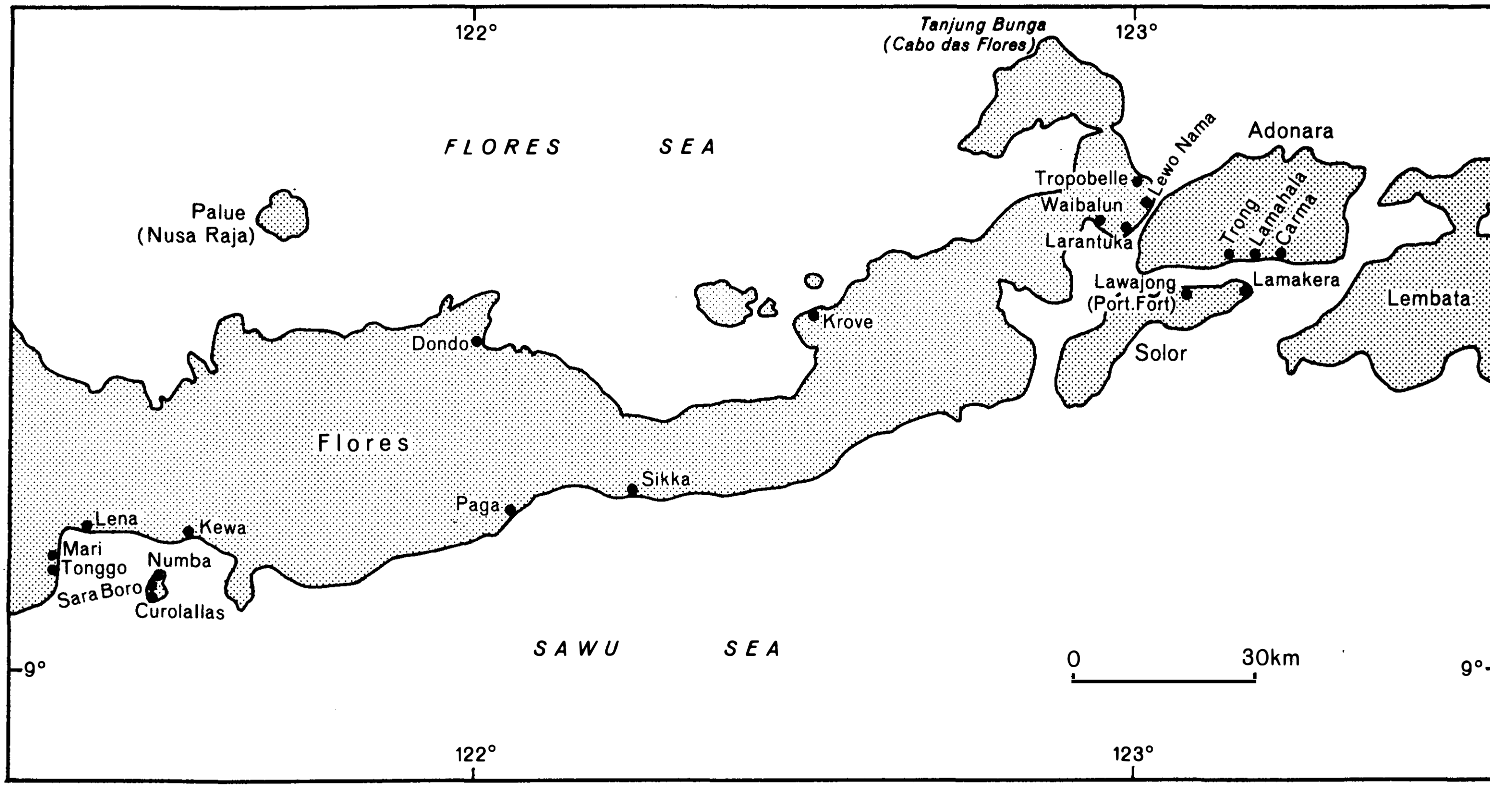

Fig.19 Dominican mission stations in East Flores and the Solor islands in the sixteenth century (after Visser 1925)

of Ende was overrun by Moslem groups and was hence given up as a missionary station.

After the fall of Malacca in 1641 the Dutch Verenigde Oostindische Compagnie (VOC) increased its efforts at bringing Flores and the neighbouring islands under its control. In this the company was exclusively guided by commercial interests. A treaty concluded with native rulers on Solor in 1618, and renewed in 1646, stipulated that all goods earmarked for export, including slaves, had to be sold to the company (Heeres 1907:460-3). The company further strengthened its position on this island by an agreement with the Sultan of Ternate in 1683 who formally ceded all his rights on the isle of Solor to the company.

In an effort to monopolize the trade of Flores and the eastern islands of the Dutch VOC concluded a permanent treaty with the ruler of Goa at Makassar (treaty of Bongaai) in 1667 which brought Bima under the control of the VOC and acknowledged the company's authority over the greatest part of Flores. Hence other European powers were excluded from trading in this region. A Dutch postholder was soon after placed at Braai (near Ende).

Excepted from this treaty were the Portuguese possessions of Larantuka, Sikka and Paga in eastern Flores (Veth 1855:172). The impact of the Portuguese in this portion of Flores was primarily religious. With the gradual decline of the Dominican mission caused by a shortage of priests, however, no more missionaries were stationed on Flores after 1782 (Bot 1955:576). The Catholics in Larantuka and Sikka were visited once every three to five years by one of three priests from Timor (Piskaty 1964:48).

In contrast to the Portuguese the Dutch were exclusively interested in trade. Of Flores' exports - slaves, sappan wood (*Caesalpinia sappan*) and wild cinnamon - they tried to monopolize the latter two. In 1669 they concluded a treaty with Bima for the exclusive purchase of sappan wood from Manggarai (West Flores) which was under the suzerainty of Bima. Wild cinnamon was received from Ende (Veth 1855:163). The Dutch East India Company is also said to have contributed to the increase of the slave trade. Slave raids by Makassarese and Buginese from South Sulawesi were a common phenomenon not only on the coasts of Flores (particularly Manggarai) but also on Sumba and Timor (Veth 1855:165). As a consequence the indigenous population retreated into the island's interior. This infamous slave trade was officially forbidden in the nineteenth century by the Dutch colonial government which replaced the VOC after the latter had become bankrupt. In 1839 a treaty with Ende officially outlawed the slave trade and gave the Resident in Kupang the power to punish offenders (Veth 1855:177-8). But even in 1907 it was still reported to exist in Ende (van Suchtelen 1921:93).

The VOC never really managed to monopolize Flores' exports. The island offered too long a coast and too many sheltered bays for effective control of trade. Well before the arrival of the Europeans trade with Flores was firmly in the hands of Makassarese and Buginese. The main ports of export were Bari and Pota in Manggarai, Geliting in Sikka and Larantuka on the north coast, and Ambugaga (= Ende) and Braai (near Ende) on the south coast. The ports of Geliting and Ambugaga were Buginese settlements and belonged to a wide net of Buginese trading ports throughout the archipelago which is still typical for Buginese trading today. *Prau* used to leave Sulawesi in February and March with the north-west monsoon (*warat*) for Flores with gold, coarse porcelain, elephant tusks,[21] *parang* (a sort of machete), red and blue linen and copperware. From Flores which they left in August and September they returned with birds' nests, rubber, *trepang*(I) (sea cucumber), a great part of which they fished in the bay of Maumere (Veth 1855:161), shark fins, sandalwood, wild cinnamon, *gamuti*(I) rope (fibre from *Arenga saccharifera* palm), coconut oil, cotton and woven material from Ende (Veth 1855:164). These products were sold in Makassar and on the Malacca peninsula.

In the first half of the nineteenth century the Dutch government showed an increased political interest in Nusa Tenggara. The constant menace to the population of Larantuka and Ende provided by pirates was a welcome pretext for interventions in 1838-39 and 1851 (Veth 1855:173, 179), as a result of which Ende and Larantuka werè burnt by the captain of a Dutch man-of-war. This led to official protest by the Portuguese government in Dili, who still maintained a claim on Sikka and Larantuka. Yet Portuguese control over east Flores was merely nominal. Although in certain places the Portuguese flag was flying, Florinese did not pay any tribute to the government in Dili. Only Sikka sent a small contingent of soldiers to Dili (Minutoli 1855 II:371).[22]

After years of dispute with the Dutch, the Portuguese governor in Dili, in an effort to settle the financial problems of the colony, concluded an agreement with Holland in 1851, according to which west Timor became Dutch and all territorial claims by the Portuguese on Alor, Pantar, Lomblen and Flores (Larantuka, Sikka and Paga) as well as Wurek on Adonara and Pamangkaju on Solor (Eerde 1923:76) were ceded to the Dutch for 80,000 guilders (Veth 1855:178). This treaty was obviously made without the formal

[21]According to Hens (1916 II:59) these elephant tusks were first introduced into Flores by the Portuguese. Up to the present they are in high esteem as bridewealth (the larger ones are called *bala repang*, the smaller ones *dĕdung*, according to ten Kate 1894: 212). Formerly they also served as money, particularly in Sikka and eastern Flores.

[22]According to Lencastre (1934:15) Sikkanese soldiers used to live in a quarter of the town of Dili called Sica as late as 1912.

approval of the Portuguese government in Lisbon who, because of poor communications between Portugal and Timor received word of the agreement too late. Despite violent protests the agreement became effective in 1859 (treaty of Lisbon) (*Indische Staatsblaad*, No.97; *Ind. Stbl.*, 1860, No.101). In 1851, roughly seventy years after the last priest had left Flores, a Dutch secular priest arrived in Larantuka. In 1862 Dutch Jesuits took over all missionary work from the secular priests on Flores and founded new stations in Sikka and Maumere (Piskaty 1964:50).

The Dutch administration was far less successful than the missionaries in gaining control of the island. From 1859 down to the first decade of the twentieth century Dutch authorities were continually confronted with rebellions and tribal wars. The lack of a consistent policy throughout the island was moreover due to the administrative division. While Manggarai was a dependency of Bima (Sumbawa) until 1929 (Bosselaar 1932:69) and until 1909 under control of the regency of Celebes en onderhoorigheden, the rest of Flores came under the control of the regency of Timor en onderhoorigheden. Between 1890 (Rokka expedition) and 1907-08 (North Flores expedition) military operations assumed considerable dimensions (van Patot 1907:762-72) (Fig.20).

As a result of constant intertribal warfare the Dutch decided to give up their strict policy of non-interference with native affairs and tried to bring the island under firm administrative control. By the end of 1906 the Dutch government sent a controleur, A. Couvreur, to Ende whose order was to establish firm administration throughout the island. To this end the island (with the exception of Manggarai) was divided into four districts: 1. Noord Flores with a *posthouder* at Maumere, 2. Oost Flores with a *civiel gezaghebber* at Larantuka, 3. Solor eilanden with a *posthouder* at Waiwerang (Adonara), and 4. Zuid Flores with a *posthouder* at Ende which until then was administered as a subdistrict from Sumba (*Gouvernements Besluit v. 2 April 1907 No.5 - Ind. Stbl.*, No. 208) (see Fig.21).

As a protest against increased control by the Dutch, Ende was burnt by native rulers in 1907. Following this incident a Dutch punitive expedition (North Flores expedition) under captain of police H. Christoffel subdued most tribes of central and western Flores (Ende, Ngada, Manggarai) (Winokan 1960:11-14; van Suchtelen 1921:12-13).

Although stout resistance continued to be offered by some tribes, especially in Ngada until 1913 (Winokan 1960:15), a new phase of Dutch colonial policy began on Flores after 1908. Instead of *ad hoc* military expeditions which characterized the period 1890 to 1907, the Dutch introduced permanent control. Local leaders had to sign declarations of allegiance (*korte verklaring*) by which they recognized Dutch supremacy and renounced local wars. Firmer

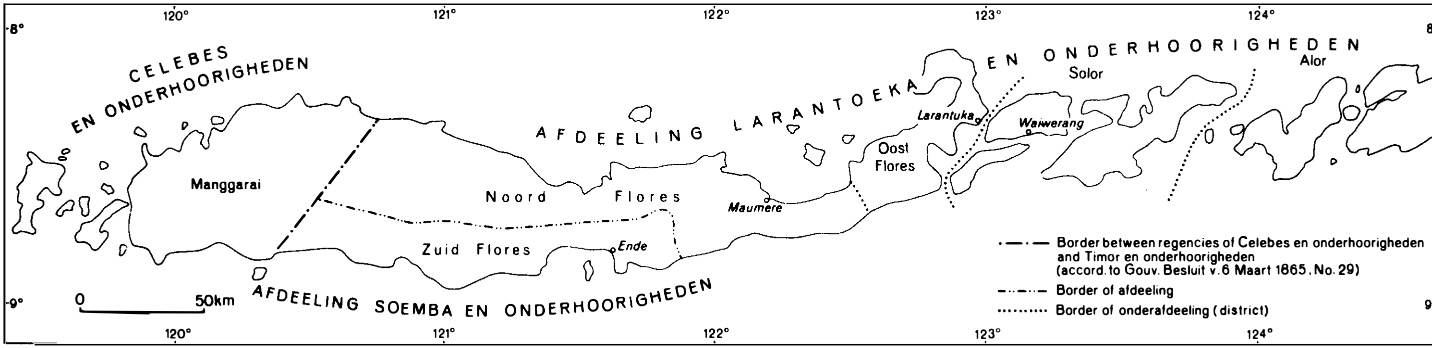

Fig.20 Flores: administrative division, 1879-1907 (after Flores Memorie 1912)

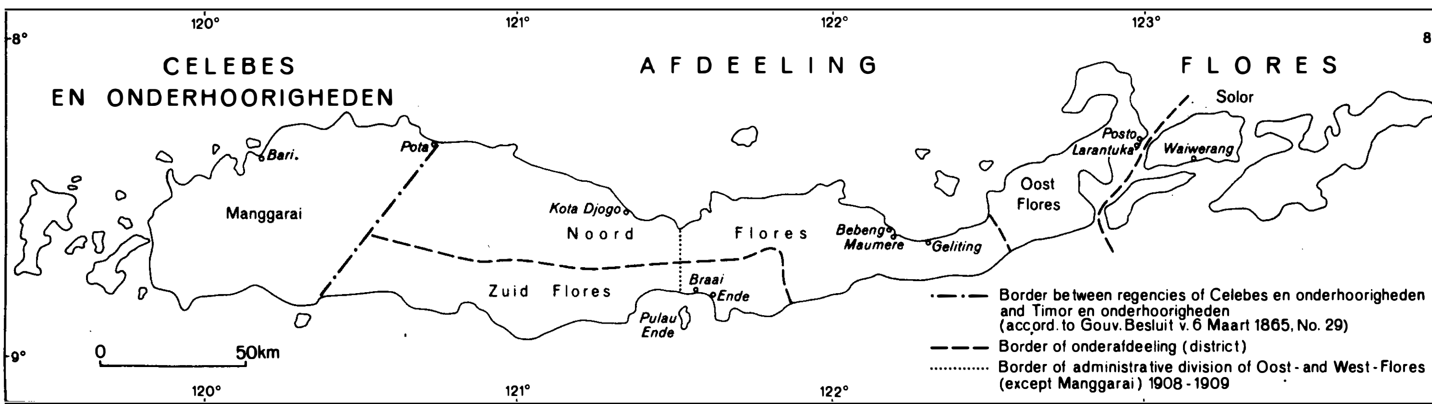

Fig.21 Flores: administrative division, 1907-09 (after van Patot 1907 and Flores Memorie 1912)

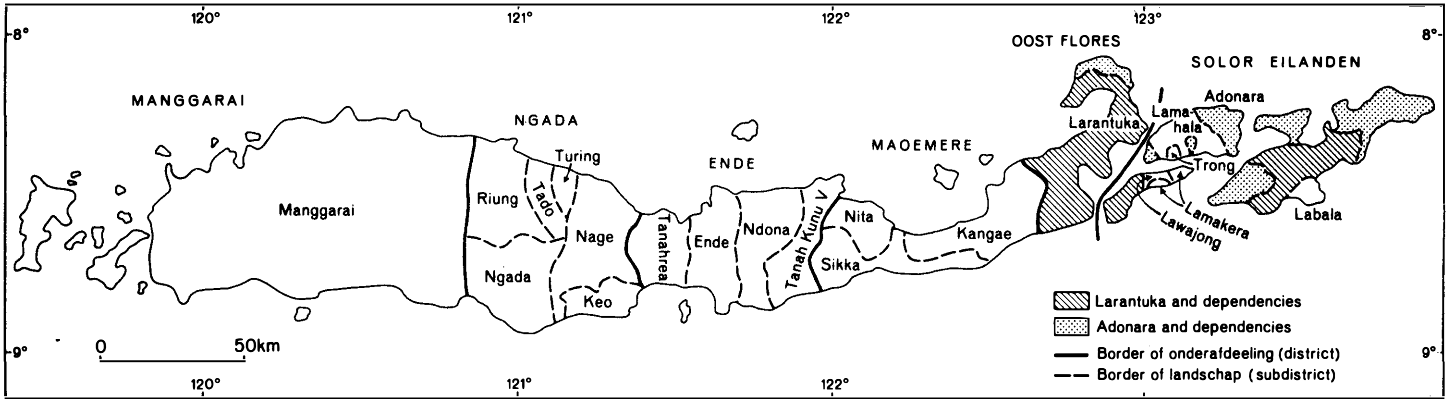

Fig.22 Afdeeling Flores: administrative division 1909-1929/31(after van Suchtelen 1921: Verkenningskaart v.d. Onderafdeeling Oost-Flores en Solor eilanden, Batavia 1931; van Heuven, Nota betreffende de onderafdeeling Ngada, Batavia 1916, unpublished)

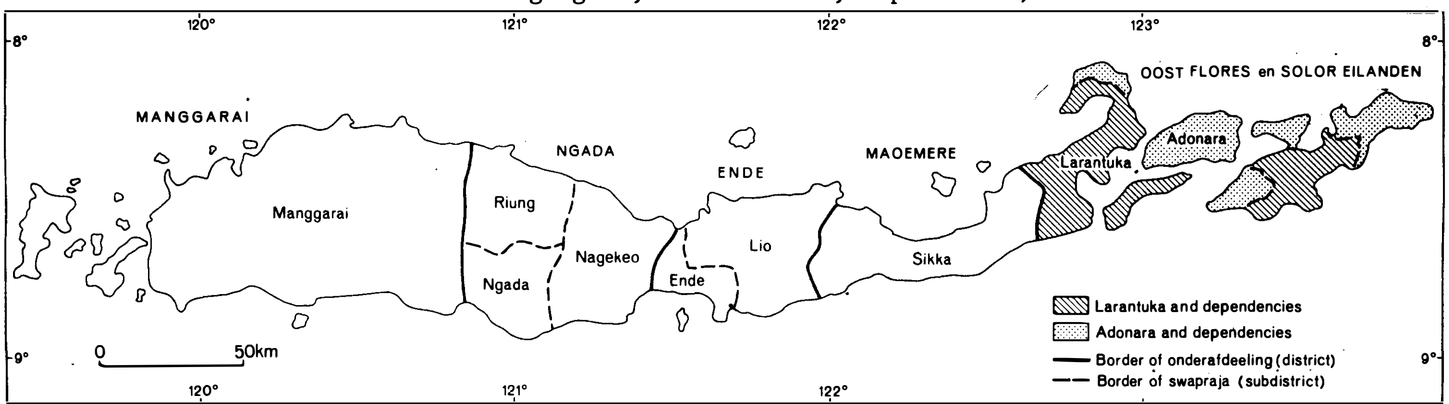

Fig.23 Afdeeling Flores: administrative division 1929/31-1950 (after 1950 only the boundaries of the onderafdeeling were retained. The districts are now called kabupaten). (Source: Winokan 1960)

administrative control was gained by the inclusion of West Flores (Manggarai) and Sumbawa into the regency Timor en onderhoorigheden in 1909 (*Gouvernements Besluit v.11 Feb. 1909 No.48 - Ind. Stbl.*, No.129). Flores was again divided administratively into the following six districts (*onderafdeeling*): Manggarai, Ngada, Endeh, Maoemere, Oost-Flores and Solor-Eilanden which were subdivided into twenty-one *swapraja* (see Fig.22), each headed by a *raja*, a title conveyed by the Dutch to a local ruler. For economic reasons the number of *onderafdeeling* was further reduced to five (Oost-Flores and Solor-Eilanden were joined) comprising only nine *swapraja* after 1929 (Winokan 1960:10) (see Fig.23). Each *onderafdeeling* was then headed by a *controleur* or *civiel gezaghebber* who was responsible to the *assistent resident* in Ende.

After this general outline of the development of the political organization on Flores until the outbreak of World War II we now revert to Sikka in particular. Unfortunately no history of Sikka has been written so far. Most documents of the pre-World War II period were destroyed during the war when Flores - and hence also Sikka - was occupied by Japanese armed forces. A few written sources that have escaped destruction are believed to be in the hands of some individuals who for fear the government might confiscate their material are unwilling to disclose their possessions. Thus I have had to rely on a rather haphazard collection of documents available in Flores. In addition, reference is made to the chronical of Sikka (*Hikayat Kerajaan Sikka*) contained in the *memorie van overgave* by Controleur Symons (1935). The historical events mentioned in this chronicle are, however, difficult to date properly. The poor state of documentation is reflected in the fact that only two of these official reports could be unearthed. Judging from the number of reports that are available on other parts of the Lesser Sundas in either Indonesian or Dutch archives Sikka is by far the least documented part of the region.

According to local myth and oral tradition Central Sikka's native population (= *krowe*) was driven back into the mountainous interior of eastern Central Sikka by invaders - the so-called Sikkanese - who are said to have landed on the south coast near the present location of the village of Sikka (henceforth called Sikka-Natar) in the fourteenth or fifteenth century (Rusconi 1940b:5). They claim to have come from Siam by way of Malacca (ibid.). According to a local myth the name of the village of Sikka, formerly known as Poma (Rusconi 1940b:7), is derived from the fact that the original inhabitants were chased away by the invaders (*sikka* or *sikang* meaning 'to chase away'). This name was later applied to all of the inhabitants of this part of Flores. Given its steep slopes and thin soil layer, the south coast offered, however, only very limited possibilities for agriculture. Therefore the *'ata Sikka*, as we shall henceforth call them in contradistinction to the inhabitants of the entire district (*kabupaten*) to whom merely the term Sikkanese is applied, began to expand their sphere of influence to the north (saddle of Nita) and to the west (Paga, Lio). It is owing to their harsh environment which did not offer bright prospects for agriculture that a considerable number of them turned to trading, chiefly as middlemen between the Buginese who lived on the north coast and the native *krowe* population.[23] As the Sikkanese had been united under a king (*ratu*) since the beginning of the seventeenth century, they played a dominant political role in the region. They were able to retain this dominant position in the region's political life until the present time. The *krowe* population on the other hand was politically split into a great number of petty *rechtsgemeenschappen*[24] grouped around a *tana pu̇ăng* ('lord of the earth') until the end of the nineteenth century, when two additional smaller kingdoms - Nita and Kangae - were formed in Central Sikka. With these, however, the *ratu* of Sikka were allied through personal union.

The relatively early formation of a sizeable state in Sikka based on an orderly administration abounding with Portuguese names appears to be attributable mainly to environmental factors. Central Sikka being neither sheltered to the north nor to the south coast by high mountains - and because of its location at the narrowest portion of the island - was more susceptible to foreign influences than Nita and Kangae. The latter two kingdoms were located in the mountains east and west of the kingdom of Sikka, hence in far less accessible areas.

The foundation of the state of Sikka which - according to native tradition - developed from a number of small *rechtsgemeenschappen* is attributed to a person called Baga, whose son Alesu is said to have spent four years in Malacca where he was educated by Portuguese priests. When he returned to Sikka in 1607 he became *ratu*, was henceforth called Don Alesu da Silva and was the first Sikkanese to become a Christian. As symbols of authority the Portuguese gave him a gilded Portuguese helmet, two golden chains, a stick with a golden head and thirty elephant tusks. Until the present day these insignia are still kept by the old *ratu* family at Sikka (see Franca 1970:Figs 26 and 27). Documents from 1613 list Sikka as one of the Christian States of Flores (Rouffaer 1923-24:212).

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[23]Wichmann (1891:147) reports that the coastal Sikkanese population of Maumere and Sikka-Natar was frequently in debt to the native hill people, a situation which gave rise to conflicts. These were enhanced by local *adat*, which, for instance, did not allow burial of the corpse of a debtor until all his debts were paid by his family. This custom was finally abolished by the mission.

[24]The term *rechtsgemeenschap* stems from the Dutch and denotes territorial units which comprise several villages and hamlets. Their members who belong to several non-localized clans submit themselves to the rules set by the 'lord of the earth', in Sikkanese called *tana puăng* (see also p. 110).

A number of offices and institutions, although mostly not existing any longer today, but characteristic of this well-organized state will be of interest to us because of their bearing on the pattern of land ownership in Central Sikka. The *ratu* was assisted by a council (*moäng pulu* = ten nobles) consisting of ten persons whose offices were hereditary and who could decide independently but with reference to the *ratu* on issues concerning land and pilfery. Each member of the council owned a piece of land. The council's decisions were carried out by a *kapitan* (not to be mixed up with the office of the same name created under the Dutch in 1910) who passed the instructions over to the *tana puang* and later to the *gai* (village officials representing the *ratu* in each village and responsible for punishing minor offences). The latter was an office created by the *ratu* with the intention of establishing a counterweight to the *tana puang*.

A few other special officials of Sikka's traditional administration, mostly bearing Portuguese names, deserve to be mentioned:

1. Kapitan Moor: attorney-general
2. Kapitan Sala: treasurer and in charge of visitors
3. Kapitan Guarda: chief judge and body guard
4. Kapitan Pontera: military head
5. Kapitan Alferis: police
6. Kapitan Jantera: head of prison
7. Moang Jarang Bunga: chief of equerry
8. Regentie: representative of the *ratu* in case the latter was unable to carry out his duties. The *regentie* was elected out of the *moäng pulu* (see Rusconi 1940b:12).
9. Komandanti: representative of the *ratu* at Maumere and harbourmaster (*sjahbandar*), who was entitled to levy harbour and market taxes, one-half of which was for the *ratu*.
10. Kabuareal: representative of the Komandanti
11. Morenyo: head of religious affairs
12. Tenente General: head of group of *tana puäng*.

Thanks to firm administrative control and to a stronger commercial spirit the *'ata Sikka* gained a leading role throughout the present kabupaten of Sikka, although only the saddle of Nita, parts of the south coast (*kapitanschappen* Lela and Wolokoli) and Maumere on the north coast were under their direct control. Their sphere of influence, however, must have been much larger than Central Sikka. It is reported to have reached from the border with Larantuka in the east (Nangahale) (north coast) and Hale Hebing, Natakoli (south coast) to the border with Bima in the west (Mole Keli Samba, Kota Djogo) (north coast approximately at Plain of Mbai - between Mt Inerië and Mt Keo (Ngada)) (see Kleian 1891: 531-2; map by van Rijckevorsel 1875; Symons 1935, appendix III:8). Villages which came under the supremacy of the king of Sikka were given an elephant tusk (*bala mangung*) by the *ratu*, thereby demonstrating their allegiance. The Catholic priest Heynen reports

(1876a:25-6) that in 1876 about 140 *negri*(I), meaning *tana puăng* were under the rule of the *ratu* of Sikka of which 8 were under the *komandanti* of Maumere, 33 under the *ratu* of Nita who was allied with the *ratu* of Sikka through personal union, 80 *negri* under Paga and the rest directly under the king of Sikka.

This dominant role of the *'ata Sikka* was further strengthened by the Dutch who established administrative control over Sikka in the second half of the nineteenth century. The beginning of the Dutch era over Sikka was overshadowed by a decision of the colonial administration which was to generate a long series of entanglements and warfare in that part of Flores. Since the ruler of Larantuka was the first to recognize the Dutch after the treaty of Lisbon (1859), an act for which he was awarded the title of *raja* in 1861 (van Dijk 1925:536), the Dutch recognized everything east of Maumere and Paga as part of the kingdom (*kerajaan*) of Larantuka (Koloniaal Regeeringsverslag of 1865, cited by Veth 1874:185). A Dutch *civiel gezaghebber* was stationed at Larantuka, under whom a postholder (*posthouder*) was stationed in Maumere in 1879. (*Gouvernements Besluit v.14 Jan. 1879 No.11* - according to *Ind. Stbl.*, No.21). Thus Sikka became one of four subdistricts (*onderafdeeling*) of the district (*afdeeling*) of Larantuka. The subdistricts were: 1. Larantuka or Oost Flores, 2. Noord Flores (Sikka), 3. Solor, Adonara, Lomblen, 4. Alor (Fig.20). The Dutch administrative heads of these subdistricts had strict orders from their superior, the resident of Timor en onderhoorigheden located at Kupang, not to interfere with native affairs (Hagenaar 1934:106). Yet Dutch administrative presence in eastern Flores could not avoid an increasing number of wars between Sikka and Larantuka as well as among local *tana puăng* groups. In 1893 the Dutch decided to give up - at least partly - their policy of strict non-interference and to separate Sikka from the kingdom of Larantuka (Couvreur 1924:74) after the *ratu* of Sikka had been given the *raja* title as well as the staff of office (*tongkat*) by the Dutch government (Engbers 1898:58). Nita's territory was never claimed by Larantuka and hence less of a problem; the Dutch had conveyed the title *raja* to its head already in 1885.

The coastal settlement of Geliting and its hinterland of Iwanggete (excluding the south coast at Wolokoli and Doreng) which became part of the kingdom of Sikka continued to be considered a portion of the kingdom of Larantuka until 1907 when it came under the administration of the kingdom of Kangae. The port of Geliting, formerly known as Bajo which reminds us of the Bajaus who settled here, became the most important trading centre on Flores' north coast in the nineteenth century, where trading Buginese, Makassarese and other groups from southern Sulawesi exchanged goods with the local population as well as with tribes from other parts of Flores. The economic importance of Geliting was recognized by the kings of Sikka and Larantuka. In Sikka's chronicle it is said that following the war of Kelisamba[25] (in the vicinity of the plain of Mbai), where Larantuka is said to have provided armed assistance to the king of Sikka against an attack by Buginese, the right of levying tribute from the people living on the isle of Pulau Besar in the bay of Maumere, a big elephant tusk as well as all market rights at the ports of Geliting and Bolong-Bolong (see Fig.24) were ceded to Larantuka for a period of ten years. At the end of this period Larantuka refused to return all fiscal rights to Sikka and maintained her presence in these ports until 1907. Geliting was thus always considered a particular thorn in the flesh of the state of Sikka. Long and bitter warfare between Sikkanese - particularly from Maumere - and inhabitants of Geliting was the result (see van Eerde 1923:95).[26]

At Geliting and Bolong-Bolong the king of Larantuka was represented by harbourmasters (*sjahbandar*) who were entitled to levy market taxes and to punish minor offences (Heynen 1876a:27). In addition to these ports Larantuka maintained a territorial claim over Geliting's hinterland, called Iwanggete, and all land east of it. *De facto* neither Sikka nor Larantuka ever succeeded in bringing this densely populated dissected hill and ravine area (*wolong-napung*) under firm control. Tribute was only paid under armed pressure, as was the case in 1894 and 1900 (Hens 1916 II:150). How ineffective Larantuka's claim over this region was may be evidenced by the fact that in 1902 the king of Larantuka himself accompanied by 1000 armed men had to go to Heo and Hewotkloang (in Iwanggete) to collect taxes and tribute which were long overdue. In view of this armed majority the taxes were reluctantly paid. In retaliation the population of these two villages burnt down the port of Geliting in the following year and refused to accept Larantuka's overlordship (van Eerde 1923:96, 100).

The area east of Maumere which is occupied today by Kecamatans Kewapante, Wairgete and Tanahai was a particular bone of contention between the two rival powers of Sikka and Larantuka. While the former claimed all territory east of Maumere to the river Nanga Gete in Tanahai (see Fig.24),[27] the latter not only claimed that

[25]No dating of this war has been possible so far.

[26]In 1860 when a Dutch missionary from Larantuka visited Maumere for the first time after eastern Flores had come under Dutch control (following the treaty of Lisbon) the town had been deserted by its inhabitants as a result of an attack by the *ratu* of Sikka. The reason behind this attack was three Buginese traders from Geliting who illegally sold opium, firearms, etc. to the local population. In fact the attack by the *ratu* was a mere trick to evade paying debts incurred to these merchants (Kondi n.d.(b)).

[27]The border between Sikka and Larantuka has been drawn according to information by Heynen (1876a) and Hens (1916). A slightly different course of this borderline is given by Kleian (1891) who believed the river Nanga Gete at Nebe to be the borderline.

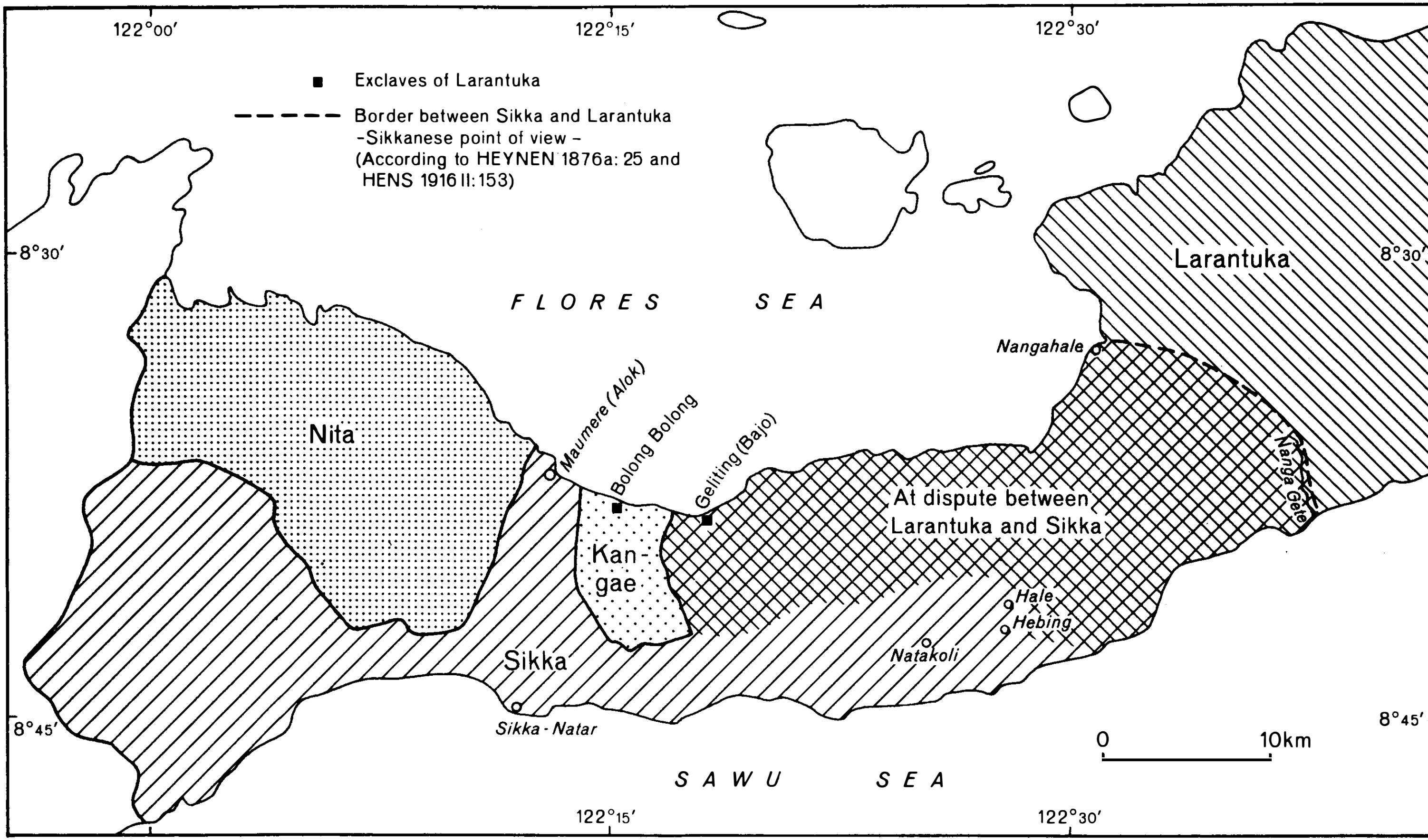

Fig.24 Political division of eastern central Flores towards the end of the nineteenth century before Dutch intervention

same territory but also overlordship over the entire kingdom of Sikka. In fact neither of the two kings had any great power in that region. In this dispute Kangae, which wholly came to lie in the area under dispute, assumed a pivotal role. In 1900 a war broke out between Sikka and Kangae. The latter was believed to have received support from Larantuka. The Dutch, however, were reluctant to interfere in what they saw as an internal conflict. The bitter warfare was finally put an end to by the resident of Timor en onderhoorigheden who in 1902 declared the head of Kangae *raja* at Waipare (Hens 1916 II:153). *Raja* Nae of Kangae was 'pagan' and the only *raja* of that *onderafdeeling* who was illiterate. His position was relatively weak by comparison to that of the *raja* of Sikka. The outstanding economic importance of Central Sikka must have been the reason why the authority of the king of Sikka was challenged not only by Larantuka but also by Kangae (see below).

The ease with which Kangae became a *kerajaan* under the Dutch in 1902 encouraged a farmer of Kangae by the name of Moang Teka to oppose the king of Sikka in 1904 in the hope of forming another independent *kerajaan*. This uprising was eventually quelled by government troops. The Dutch finally decided to give up their attitude of non-interference. *Korte verklaring* were signed by Kangae in 1907, Sikka in 1908 and Nita in 1910. As Paga was considered a tributary of Sikka no separate *korte verklaring* was signed. These treaties stipulated that the rulers of these *kerajaan* had no right to wage wars of their own as Dutch sovereignty was recognized. Despite these treaties the Dutch found it a painstaking task to bring peace and order to Central Sikka, as is evident from the list of armed Dutch interventions in response to local uprisings (see Hens 1916 II:172).

March 1908:	Hewotkloang (Kangae)
August 1908:	Eastern Nita
May/June 1909:	Hikong/Kringa (eastern Kangae)
May 1911:	Ili (Kangae)
Sept. 1911:	Western border of Sikka
Sept./Oct. 1912:	Werang/Kringa (eastern Kangae)
April 1914:	Werang

In the wake of the introduction of the head tax in 1910 (Rp. 2 per person) which replaced the annual tribute (*upeti*) that was paid by villagers straight to the king, a series of wars and rebellions broke out in Sikka which were quelled only with the help of soldiers of the Royal Army of the Netherlands Indies (KNIL) - e.g. the war of Dua Toru in Natarmage, *hamente* Werang (eastern Sikka) in 1912-13; the war of Wuko in *hamente* Werang in 1917; the war of Wololuma (Kangae) in 1910-11. Nita also refused to pay.

Concomitantly with the head tax the Dutch imposed a new administrative system which replaced the old *moäng pulu* council, *kapitan*, and *tana puang*. The Onderafdeeling Maoemere, as the new district was called, was separated from the district of Larantuka and headed by a *controleur*, was divided administratively into sixteen *hamente* (from Dutch *gemeente*), each headed by a *kapitan* who was a paid government official. The smallest administrative unit was the village (*kampong*). Twenty to thirty *kampong* formed a *hamente*. Dutch rule was indirect in so far as the three *raja* of Sikka, Nita and Kangae were recognized rulers of parts of the *onderafdeeling* (see Fig. 25)[28] and were required to assist the Dutch in executing regulations and enforcing laws down to the village level. This form of administration delegated to three rulers (*zelfbestuurer*) proved anything but smooth and economic. Under the Dutch administration Sikka's position and influence increased steadily. Sikkanese filled most of the ranks of government officialdom and were particularly successful as teachers. It was thus not surprising that in 1923 the *raja* of Sikka, Don Thomas Ximenes da Silva, was entrusted with the administration of Kangae and two years later with that of Nita. Finally in 1929 both kingdoms were formally joined under the rule of Sikka (*Gouvernements Besluit v.27 Sept. 1929 No.148*). For economic reasons the number of *hamente* was reduced to twelve in 1932.[29]

The *raja* of Sikka was considered one of the most competent rulers of Flores. From 1932 to 1937 he was entrusted with the administration of the onderafdeeling Maoemere. During these five years no Dutch official was posted in Maumere. The district became part of *afdeeling Oost-Flores en Solor-Eilanden* (Rusconi 1940a:43). The contrast between the *ata Sikka* and the other ethnic groups, which essentially was the age-old conflict encountered throughout Southeast Asia between lowlanders and uplanders, led to increasing clashes and tensions in Sikka.

After World War II Dutch colonial administration became weaker and thus less able to straighten out ethnic differences. The kingdom of Sikka (*kerajaan Sikka*) was given the status of an autonomous region (*daerah swapraja*) under the administrative supervision of the *raja* of Sikka. In 1946 the nine *raja* of Flores agreed to form a united kingdom of Flores to be known as *Flores*

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[28] Figure 25 shows that Kangae particularly had made territorial gains under the Dutch. In addition to the Kangae homeland called *napang pitu wolong walu*(S) meaning: seven valleys, eight hills - i.e. comprising approximately the *hamente* of Wetakara and Ili- the *hamente* east of it on the north coast (Hewotkloang, Wairgete, Werang, Kringa) were brought under Kangae rule.

[29] These 12 *hamente* were: Nele, Nita, Maoemere, Sikka, Megoh, Mbengoe, Boe, Wetakara-Ili (both parts were joined in 1932 under the name of Gerong), Tanahai, Iwanggete (consisting of Hewotkloang, parts of Doreng and Wairgete), Wolokoli and the islet of Palue (see administrative division on Fig.28 for the year 1930).

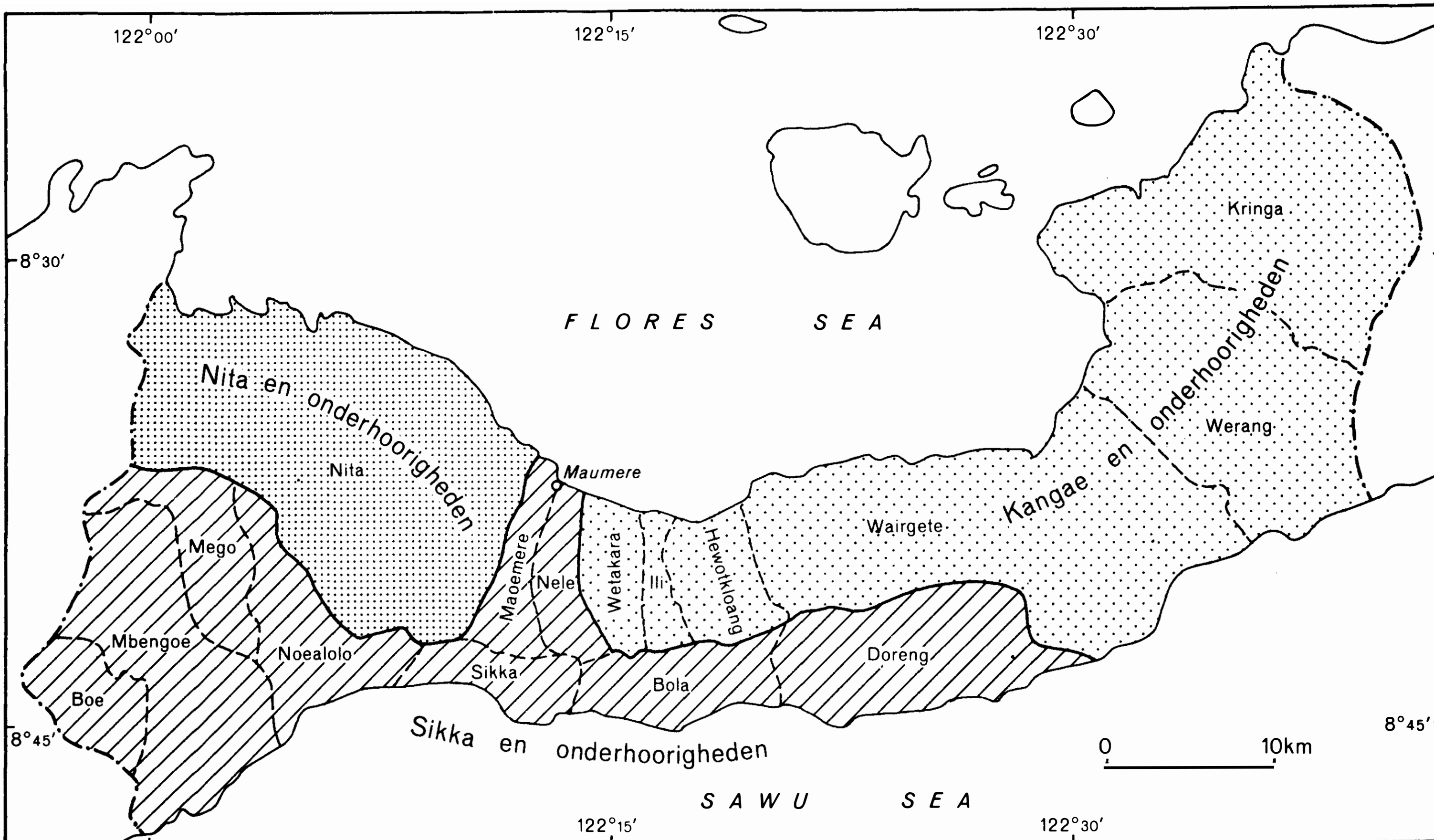

Fig.25 Political division of onderafdeeling Maoemere following Dutch intervention at the beginning of the twentieth century

Federatie consisting of a council of *raja* (*dewan rajaraja*) and a parliament (*Flores raad*). In fact, however, the council of *raja* determined the policy (Winokan 1960:17). Among Flores' *raja* Don Thomas Ximenes da Silva of Sikka was by far the most respected and the only one who dared to oppose first the Dutch and after independence also the local Indonesian administration. As the *Flores Federatie* left all political power unchanged in the hands of the *raja*, it was bound to run counter to the yearnings of the people for greater political participation. Hence it was not surprising when a series of upheavals were reported from all corners of the island. These were directed either against the *raja* or against the *kapitan*.

Opposition against the *raja* was particularly strong in Sikka where ethnic differences cropped up again. In 1948 leaders of the so-called hill population of Kangae, Nita and Lio (Maumere) united into the socalled Blok Kanilima against the *raja* of Sikka.[30] A secession of these three regions as one or more separate *swapraja* from Sikka, as was first envisaged, did not however materialize. Yet the administrative division of Sikka which existed before 1929 was reintroduced in 1948. When after the independence of Indonesia in 1949 it became obvious that the era of *swapraja* was over, the Kanilima movement concentrated its efforts towards the creation of a local government (*Dewan Pemerintah Swapraja Sikka* - DPS). The first stage in the struggle for greater participation of the people was reached in 1949 with the abolition of the *Flores Federatie* and the creation of *Daerah Flores*. The status of the People's Assembly (*Dewan Perwakilan Rakyat*) of Flores changed from an advisory body to a lawmaking institution. Although the council of *raja* was discontinued in January 1951, at which the 'golden era' of the *raja* of Flores came to a sudden end (Manteiro 1953b:4),[31] only gradually and very reluctantly did the *raja* relinquish their power. It is only after they were heavily boycotted by the people in matters of payment of taxes or the construction of public roads for which the *raja* summoned the people that they finally gave in. In 1953 the *raja* were deprived of their right to levy and to collect taxes.

[30]4000 to 5000 persons demonstrated at Waioti airfield (east of Maumere) on 3 May 1948 in front of the resident of Timor en onderhoorigheden who stopped over at Maumere on his way to Macassar (Manteiro 1953b:1). While Nita and Kangae envisaged independence from Sikka under a separate *swapraja*, Lio (Lio-Maumere) intended to merge with Lio (Ende). All three areas were administered by *kapitan*, who were Sikkanese-proper, often closely related to the *raja*'s family.

[31]Despite the formal abolition of the council of *raja* after 31 Dec. 1950 (based on law No.44 of 15 June 1950 - *Undang Darurat Pemerintahan Daerah - Daerah Indonesia Timur*), the *raja* met again illegally in Ende in April 1953 (Manteiro 1953b:17). The government intervened, after which no further incidents of this nature occurred on Flores.

Opposition to the *raja* was particularly vehement in Sikka. In the wake of a rebellion by Kanilima on 17 August 1952 a local government was created which consisted of four persons from Kangae, Lio and Sikka. It was the first local government of any part of Flores to replace the old rule of the *raja*. In 1958 the Province of Nusa Tenggara Timur was created which comprised the islands of Timor, Sumba, Flores, Adonara, Solor, Lembata and Alor. The former districts were called *kabupaten* (or *Daerah Tingkat II*) which largely resembled the *onderafdeeling* of colonial times. Despite this development towards greater political participation the ethnic contrast between Sikkanese-proper and the *krowe* population has been perpetuated until today. This was reflected, for instance, in tensions arising in the settlement project of the plain of Magepanda in the late fifties.

From the foregoing paragraphs it is evident that Sikka - particularly its central portion - has been subject to an unusually strong foreign influence. This seems to be due to its exceptional physical properties: fertile soils, topographical conditions propitious for strategic purposes, ease of access on its northern shores where ships can anchor - i.e. the only part of Flores where a portion of the geoanticline has submerged. It was here that the spheres of influence of the two Muslim empires of Goa (south Sulawesi) and Ternate (northern Moluccas) overlapped and where later a confrontation of Portuguese and Dutch interests occurred. Central Sikka has been the scene of strong immigration from both the west (Sikkanese-proper presumably from mainland Southeast Asia) and the north (Buginese and other groups from south Sulawesi) as well as the east (Lamaholot speaking groups). Until the first decade of this century this part of Flores was a subject of contention between the kingdoms of Sikka and Larantuka. Even the Sultan of Bima on the island of Sumbawa once claimed a portion of Sikka's north coast (between Mautenda in the west and Nangahure in the east) as Heynen pointed out (1876a:22 and map of Flores). Foreign influence was both religious (Hinduism, Islam, Christianity) and commercial (Buginese, Dutch).

The forces that have contributed to the regional differentiation of Central Sikka were characterized by the juxtaposition of lowlanders and uplanders, Christians and non-Christians traditional beliefs and religion, Islamic and non-Islamic groups, merchants and non-merchants, subsistence farmers and commercial farmers. These forces strongly determine the relationship between the inhabitants of Central Sikka and their environment. For a fuller understanding of Sikka's ecosystem we need to know more about the main aspects of Sikkanese social organization as well as the demographic and settlement patterns to which we will now turn.

Aspects of Sikkanese social organization

Knowledge of the social structure of Sikka's ethnic groups is quite inadequate and restricted to a publication by Father Arndt (1933). New insights into this aspect can be expected from E.D. Lewis, a Ph.D. candidate in anthropology of the Research School of Pacific Studies, Australian National University, Canberra, who carried out fieldwork in Sikka from 1978 to 1979 and again in July-December 1980. Hence it seems premature to attempt to analyse the social organization of Central Sikka's population. All we shall be concerned with here are a few aspects of social organization considered to have a bearing upon the Sikkanese way of using their land. While certain social factors may retard efficient utilization of natural resources, others - often in rather dormant forms - may serve as starting points for readjusting Central Sikka's ecosystem and thereby also for improving its economy.

The principal kinship unit in Sikka was the clan (*kuat* or *kuat wungung*) which is non-localized and exogamous. This kin group was of patrilineal descent in Central Sikka in contrast to the eastern portion of kabupaten (Tana Ai) where it is essentially matrilineal. The head of the clan managed his affairs in consultation with the older kinsmen.[32] He was entrusted with the custody of sacred clan property and as a priest he maintained contact with the ancestors of the clan (Arndt 1933:86-8). For this he brought the clan's ceremonial objects to the 'sacred stone' (*watu mahe*) in the village where animals were sacrificed (Plate 12). The members of a clan are closely related to each other by a specific totem and its taboos, by specific customs and rituals performed on festive occasions or in connection with agricultural tasks, and by the clan's property - e.g. necklaces, earrings, elephant tusks, ivory armrings, gongs, old weapons (Arndt 1933:82). It is the task of all members of a clan to strive to increase the wealth of the group. The clan is often also in possession of land (*tana gung*) which with the approval of the head of the clan may be used for a specific number of years by its members - often irrespective of whether these belong to the *tana puäng* group in question or not (Rusconi 1940b:63). Since this issue entails a whole series of implications for agricultural use we shall deal with it in more detail below, under Traditional Land Tenure.

The members of a clan rely upon mutual help. The analysis of the various forms of group labour, their advantages and drawbacks will be the subject matter of the section on pp.133-8. Here it

[32] According to Arndt (1933:85-6) the head of a clan has no common title throughout Sikka. He may simply be called *moang* (title with which men of authority are approached). Other names are *gahar*, *gete berat*, *gete gahar aming*, *labang mérang* or *lhoeng puang* in the vicinity of Bola; while in Tana Ai there are two heads - a man and a woman, both called *sope*.

suffices to point out that mutual help is common for fulfilling agricultural tasks - for instance, for opening a large field, for house-building, fence erection, for paying the bridewealth (*ling weling*) and debts of its members. Moreover, the members of a clan consider themselves responsible even for indemnity payments caused by offences of their kinsmen (Arndt 1933:83). In case several clans are involved in the offence the issue is brought to the *tana puăng* ('lord of the earth') who is the head of the clan longest in the respective area.

Most *adat* institutions have lost much of their power since the beginning of this century when evangelization was increased and *Pax Neerlandica* came to Sikka. Thus traditional taboos are hardly observed any more today. This applies to sacred forests in particular which in old times nobody was allowed to enter, as well as to specific types of meat and fruit which only certain clans or specific members of a clan were allowed to eat (see also Arndt 1933:89). Likewise the institution of the *tana puăng* and the council of elders dealing with land issues (*duă moăng watu pitu*) have also disappeared in most of Central Sikka. Agricultural ceremonies are gradually falling into oblivion. Less modified are ceremonies related to marriage (see Kondi n.d.(d)). A traditional institution that has survived until the present day is the bridewealth (*ling weling*; or *leto* according to Arndt 1933:28) which is found throughout Central Sikka and is common to both the *ata Sikka* and the *krowe* population.[33] Hence in this respect Central Sikka clearly differs from eastern Sikka (Tana Ai) where matrilineal descent prevails although contrary to Arndt (1933,35) bridewealth does exist (E.D.Lewis, pers. comm.).

The bridewealth is of major importance in social and economic life and requires enormous material sacrifices on the part of the bridetaker. Although a counter-bridewealth is customary which may amount to about one-third of what the bridegiver receives, in some cases bridewealth may become very burdensome. The bridewealth is seldom paid in full, in order to avoid the notion that the bride has been 'bought'. Neither does the bride's family seem to be interested in a full payment of the bridewealth as it is believed that these liabilities strengthen the social ties between the man's and the woman's families or clans (Hens 1916 II:95, and ten Dam 1950b:26). Elephant tusks are the main form of bridewealth in Central Sikka (Plate 10). Gold and silver coins, golden bracelets, necklaces and earrings, horses, pigs and rice are also required. The volume of the bridewealth varies greatly from region to region. The forms of bridewealth given for Ds. Bola (Table 9) and Ds. Nita (Tables 8 and 10) are drawn from Arndt and ten Dam and no longer exist today while the example of Ds. Wolonwalu (Table 11) for a noble wedding is more recent and obviously still found occasionally.

[33] A detailed account of a traditional wedding ceremony held at Watublapi (Kecamatan Kewapante) is given by Brabander (1949).

Table 8

Bridewealth commonly given in Nita in the 1930s

1. *Tudir ihing* (or *tadang kila* = engagement present): money, a piece of gold (*bahar habi)*, a small and a large elephant tusks; total worth f 150, plus one horse.

2. *Lea*: 1 elephant tusk, 2 pieces of gold (*bahar habi*) money f 10 to f 30; total worth f 100 (poor men pay a total of only f 25).

3. *Teli seneng*: 1 tusk worth f 20; two pieces of gold and silver worth f 10 to f 30; total worth f 100.

4. *Inat*: 1 elephant tusk worth f 25 to f 50; 2 pieces of gold worth f 55; 1 alloy consisting of 2 pieces of gold worth f 5; silver worth f 10 to f 100.

5. *Amat*: 1 elephant tusk worth f 20 to f 50; 2 pieces of gold.

6. *Narat* (or *waga lima*): for the brothers and sisters of the bride; e.g. the eldest brother receives f 100, the younger brothers each f 80. In addition each one may ask for a horse or an elephant tusk, which is given depending upon the economic position of the wifetaker.

7. *Denu mune*: 1 elephant tusk worth f 50; two pieces of gold (*nao rua*) worth f 55; alloy of silver (*pera heret*) worth f 5 for other members of the bride's family.

8. *Wua taa*: 1 elephant tusk worth f 150; 2 pieces of gold (*nao rua*) and alloy of silver worth f 200; a large pig (*kleber*); 4 pieces of native cloth (two for men, two for women); 1 piece of cloth from Sawu (*kain sawu*) worth 1 horse; 50 kg of pounded rice.

9. *Tubung*: 1 elephant tusk worth f 150 and the following 7 items (*nao*):
   a. *Tubung*: 1 elephant tusk
   b. *Tubung labon*: 1 piece of gold worth f 30
   c. *Kadut uri waa*; *kadut uri*: 2 pieces of gold
   d. *Pua glohuk menong*: 2 pieces of gold
   e. *Kodza nana*: 1 piece of gold worth f 20
   f. *Manu wulun*: 1 piece of gold worth f 20 and 10 guilders
   g. *Pera heret*: unspecified.

Source: Arndt (1933:29-30).

Table 9

Bridewealth in Bola in the 1930s

1. *Wuung tudi*: 6 golden earrings worth 3 to 10 *ringgit* (1 *ringgit* = 2½ Dutch guilders)
2. *Wuung buku* (or *Wuung oko*): 6 earrings
3. *Wuung tudi helit*: not specified by Arndt
4. *Wuung wua taa*: 4 earrings
5. *Wuung wungung*:
   a. *tuk* = 1 earring
   b. *nehek* = 1 earring
   c. *wungung tebong* = 1 earring
   d. *wungung wungung* = 1 earring and 2 additional earrings
6. *Wuung kuat*: 5 earrings
7. *Wuung kabor*: 8 earrings
8. *Wuung song, kaur, kadang, kegat, song*: 6 earrings
9. *Wuung limang tedang*: 4 earrings
10. *Wuung pulung hang wuang*: 4 earrings
11. *Wuung liting - Wuung toeng*: 4 earrings
12. *Wuung tewu wair*: 6 earrings, 9 guilders

Note: The names of the individual portions of the bridewealth differ widely even within Central Sikka. Their meanings have not yet been properly investigated.

Source: Arndt (1933:31-2).

The bridewealth also largely depends on the social rank of the families involved. Three social classes have traditionally to be distinguished: the nobles (*'ata moäng*) to which, besides the king, also belonged the officials, the commoners (*'ata riwung*) and formerly a class of slaves (*'ata maha*) (ten Kate 1894:212).[34] This social stratification is, however, being replaced today by another which is dependent on education rather than on descent. Since inheritance is patrilineal, the children belong to the father's

[34]According to ten Dam (1950b:48) only two social classes could be differentiated in 1950: the nobles and the commoners on one side and the descendants of slaves on the other. Although slavery was said to have been officially abolished in Nita in 1904, it was still known in 1950. In *hamente* Wolokoli such persons were not invited to weddings.

descent group provided the *ling weling* is paid. Property is divided equally among the male descendants. If dry fields become too small to be divided the eldest brother administers the property on behalf of his brothers (ten Dam 1950b:51-2).

Table 10

Bridewealth in Nita in 1950

1. Engagement present (*tudir ihing*):	1 horse	R. (Rupiah) 200
	2 pieces of gold	R. 125
	(or 55 silver guilders	R. 110)
	1 elephant tusk of 1m in length worth	R. 150
	(or 60 silver guilders	R. 120)
	45 silver guilders	R. 90
2. For the girl's father (*amat*):	150 silver guilders worth	R. 300
	1 horse	R. 200
	2 pieces of gold	R. 125
	1 elephant tusk	R. 150
		R. 775
3. For the girl's mother (*inat*):	85 silver guilders worth	R. 170
	2 pieces of gold	R. 125
	1 elephant tusk	R. 150
		R. 445
4. For the girl's eldest brother brother (*narat*):	same as for father	R. 775
5. For the girl's second eldest brother (*narat*):	100 silver pieces worth	R. 200
	1 horse	R. 200
	2 pieces of gold	R. 125
		R. 525
6. For the girl's third eldest brother (*narat*):	100 silver pieces worth	R. 200
	1 horse	R. 200
	1 elephant tusk	R. 150
		R. 550
7. For the girl's fourth eldest brother (and for any other brothers) (*narat*):	80 silver pieces	R. 160
	1 horse	R. 200
	2 pieces of gold	R. 125
		R. 485

Source: ten Dam (1950b:25-6).

Table 11

Bridewealth in Desa Wolonwalu in 1974

1.	*Tudir ihing* (or *tadang kila*) ('engagement present'): 1 horse, 1 small elephant tusk worth R.7000 and gold
2.	*Wuung kata mas*: 1 horse; 1 elephant tusk; money twice R. 7000 = R. 14,000
3.	*Manu alang*: same as under 2
4.	*Wuung toa taa*: "
5.	*Wuung wadjak*: "
6.	*Wuung kata*: "
7.	*Wuung tudi*: "
8.	*Wuung kabor*: "
9.	*Wuung lea*: "
10.	*Wuung ina tai blara*: "

Source: A. Boer Parera (pers. comm. 3 May 1976).

The bridewealth has traditionally been the prime motor for economic activity and seems to have been particularly onerous in Central Sikka. As a young man is seldom in a position to meet the requirements of a *ling weling* he is usually assisted by his kin group. Only gradually does the bridewealth lose its importance. A growing degree of commercialization - initiated by the colonial administration which advocated the large-scale planting of coconuts - education and, not the least, the influence of the Christian mission have caused the population gradually to abandon this old social institution. This process is still going on.

Distribution and growth of population

With its obvious advantages of fertile soils and a topography that afforded easy access from either coast, Central Sikka attracted many foreigners in the course of its history - Sikkanese-proper, Buginese, Bajau, pirates, slave raiders as well as rulers of foreign empires (Sulawesi, Moluccas, Portuguese, Dutch) and neighbouring states (Larantuka). As a result the indigenous *krowe* population was forced to retreat to the mountainous interior.

A combination of war, pestilence and famine served to keep population growth at bay. These checks were removed around the turn of this century when the Dutch abandoned their policy of non-interference in native affairs and put an end to tribal wars which were particularly severe in Sikka. Concomitantly health care was introduced by both the government and the mission. As a result of *Pax Neerlandica* population figures soared as demonstrated in Table 12.

Table 12

Population of Sikka, 1854-1975

1854:	37,000	(estimate) (Minutoli 1855:371) (= 4625 'fireplaces')
1911:	90,000	(estimate) (Flores Memorie 1912:87)
1916:	93,271	(Hens 1916 II:10)
1926:	118,870	(Schultz 1927:Bijl.X)
1930:	123,132	(census) (Rusconi 1940a:2)
1942:	130,000	(Tomasoa 1947:1 after data provided by the *raja*)
1949:	131,501	(from archives of Kantor Sensus dan Statistik, Kab. Sikka)
1954:	146,216	(Sastrodihardjo 1956:6)
1961:	168,488	(census) (Tan 1964a:1)
1971:	191,087	(census) (Kantor Sensus dan Statistik, NTT 1972: 1+17)
1975:	201,260	(Kantor Sensus dan Statistik, Kab. Sikka, pers. comm.)

Roughly 60 per cent of Sikka's population is concentrated in its central portion - that is on about one-sixth (290 sq.km) of the district's area (formerly Onderafdeeling Maoemere). This corresponds to about 370 persons/sq.km which makes Central Sikka the most densely populated rural area in the eastern Lesser Sunda Islands (see Fig.29). The population is, however, by no means evenly distributed over these 290 sq.km as seen on Fig.26 which shows population densities for 1975 on the basis of desa as the smallest administrative units for which population figures are available. The boundaries of the desa are not official and were obtained from information provided by village elders and desa heads (*kepala desa*). They constitute approximations of actual precincts.[35] The number of inhabitants per desa varies, ranging

[35]For this purpose, as well as for tracing demographic development on the greatest possible scale, a new map of place names of Central Sikka on the scale of 1:25,000 had to be compiled into

(continued p.93)

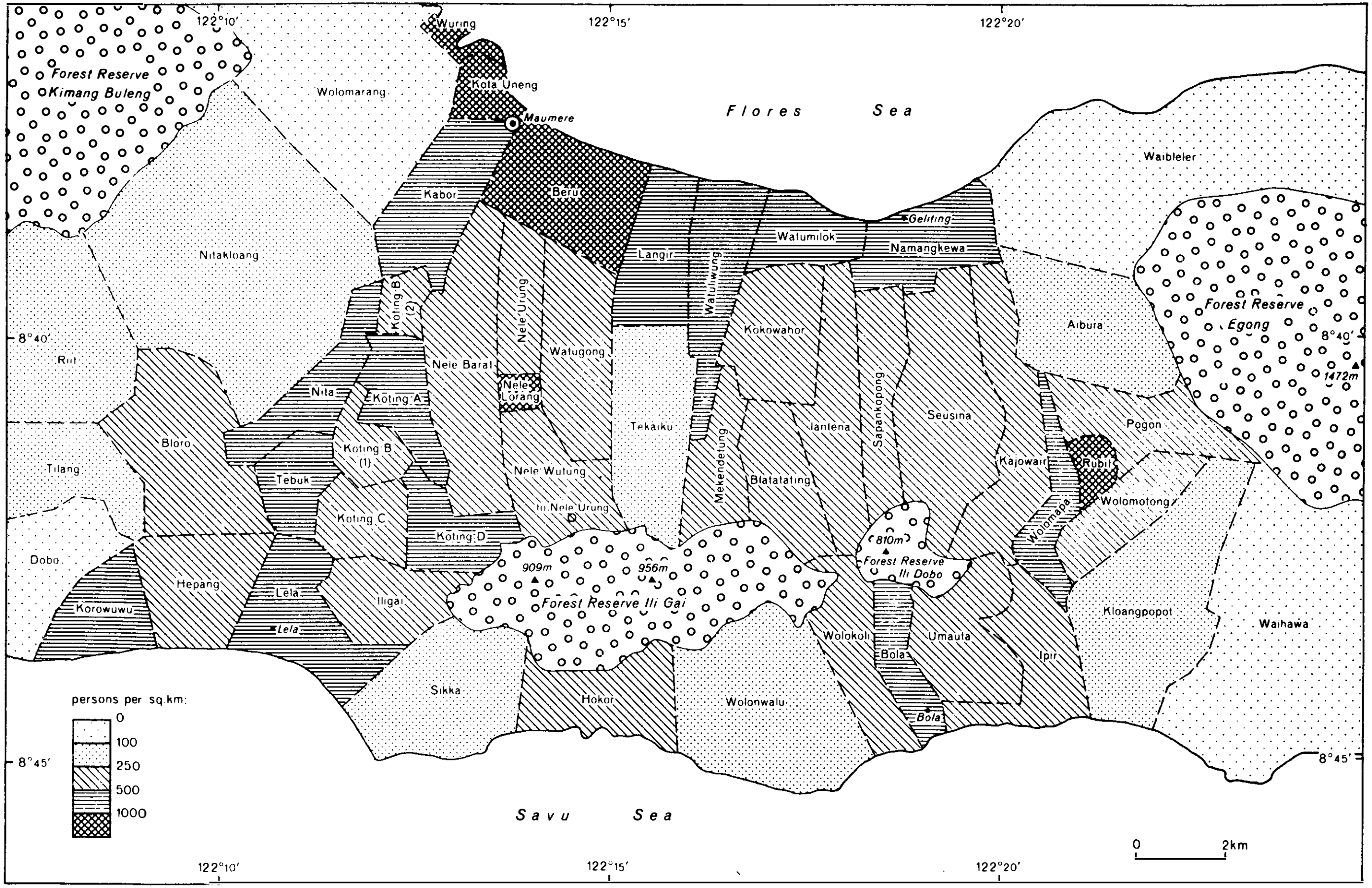

Fig.26 Central Sikka: population density by desa, 1975

from 1316 (Ds. Waihawa) to 3960 (Ds. Nitakloang) in the rural areas and up to 10,461 in Ds. Beru in the town of Maumere (see Table 13).

The lowest densities (under 100 inhabitants/sq.km) are to be found at the extreme corners of the area (Ds. Wolomarang, Ds. Dobo, Ds. Waibleler, Ds. Waihawa). The group of desa with densities of the next highest group (100-250 inhab./sq.km) is found along the eastern and the western limit of the area (Ds. Nitakloang, Ds. Riit, Ds. Tilang in the west; Ds. Aibura and Ds. Kloangpopot in the east) as well as along the south coast (Ds. Sikka and Ds. Wolonwalu).

By far the greater number of all desa in Central Sikka are falling into higher categories of population density - i.e. 250 to 500 and 500 to 1000 inhabitants/sq.km. The latter group is strongly represented by desa at the saddle of Nita (Ds. Koting A, Ds. Nita, Ds. Tebuk, Ds. Lela, Ds. Koting D) and along the northern littoral (Ds. Langir, Ds. Watuliwung, Ds. Watumilok, Ds. Namangkewa) as well as in Ds. Wolomapa (saddle of Baomekot). Ds. Korowuwu and Ds. Bola, which also fall into this group, form exceptions on the southern littoral. These as well as the most densely populated rural desa of Rubit and Nele Lorang (both located on saddles) will be discussed later. The remaining desa which all belong to the density class of 250 to 500 inhabitants/sq.km are mostly located on the northern flanks of Mt Tolawair and Mt Dobo, as well as in

[35] (continued)
which about 360 names of villages and hamlets and several hundred names of volcanic ridges, rivers and creeks were mapped. As mentioned already in the introduction, the sketch map of Sikka made by the Dutch in 1930 proved to be useless. Our map used in the field was partly controlled by aerial photographs (southern flanks of central divide and northwest of Maumere (see Fig. 3)) and subsequently reduced to a scale of 1:50,000. The contour lines on this map were derived from a blown-up version of the US Army map of Sikka (scale 1:250,000) (Edition 1-AMS; sheet Sc 51-2, series T 503), hence the ravine and ridge character of the relief does not show up. Still, this map proved to be sufficiently reliable, as was found out by a comparison of elevations of villages and hamlets measured in the field with those indicated by contour lines which were put on top of the map of place names. The compilation of this map obviously constituted a major part of my work in the field. This map was a necessary prerequisite for temporal comparisons of demographic data. Since administrative units have been constantly reshuffled only references to the village level render such comparisons possible. From the beginning the four forest reserves that come to lie within Central Sikka have been excluded from all computation though villagers often maintain a traditional claim on portions of these reserves. For agricultural purposes and as a source of firewood, however, these reserves could not be drawn upon.

Table 13

Central Sikka: Population by desa, 1975

Kecamatan	Desa	Inhabitants in 1975	Households (*rumah tangga*)	Persons per household	Area sq. km[a]	Inhabitants per sq. km
Koordinatorschap Pemerintahan Maumere	Beru	10,461	1,133	9.2	7.25	1,442.9
	Kabor	4,211	586	7.2	6.35	663.7
	Kota	1,627	273	6.0	1.50	1,084.7
	Uneng; Wuring	2,155	323	6.7	0.50	4,310.0
	Wolomarang	2,088	385	5.4	28.10	74.3
Total		20,542	2,700	7.6	43.70	470.1
Maumere	Koting A	1,979	352	5.6	3.50	565.0
	Koting D I & II	1,486	275	5.4	4.96	395.2
	Koting C	1,452	267	5.4	3.52	412.5
	Koting D	2,034	359	5.7	3.76	541.0
	Nele Barat	2,754	485	5.7	9.87	279.0
	Nele Wutung	1,841	324	5.7	5.50	334.7
	Nele Lorang	1,393	234	6.0	0.70	1,990.0
	Nele Urung	1,469	230	6.4	3.52	417.3
	Watugong	1,823	319	5.7	7.05	258.6
Total		16,231	2,845	5.7	42.18	384.8
Lela	Lela	3,097	463	6.7	5.50	563.0
	Sikka	2,132	372	5.7	8.93	238.7
	Iligai	1,775	329	5.4	4.75	373.7
	Hepang	2,109	348	6.1	6.11	345.2
	Korowuwu	1,778	309	5.8	3.50	508.0
Total		10,891	1,821	6.0	28.79	378.3
Nita	Nita	3,578	512	7.0	4.70	761.3
	Tebuk	1,742	290	6.0	3.29	529.5
	Nitakloang	3,960	613	6.5	30.31	130.6
	Bloro	2,952	459	6.4	10.34	285.5
	Riit	2,148	334	6.4	13.40	160.3
	Tilang	1,629	302	5.4	9.20	177.1
Total		16,009	2,510	6.4	71.24	224.7
Kewapante	Rubit	1,482	246	6.0	1.17	1,266.7
	Sapankopong	1,474	237	6.2	4.50	327.5
	Namangkewa	2,972	500	6.0	4.93	602.8
	Watumilok	1,579	290	5.4	3.05	517.7
	Kokowahor	2,183	413	5.2	6.11	357.3
	Tekaiku	1,790	314	5.7	8.00	223.8
	Wolomapa	2,025	329	6.2	3.52	575.3
	Kajowair	2,752	455	6.0	7.52	366.0
	Blatatating	1,795	283	6.3	5.00	359.0
	Langir	2,616	462	5.7	4.94	529.6
	Watuliwung	2,802	447	6.3	5.40	518.9
	Seusina	3,752	478	7.8	10.75	349.0
	Iantena	1,608	237	6.8	6.00	268.0
	Mekendetung	1,882	270	7.0	3.99	471.7
Total		30,712	4,961	6.2	74.88	410.1
Bola	Hokor	1,598	202	7.9	6.00	266.0
	Wolonwalu	2,789	380	7.3	13.16	211.9
	Wolokoli	2,377	383	6.2	4.94	481.2
	Bola	1,777	255	7.0	3.00	592.3
	Umauta	2,298	327	7.0	6.00	383.0
	Ipir	2,353	316	7.4	5.64	417.3
	Wolomotong	1,786	290	6.2	4.23	422.2
	Kloangpopot	2,462	376	6.5	14.57	169.0
	Waihawa	1,316	181	7.3	14.00	94.0
Total		18,756	2,710	6.9	71.54	262.2
Perwakilan Kec. TaliBura (Waigete)	Waibleler	2,385	291	8.2	25.00	95.4
	Pogon	1,711	240	7.1	5.25	325.0
	Aibura	1,895	265	7.2	9.16	206.9
Total		5,991	796	7.5	39.41	152.0
Pewakilan Kec. Paga Lekebai	Dobo	1,782	284	6.3	28.00	63.6

a Calculated by means of planimeter.

Source: Kantor Sensus dan Statistik, Daerah Tk.I, Sikka.

the saddle of Nita (Ds. Iligai, Ds. Koting C, Ds. Koting B), saddle of Blatatating (Ds. Blatatating, Ds. Wolokoli) and saddle of Baomekot (Ds. Umauta, Ds. Ipir, Ds. Wolomotong). These rural density figures are unusually high for eastern Indonesia. From the discussion of the regional distribution of population the sharp contrast between the densely populated northern flanks and the northern littoral on one hand, and a less densely populated southern escarpment on the other hand becomes evident. Highest density figures are attained in the saddles of Nita and Baomekot while lowest figures are encountered at the extreme ends of our study area.

An even more detailed picture of actual distribution of Central Sikka's population was attempted on the basis of unpublished data of the 1974 educational census of Sikka (*sensus pendidikan*) which lists the number of inhabitants per village and hamlet within the regional precincts of a primary school. These data if taken together deviate only slightly from the official registration figures per desa. The actual regional distribution of the population is illustrated on Fig. 27 which clearly brings out the settlement pattern on the crest of volcanic ridges, particularly north of the watershed, thus reflecting age-old strategic considerations.

An overwhelming majority of Sikka's population is engaged in agriculture (see Table 14) although this percentage is gradually falling (from 93 per cent (1969-70) to 90 per cent (1973-74) - see da Cunha 1974:8). With the exception of the commercial and administrative centre of Maumere non-farmers accounted for fewer than 3 per cent of all households in 1970 (kecamatan Maumere, Kewapante, Nita, each 1 per cent; kecamatan Bola 1.5 per cent and kecamatan Lela 2.5 per cent (da Cunha 1974:7).

In order to gain an idea of the labour force per family we have to refer to the Indonesian notion of 'household' (*rumah tangga*) which comprises all inhabitants of a house. Hence several families may live together under one roof. The average number of persons per household varies slightly from desa to desa, as seen in Table 13. Given the scarcity of information on Sikka's social organization no plausible explanation can be provided for these regional differences. Average figures seem to oscillate between 6 and 7 persons per household. This average figure is markedly lower than that provided by ten Dam (1950b:24) for Nita in 1950 (10 persons/household). Whether these figures reveal any development towards smaller households is as yet unknown and needs further study.

The labour force of a family has been calculated by ten Dam (1950b:25) for Nita on the basis of detailed fieldwork. He arrived at the conclusion that 32 to 38 per cent of the household's members are actively engaged in food production. Surprisingly enough, this average figure of 35 per cent is comparatively stable

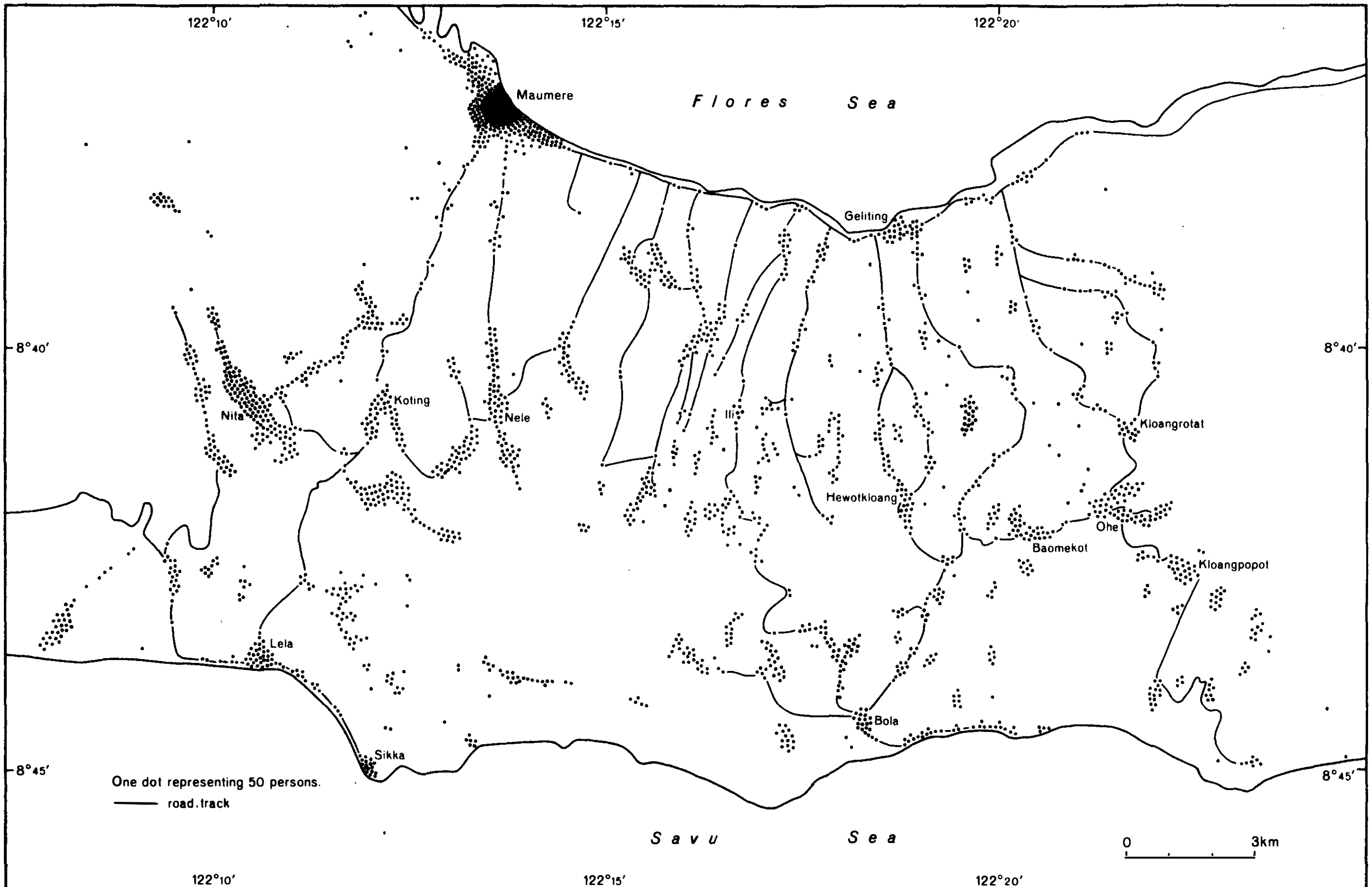

Fig.27 Central Sikka: settlement pattern, 1976 (according to data from Sensus Pendidikan, Kabupaten Sikka (unpublished), Departemen Pendidikan dan Kebudayaan, Kab. Sikka)

Table 14

Sikka households (*rumah tangga*) by occupation, 1971

	Rumah tangga	Per cent
Farmers	27,545	90.4
Livestock keepers and fishermen	814	2.7
Small-scale and medium-scale merchants[a]	692	2.3
Entrepreneurs	11	0.1
Large-scale merchants engaged in import-export[a]	11	0.1
Others (mostly government officials, clerks, etc.)	1,384	4.5
	30,457	100.0

a) According to Parera (1972:24) there were 241 merchants recorded for the year 1971. The discrepancy between Dagomez's and Parera's figures may be explained by the fact that several *rumah tangga* obviously run an enterprise together. Of the 241 merchants 71 were foreigners (i.e. non-Indonesian nationals), 19 medium-sized and 52 shops. The remaining 170 merchants were 7 large-scale, 35 medium-scale, 27 shops, 101 small-scale. By comparison with comparable figures for 1966 the number of merchants seems to have considerably decreased since (1966: 453 small-scale merchants, 46 medium-scale merchants and an unspecified number of large-scale merchants). Likewise the number of foreign merchants dropped (114 small, 29 medium-scale merchants) (Say 1968b:19).

Source: Information provided by Kantor Pemerintah Daerah Kab. Sikka (from Dagomez 1974:8).

irrespective of the size of the household. Ten Dam points out that the aforementioned percentage seems to be deliberately maintained. This may be achieved through the *adat* institution of *pulanê* or *manê* which describes the special relationship between mother's brother and sister's child (E.D. Lewis, pers. comm.). The uncle has to look after the child. In case of shortage of labour for fieldwork the uncle will also ask this child for help. Frequently the child is also adopted by the uncle's family. Through this mechanism the percentage of persons engaged in food production as related to the total number of persons in a household can be kept constant.

Although foreign ethnic groups played a significant role in Sikka's history, they hardly figure in Sikka's statistics

(Table 15). The low percentage of registered foreigners should not be misinterpreted, as a numbe of them, particularly those from south Sulawesi, have settled down in Sikka and intermarried with native Sikkanese. Most Buginese at Bebeng (Plate 48), for instance, have ceased to speak Buginese and speak Sikkanese instead. Buginese and Bajau/Boneratese, who are mainly found in Kewapante and Maumere, are probably collective terms which also include people from the islands of Saleijar and Buton, located between south Sulawesi and Flores.

Demographic development in Sikka was all but uniform. While growth rates for Sikka as a whole are comparatively low (Table 16), regional rates deviate considerably from these averages. As we can safely assume that regenerative habits of the population are fairly uniform throughout the area, regional differences in growth rates are primarily a function of migration. This aspect will be dealt with in Chapter 3. Reliable demographic data for Sikka as a whole are hard to come by. In contrast to Java birth and death rates are unknown in Nusa Tenggara Timur. Neither are comparable demographic data of specific regions of Sikka (e.g. *kecamatan*, *kapitanschap*) covering a span of several decades available as administrative boundaries in eastern Sikka were repeatedly changed after the population census of 1930. Since population figures for hamlets were not available either, regional comparison with population figures of subsequent years was rendered impossible. For this reason we merely depicted regional population densities in a series of maps (Figs. 28, 29) for the years 1911, 1930, 1954, 1961 and 1975.

These maps clearly show Central Sikka to have been the centre of population ever since 1911, followed by Mbengu in the Lio portion of western Sikka. Hamente Ili was exceptionally densely settled with 324 inhabitants per sq.km. In the census year of 1930 Maoemere also passed the threshold of 260 persons/sq.km indicated on Fig.28 with 286 inhabitants/sq.km. By 1954, hamente Sikka and hamente Maumere which comprise the saddle of Nita, as well as hamente Ili and hamente Hewotkloang which include the saddles of Blatatating and Baomekot ranked as the area's most populated portions. By 1961 almost the whole of Central Sikka - with the exception of hamente Nele - had exceeded that density figure, while Nita, Wairgete, Werang and Kringa continued to be very thinly populated and had remained almost unchanged for five decades.

A comparison of the population densities of 1961 with 1975 reveals that Kecamatan Nita as well as the northern littoral of what belongs now to *Koordinatorschap Pemerintahan Kota Maumere* (Kopeta) have had significant population increases while Kecamatan Lela displayed a net population decrease. Thus it appears that the constantly increasing population trend - which could be observed since 1911 in Central Sikka - came to a standstill and was even reversed in Kecamatan Lela after 1961.

Table 15

Non-indigenous population of Sikka

Year	Chinese		Europeans	Buginese	Bajau/ Boneratese
1916	84		26		
1930	247		35		
1934	230		35		
1949	450		50		
1953	591		58		
1967	140[a]	712[b]	65		
1971		721[b]			
1972		808[b]	53	2240	4507
1974	187[a]	880[b]	52		

a) Indonesian nationals.
b) Nationals of the People's Republic of China.

Sources: 1916: Hens (1916 II:10); 1930: Rusconi (1940a:29); 1934: Hagenaar (1934:92); 1949: From archives Kantor Sensus dan Statistik, Sikka; 1953: From archives Kantor Sensus dan Statistik, Sikka; 1967: Say (1968b:9); 1971: Perera (1972:19); 1972: Pers. comm. Kantor Sensus dan Statistik, Sikka, 16 March 1976; 1974: Say (1974:64).

Table 16

Population growth for the district of Sikka

Period	% change	annual change in %
1911-26	+ 32	1.8
1926-30	+ 4	0.9
1930-42	+ 6	0.5
1942-49	+ 6	0.3
1949-61	+ 27	2.0
1961-71	+ 13	1.2
1971-75	+ 5	1.2

Sources: See Table 12.

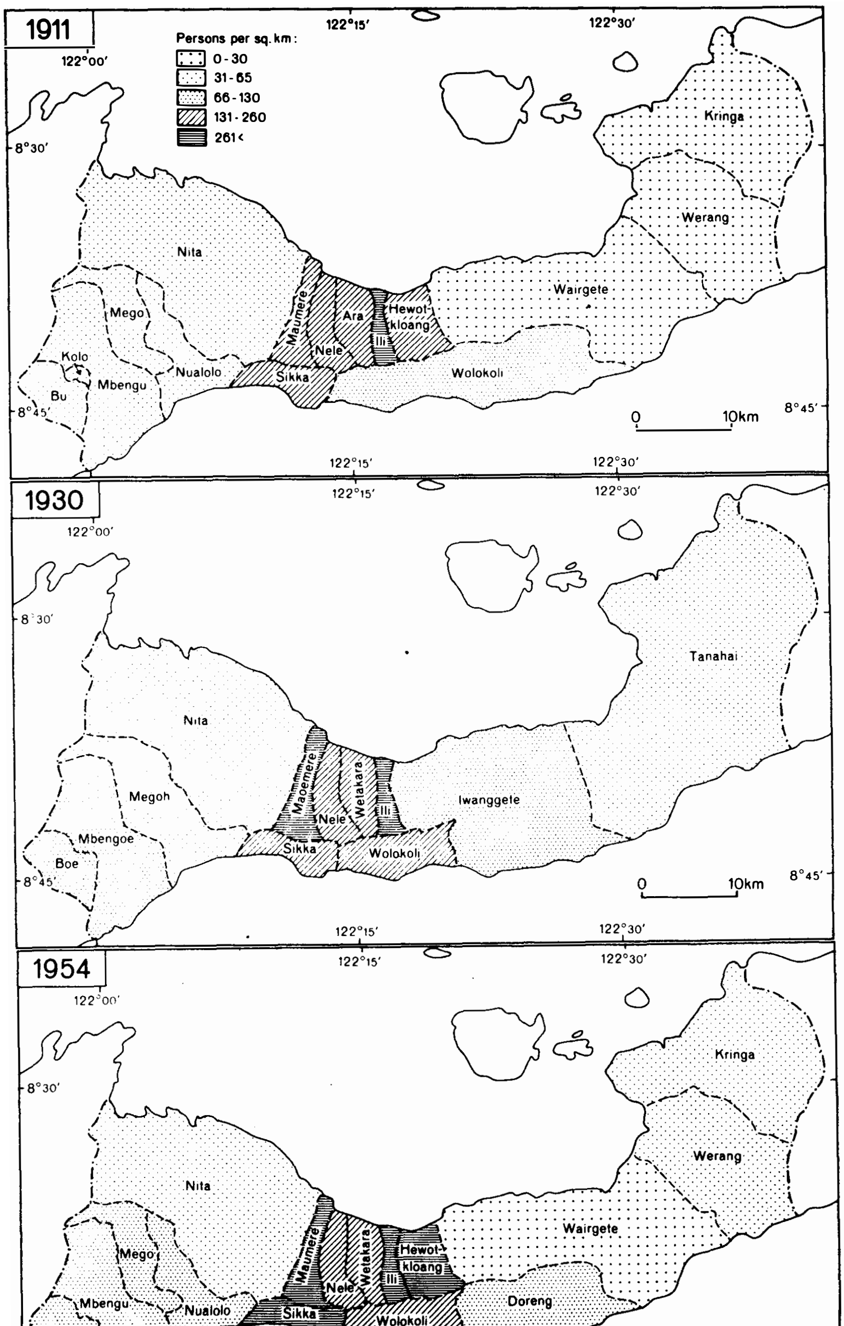

Fig.28 Density of population by hamente, 1911, 1930, 1954 (for sources see Fig.29)

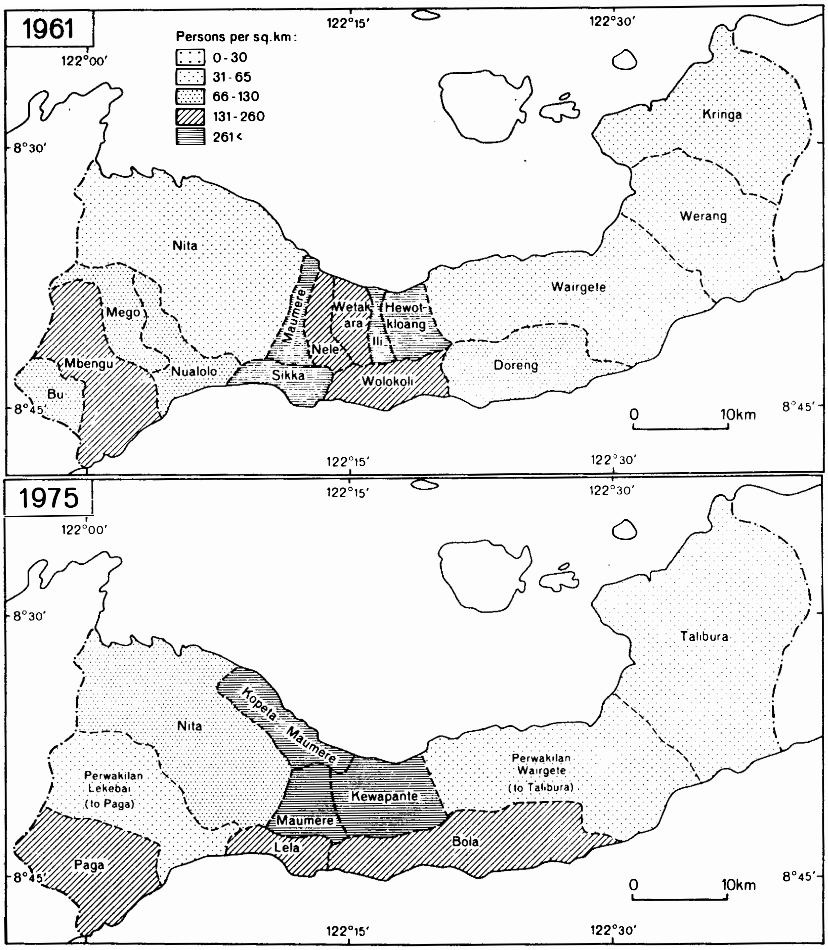

Fig.29 Sikka: density of population by kecamatan, 1961, 1975

Sources: 1911: Flores Memorie (1912:87, calculated from number of registered men per district multiplied by 3.6).
1930: Bosselaar (1932:43) (census data).
1954: Kantor Sensus dan Statistik, Sikka-Jumlah djiwa pemilih di Daerah Pemilihan Kab. Maumere (pendaftaran sampai dengan 1 Okt. 1954).
1961, 1975: Kantor Sensus dan Statistik, Kab. Sikka, pers.comm.

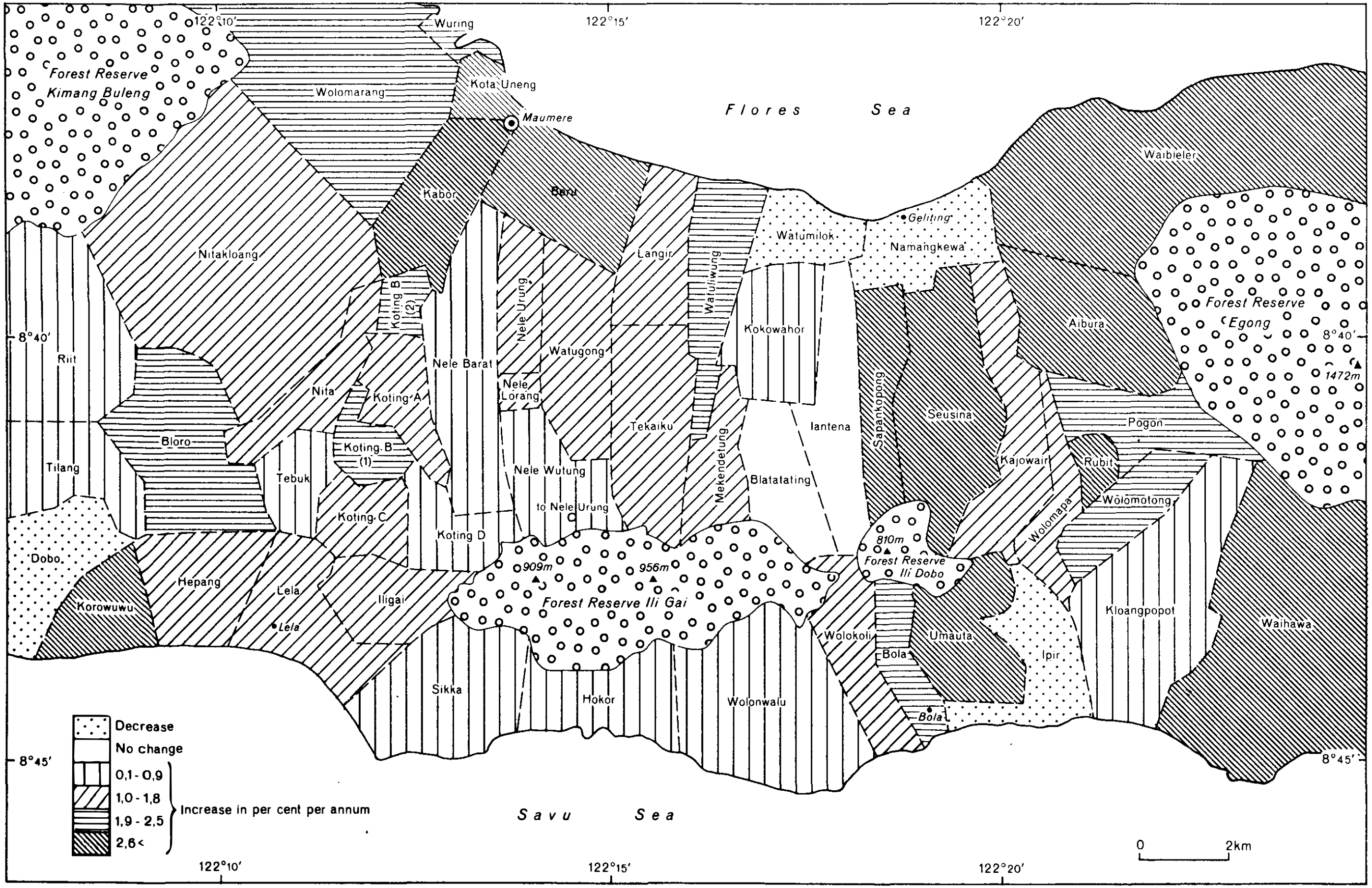

Fig.30 Central Sikka: population change per annum in per cent (1954-61)

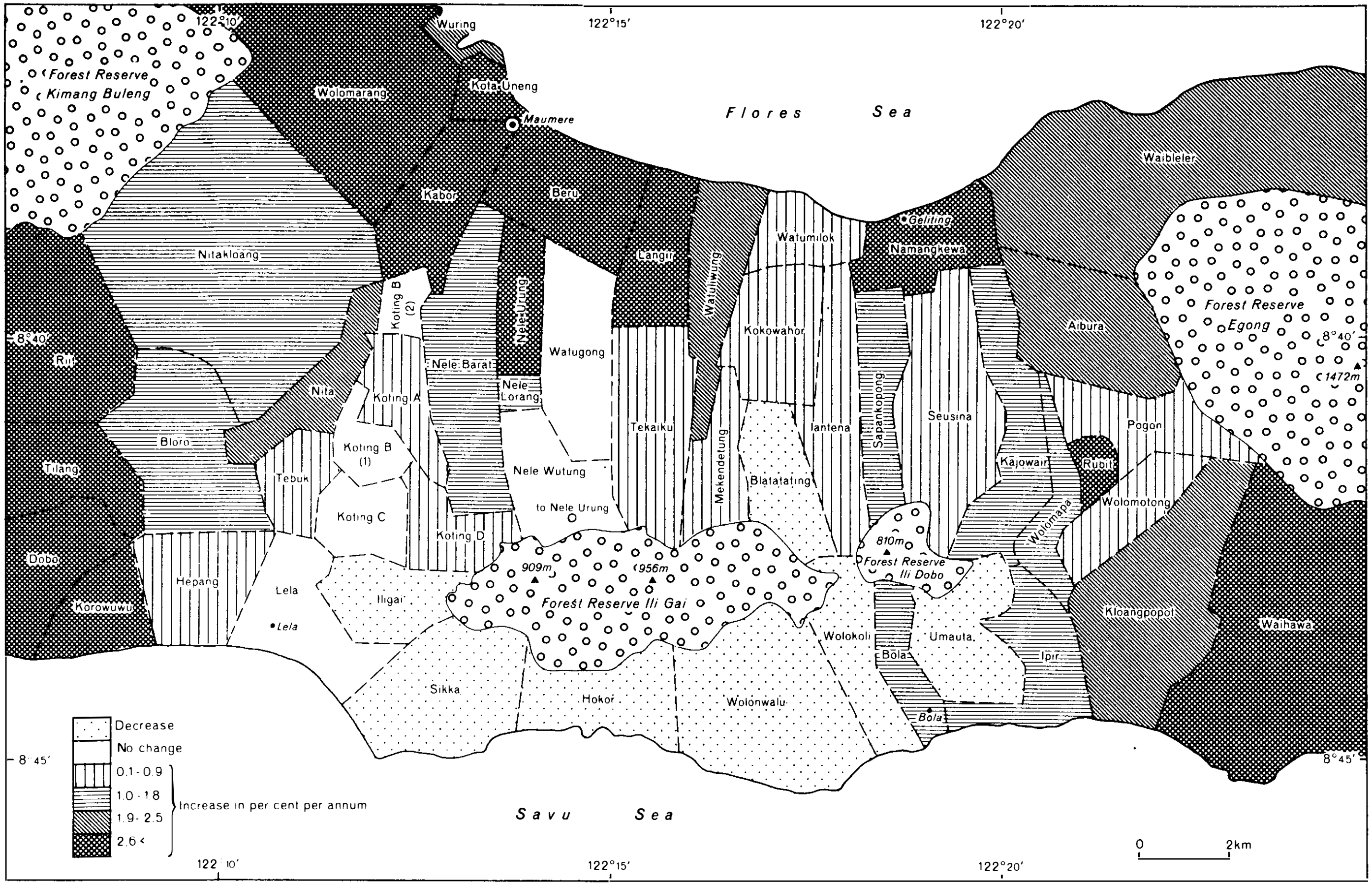

Fig.31 Central Sikka: population change per annum in per cent (1961-75)

This picture is still somewhat rough. For a more detailed interpretation we shall have to base our analysis upon smaller administrative units. Because of constant reshuffling of administrative units, only reference to the *kampung* level makes such a comparison possible. For an analysis of this kind figures for 1954, 1961 and 1975 were available. The demographic development for the periods 1954 to 1961 and 1961 to 1975 has been mapped (Figs. 30 and 31). A comparison of these two maps makes clear that since 1961 most desa on the south coast display an absolute increase in population (Wolonwalu, Hokor, Wolokoli, Umauta, Iligai, Sikka, Lela). Only at Ds. Ipir was a decreasing trend observed between 1954 and 1961 which was, however, reversed after 1961.

A similar development can also be observed at the saddle of Nita. Here in a number of desa (Koting B, Koting C, Nele Wutung, Watugong) the slight population increase typical until 1961 was brought to a standstill during the subsequent period. Spectacular population increases were registered in some desa on the western slopes of Mt Tarat-Egong (Ds. Waibleler, Ds. Aibura, Ds. Waihawa) as well as in Ds. Seusina, Ds. Sapankopong and particularly so in the town of Maumere after 1961.[36]

After 1961 the desa of the northern littoral of Central Sikka (Ds. Namangkewa, Ds. Langir), west of Maumere (Ds. Wolomarang) and in the southwest (Ds. Riit, Ds. Tilang, Ds. Korowuwu, Ds. Dobo) seemed to benefit most from population increase. From this rather heterogeneous demographic development over space and time follows that the lack of correlation (r = .39) between population density and population growth is not surprising. Different environmental conditions, the impact of local *adat* and different degrees of commercialization are responsible for this.

Settlement pattern

In precolonial times the settlement pattern was largely determined by considerations of security. In addition the potential site had to offer good possibilities for agriculture. A favourable combination of these elements was found in Central Sikka's mountainous spine, where rainfall was more evenly distributed over the year and the soils were of high natural fertility provided deficiency in nitrogen and organic matter could be overcome. The unique character of Central Sikka as against the eastern and western portion of the district was already recognized by early settlers. Permanent warfare between Sikka and Larantuka, between Sikka and Kangae, among tiny *rechtsgemeenschappen* in the area between Kewapante and Bola as well as attacks by Buginese slave

[36]Inhabitants of Maumere: 1948: 5490 (Departemen Dalam Negri 1976: 1); 1961: 7880 (Ds. Kota Asing, Ds. Pohon Pisang, Ds. Beru, Ds. Kabor); 1975: 16,299 (Ds. Beru, Ds. Kabor, Ds. Kota Uneng) (Kantor Sensus dan Statistik Kabupaten, Sikka).

raiders prevented the population from spreading east and west of Central Sikka and from forming dispersed settlements (see also ten Dam 1950b:11). Instead clustered settlements in localized fortified villages were common. Short narrow volcanic ridges (*wolong doi*) or high points were preferred for settlements to long ridges (*wolong blong* = long hill) because these were more difficult to defend. The northern littoral plain remained free from settlements for fear of slave raiders and malaria until the second decade of this century. After pacification at the beginning of this century people felt more secure and hamlets were founded away from the villages. The present distribution of villages and hamlets in the Iwanggete region of Baomekot, Hewotkloang and Ohe still clearly reflect the traditional settlement pattern. The settlements were traditionally surrounded by bamboo palisades about 2 metres high. Behind these palisades an earth dam was built from which protruded sharpened bamboo poles (van Patot 1907:768).

There were set places for local wars. One such place was at Watublapi where the mission is located today. At this spot called Wuadetut the members of the *tana puäng* areas of Baomekot and Hewotkloang used to fight as late as the 1890s. Battlegrounds (*tana boeng alang*) as well as places where peace was concluded therefore remained free from settlement. One such place for peace was Hewerbura (meaning to hoist the 'white' - i.e. white flag consisting of a young sprout of a coconut leaf) near the present site of the village of Watublapi. Such neutral zones which were not used by either side remind us of conditions in New Guinea. As land shortage was far more acute in Central Sikka, these neutral zones were considerably smaller.

Traditionally non-Christian villages were divided into clan quarters (*wisung*). Each clan (*kuat* or *kuat wungung*) within the village designated one house as its clan house (*wisung wanga* or *kloäng klêreng*; or *lepo puäng ramut* according to Arndt 1933:86) where the clan's inherited wealth (elephant tusks, gold, etc.) was kept (Rusconi 1940b:63). A clan was divided into several sub-clans or lineages (*lepo*), each consisting of individual families (*ina mae ama mae*) who lived in individual houses (*oring*). The main house of a lineage was called *lepo woga*. In the village of Hewotkloang the following sixteen lineages were found in 1976:[37]

Lepokirek	Lepogai	Lepotana
Lepogahar	Leporatu	Lepolaka
Lepotanawura	Lepomugenput	Leporotanjonong
Lepomapat	Lepomusidok	Lepolai
Lepobarirewo	Lepokoat	Lepogogu

Lepolora (Lepolora ha lora wali ledun and Lepolora ha ripa ledun)

[37]Based on his own findings, E.D. Lewis questions the functional significance of these groups today (pers. comm.).

For the old village of Nita, Arndt (1933:96-9) reports that it consisted of ten *wisung*, nine of which were arranged in a crescent open to the north while the tenth house was somewhat removed and located in the centre next to the offering stone (*watu mahe*). This latter house belonged to the *mangung lajar* (*mangung* = mast; *lajar* = sail), an official of the *ratu* or *raja* acting as mediator between the *ratu* and the *tana puäng* (Rusconi 1940b:49). Here again we are strongly reminded of the boat (*prau*) which was mentioned in the context of early migrations and settlement of the island. This village pattern which was also reported for the village of Sikka (Meyerranneft n.d. :33) has disappeared today. Instead houses - formerly built on stilts with a platform 1 to 1½ m above ground (Jacobsen 1896:66) - are often arranged in rows today, as for instance at Hewotkloang (Ds. Seusina) and Koker (Ds. Pogon), with several offering stones in the centre (Plate 12). The *wisung* - village quarters - are usually no longer inhabited by the founder clan (*kuat*) but by several clans. A *wisung* may comprise several houses. When it becomes too small for all members of the clan to live in, new settlements are founded outside - called *kloang*. The traditional ties to the old *wisung* are, however, maintained, even by the women who normally move away when they get married (Arndt 1933:93).

The native population of Sikka traditionally settled on the flanks of the volcanic cones because of pirates and slave raiders. Moreover the northern littoral zone was shunned because of malaria (*rou leling*) and elephantiasis (*waing bou*).[38] Until the 1920s this zone was chiefly used for hunting purposes. The wide occurrence of fire-resistant grasses after which these savannas have been named (*urung rii rotang*) and which are still found today north of Mt Kimang-Buleng and Mt Tarat-Egong bear witness to this activity. Fire was the main agent with which game was driven. The hill dwellers went to the coast not only for hunting which took place once a year, but also for trading at a few market places and for religious purposes. While customarily each *krowe* non-Christian *tana puäng* territorial group maintained sacred places in the mountains (*watu mahe urang dare*)[39] some groups also maintained offering places at the seaside (*nuba nanga*) where sacrifices were made to the spirits of the earth and the sea. The location of a few *nuba nanga* - those of Kewa, Geliting, Habigete, Nitung and Ili - are shown on Fig. 53.

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[38]For instance Jacobsen (1896:44, 65) who visited Sikka in 1888 reports that Maumere was surrounded by swamps while the coastal plain was covered by tall grass (more than 2 metres tall) which hardly allowed him to look over the plain when he crossed the area on horseback.

[39]And at *tana tena sida wai*. *Watu ai* - offering stone in the forest where people used to hunt; *watu ber* - coconut grove (Arndt 1932:19).

According to oral tradition the site of the town of Maumere was known as such a sacred place called *Nuba Nanga Sida Wai* (Mandalangi 1972b). A market developed at this place where goods (particularly earthenware) were exchanged with merchants from southern Sulawesi (Buginese, Makassarese) and Bajaus. No exact date can be given for its beginning as a port. All that can be stated is that it was already known as *Alok Wolokoli* when the Sikkanese king, Don Alesu, returned from Malacca at the beginning of the seventeenth century. The strategic position of this port was soon recognized and a representative of the king of Sikka, called *komandanti*, was permanently placed in what was then called *Alok Sikka* (= harbour of Sikka). He was entitled to levy market taxes. Traders from southern Sulawesi found it profitable to live permanently in Alok, a name which Maumere still holds today among its inhabitants.

This port became the capital town of Sikka after the Dutch arrived in Sikka in the second half of the last century. The coastal reef which somewhat protects the port during the northwest monsoon is open, thereby allowing ships to enter the bay. Until that time the chief trading centres on the north coast were Bebeng near Wuring and Geliting, formerly called Bajo. Bebeng is probably Sikka's oldest port on the north coast and mentioned in Sikka's oral history (*kleteng latar*) as the port from where Lesu, who later became the first king of Sikka, left for Malacca at the beginning of the seventeenth century. Geliting is reported to have been founded much later, at the beginning of the nineteenth century, by Buginese (Wichmann 1891:109). Bitter rivalry characterized the relationship between Maumere and Geliting (Vosmaer 1862:148-9). The reason for this was the claim of the *ratu* of Sikka on Geliting which was under the rule of Larantuka.

Under the Dutch Maumere[40] gradually outranked the neighbouring ports on Sikka's north coast. In 1875 when Kleian (1891:513-14) visited the place it had about 400 inhabitants, who lived on salt production and trading, chiefly of tamarind (*asam*) which was either bartered or sold to Makassarese. In 1874 a Catholic mission was opened by Jesuit priests (Heynen 1876a:81) and in 1879 the first permanent Dutch post-holder for Sikka arrived in Maumere which became the administrative centre of the district of Sikka. Before the end of the century the king of Sikka also moved his seat of residence from Sikka-Natar, located at the south coast, to Maumere.

In the wake of firmer Dutch administration after 1907 Maumere also became the seat of a garrison and of a contingent of armed police. Thus by 1916 it was by far the most important trading centre on Flores' north coast with a population of 1272 (Hens

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[40]The name of which is said to stem from Lionese traders (Lionese: Mau = harbour, mere = big) (Departemen Dalam Negri 1976:16). The Sikkanese, however, use the name *Alok* instead of Maumere.

1916 I:212). The place was composed of various quarters (*kampung*) of different religion: Kampong Kabor (south) and Kampong Pohon-pisang (west) were inhabited by Christians while in Kampong Beru and Kampong Makassar (east) chiefly Moslems were to be found (Wichmann 1891:106).

Maumere's unhealthy location was the reason why Catholic sisters (*zusters van de Liefde* from Tilburg) who arrived in Maumere at the end of the last century decided to leave the port and to open a hospital at Lela on the healthier south coast in 1899. The salt pans around Maumere were believed to have enhanced malaria incidence (see De Missie van Midden-Flores in Vogelvlucht 1901:50). In the last 1930s even the shifting of the administrative seat of the *onderafdeeling Maoemere* to Nele on the saddle of Nita was contemplated (Bosch 1938:88-90). Although these plans did not materialize, they underscore the fact that the north coast's health problems had not been solved in the 1930s and are still a menace today, as indicated by the high incidence of malaria chiefly incurred along the northern littoral zone (see Table 17).

The rural settlement pattern as found at present differs considerably from the traditional form of settlement outlined above. Instead of clustered fortified villages houses are built on the crests of ridges in a line along both sides of a path. Examples of this pattern are Kei, Bloro and Wukuk (Ds. Bloro) or Nitakloang, Natarwulu, Rotat (Ds. Nitakloang). This pattern was the result of Dutch legislation as will be shown below (pp.183-4).

This concentrated form of communal living typical for Central Sikka is in strong contrast to the dispersed settlement pattern of eastern Sikka (Tana Ai) where most of the population still lives in hamlets composed of a few houses at most. Although Central Sikka's settlement pattern facilitates administrative control and agricultural extension, it prevents the farmer from visiting his fields regularly owing to the great distance to his *ladang*. In his socio-economic study of Nita, ten Dam (1950b:59) arrived at average distances of 4 to 5 km and a maximum of 8 km. Because of this time-consuming journey he believes farmers are less given to tending their fields and this results in aggravation of erosion. Moreover, in his opinion gambling and general loafing in the village including drinking of *tuak* is increasing. The question whether these alleged disadvantages of concentrated living actually weigh as heavily as ten Dam believes cannot be evaluated here. Only investigation of the precise labour input of *ladang* cultivators living near and far from their fields can provide a definite answer.

Yet what seems to have definitely influenced the farmers' lives in most portions of Central Sikka more is the growing of tree crops, above all coconuts, and this was encouraged by the government. Once tree crops had to be tended farmers, as a rule, became unwilling to live far from their trees. The concentrated

Table 17

Sikka: febrile cases reported as malarial, by kecamatan, 1975

Kecamatan	Population	Consultations[a]	Cases of reported malaria	Malaria cases in per cent of consultations
Koordinatorschap Maumere	20,540	40,864	22,976 (9868)[b]	56.2
Lela	10,891	19,624	8,039 (2913)[b]	41.0
Bola	24,196	8,209	2,515	30.6
Kewapante	30,712	22,056	6,178	28.0
Maumere	34,893	11,212	2,565	22.9
Nita	21,465	15,315	3,873	25.2
Paga	30,659	15,064	4,389	29.1
Talibura	27,904	12,821	4,634	36.1
Kabupaten Sikka	201,260	145,165	55,169	38.0

a Any consultation; hence several consultations with the same patient are counted separately.
b Cases of malaria verified by blood tests (figures included in overall malarial figures for the respective kecamatan).

Note: It should be remembered that the hospitals in the town of Maumere and at Lela are frequented by patients from various kecamatan. The figures should therefore be interpreted with caution. Official figures of malaria incidence seem to convey a distorted picture as Tan (1964b:13) was able to show at Lela hospital. While only 352 of all patients who consulted medical treatment at one of the polyclinics in Kecamatan Lela were counted as having malaria in official statistics, almost every patient (95.7 per cent) who came to the hospital at Lela actually had malaria - often without his being aware of it - besides other ills. As these patients came from all parts of Sikka, this figure cannot be related to malaria incidence of any particular region.

Source: Unpublished data provided by Kepala Dinas Kesehatan Sikka, Dr A.J.G. Berek, May 1976.

kind of living as well as the government's encouragement of planting coconut trees led to a growing degree of immobility, as already observed by ten Dam (1950b:59).

The decreasing mobility and its negative effect upon food cropping was recognized and overcome by more aggressive farmers from Ds. Sikka and Ds. Iligai (south flank of saddle of Nita). While they maintain a few houses, for instance, at the villages of Ililewa, Napunnao, Du, Puho and Wolowukak, most of them have their main residence in Ds. Korowuwu, Ds. Tilang and Ds. Dobo in western Sikka next to their fields. Here they frequently live in dispersed settlements (see also ten Dam 1950b:59).

Traditional land tenure

In the pre-contact era - that is until about the end of the nineteenth century - the Sikkaneses' relationship to their environment was to a large extent determined by the way in which resources were allocated among the members of a certain territory. According to traditional belief all land rights were associated with a particular descent group which, conquests apart, traced its connection with that land back through generations of ancestors to founders who occupied that piece of land in the name of the descent group (see Arndt 1933:104ff.). This right of first occupation of a piece of land was called *duä bekor nian kokan muhan, moäng bira tana blinet peke*. The founder and his successors, called 'lord of the earth',[41] exercised the right to allocate usufruct rights (*suwung gawuk* or *gopi hokot suwung gawuk*) of parts of that land to the members of their founder descent group and to people belonging to other descent groups (*ata nanê maing* = 'people who came long ago') who subsequently decided to settle in that area. Such movements were generally welcomed by the founder group because of strategic considerations. As outlined earlier permanent warfare forced the inhabitants of a certain territory to live together in palisaded villages preferably located on ridges and hilltops. The territorial units grouped around a *tana puang* were thus not commensurate with land of certain genealogical groups, for members of a descent group could be found in various *tana puang* territories. The territory of a *tana puäng* was clearly demarcated by stones (*watu kêbar*) which were placed at the four corners (*hikong*) of a territory for which a ceremony was held (*paat watu kêbar*) (Djafar 1972:2).

Before opening a new field in the forest (*uma tuang*) the members of a *tana puäng* area had to announce their intention to the *tana puäng* whose duty it was to make a sacrifice (*tung piong*) at a specific location in the forest in order to reconcile the evil spirits. The *tana puäng* was subsequently given a present, called *wawi peping ara piong*, which consisted of seven parts

[41] The term 'lord of the earth' has here been used according to Fox (1972:89).

(1. *tali blai*, 2. *api matang*, 3. *rego*, 4. *hoko tana bait*, 5. *papa*, 6. *piong*, 7. *manuala*), chiefly chicken, boiled rice, thighs, head and breast of a pig and dog meat as well as *tua*, an alcoholic drink made from the *koli* palm (Djong 1961:3). By this gift it was clearly demonstrated that the family working that particular piece of land was only entitled to exert usufruct rights - not ownership rights - over the land.

Farmers living outside the *tana puäng* territory who intended to work a piece of land located within the territory of another *tana puäng* had to ask permission to do so from the *tana puäng* as well as from the land council of that territory called *dua moang watu pitu* in the areas of Iwanggete and Kangae, *dua liting pitu moang ler walu* in the former kingdom of Nita (Rusconi 1940b:21). Such an institution was unknown in the former kingdom of Sikka. The *dua moang watu pitu*, which seems to be best known as it existed in that portion of Sikka that was least affected by foreign influences, consisted of the following seven persons:

1. *Tana puäng*
2. *Kokokek* = public announcer
3. *Gai* = village policeman and warlord
4. *Buwung gajong* = master of ceremony and public welfare
5. *Jaga nuba plamang nanga* = harbour master entitled to collect harbour and market taxes and taxes for salt production
6. *Jaga dueng plamang heat* also known as *wara wolong* = guardian of the borders
7. *Urung blong damar gahar* or *dua kula moang kara, urung blong damar gahar* = judge responsible for settling disputes.

The council decided upon the request of an outside farmer to open a piece of land within the precincts of their *tana puäng* territory. Once permission was given the farmer made a gift (*lageng*) to the *tana puäng* (Rusconi 1940a:59ff.). The legal position of such outsiders was, however, highly insecure as evidenced by the fact that they were refused the right to plant perennial crops on the fields assigned to them. Such planting would have established permanent rights which the land council was not willing to cede.

The size of a *tana puäng* territory was essentially contingent upon population density. As Fig.32 shows the *tana puang* territories were clearly smaller in densely populated Central Sikka than in eastern and western Sikka.[42] The boundaries of these territories (Fig.32) are not official, although they are sufficiently accurate in Central Sikka where they were drawn on the basis of a map of

[42] It has to be mentioned that the land tenure systems in the latter two regions slightly differed from those in Central Sikka.

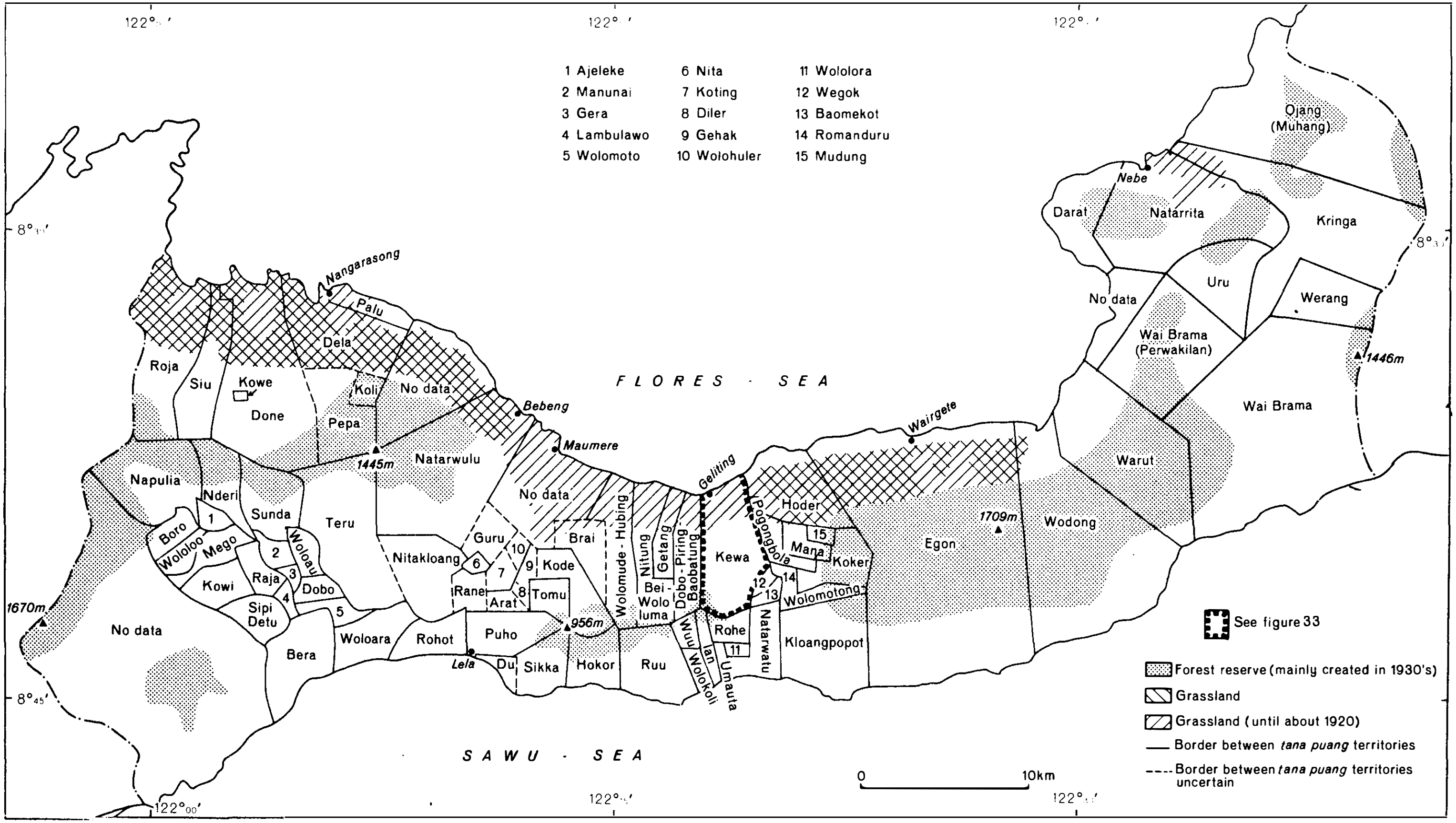

Fig.32 Sikka (excluding the islands): chief traditional territories (*tana*) of the 'lord of the earth' (*tana puang*)

1:25,000. They were based on oral and written information provided by experts of local *adat* (A. Boer Parera at Bola; Petrus Jacobus Bapa Mekeng at Kewapante (Plates 34, 35); Willibordus Woga, former teacher at Watublapi; as well as reports by former controleur Rusconi (1940b)).[43] Figure 32 thus serves to convey an approximate idea of former *adat* territories. In one of the most densely populated portions of Central Sikka - at the saddle of Nita and around Maumere - however, it was not possible to delineate unequivocally the borders of such territories.

As the population of a territory grew in number, *tana puäng manuala* (in Kangae called *tana puäng matang*) were located as representatives of the main *tana puäng* (also called *tana puäng gete*) (in Kangae: *tana puäng ubeng* (Mandalangi, n.d.)) at various villages. The *tana puäng*'s main function was to ensure that adat rules relating to the use and protection of the land were observed. The territory was usually divided into land use zones as illustrated on Fig.33, for the *tana puäng* areas of Kewa, for which former teacher Willibordus Woga (Watublapi) was able to provide detailed oral information. The following land zones had been differentiated, although only a portion could be distinguished on Fig. 33:

1. Land reserved for agricultural purposes (*uma tana* or *uma tana ai tali opi hokot ru supung*) consisting of unused (*tana dueng êong*) and agricultural land (*tana luma lago*). On such land each member of the *tana puäng* territory had usufruct rights. With the symbolic present (*wawi pepi ara piong*) to the *tana puäng* the farmer committed himself to strictly observe a number of rules and ceremonies. Thus the user agreed to work the plot for at least two, at most three years in a row. Should the field be worked beyond that period the *tana puäng* erected a sign (*kuwa lela*) on the field which prohibited its further use. Moreover, uncontrolled fires as well as the cultivation of steep slopes with hoes was prohibited because of the erosion hazard. The *tana puäng* determined the date of planting and harvesting (Rusconi 1940a:60). The cultivator was not allowed to harvest early maize (*lele ropo*) before the 'lord of the earth' had cut and tasted it. For this a ceremony was held at which the 'owner' of the field sacrificed a dog. The dog's legs had to be offered to the *tana puäng* together with *tua* and rice. Before abandoning his plot the cultivator was obliged to plant fallow plants (this condition was called *pu tuäng*) - mainly *luma* (Leguminosae: *Sesbania grandiflora*)

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[43]As a result of recent anthropological research in Tana Ai by E. D.Lewis, Australian National University, Canberra, it was possible to locate the *tana puäng* territories east of Warut more accurately and thereby to improve an earlier version of that map published in 1977 (Metzner 1977b). I am grateful to Mr Lewis for this valuable piece of information.

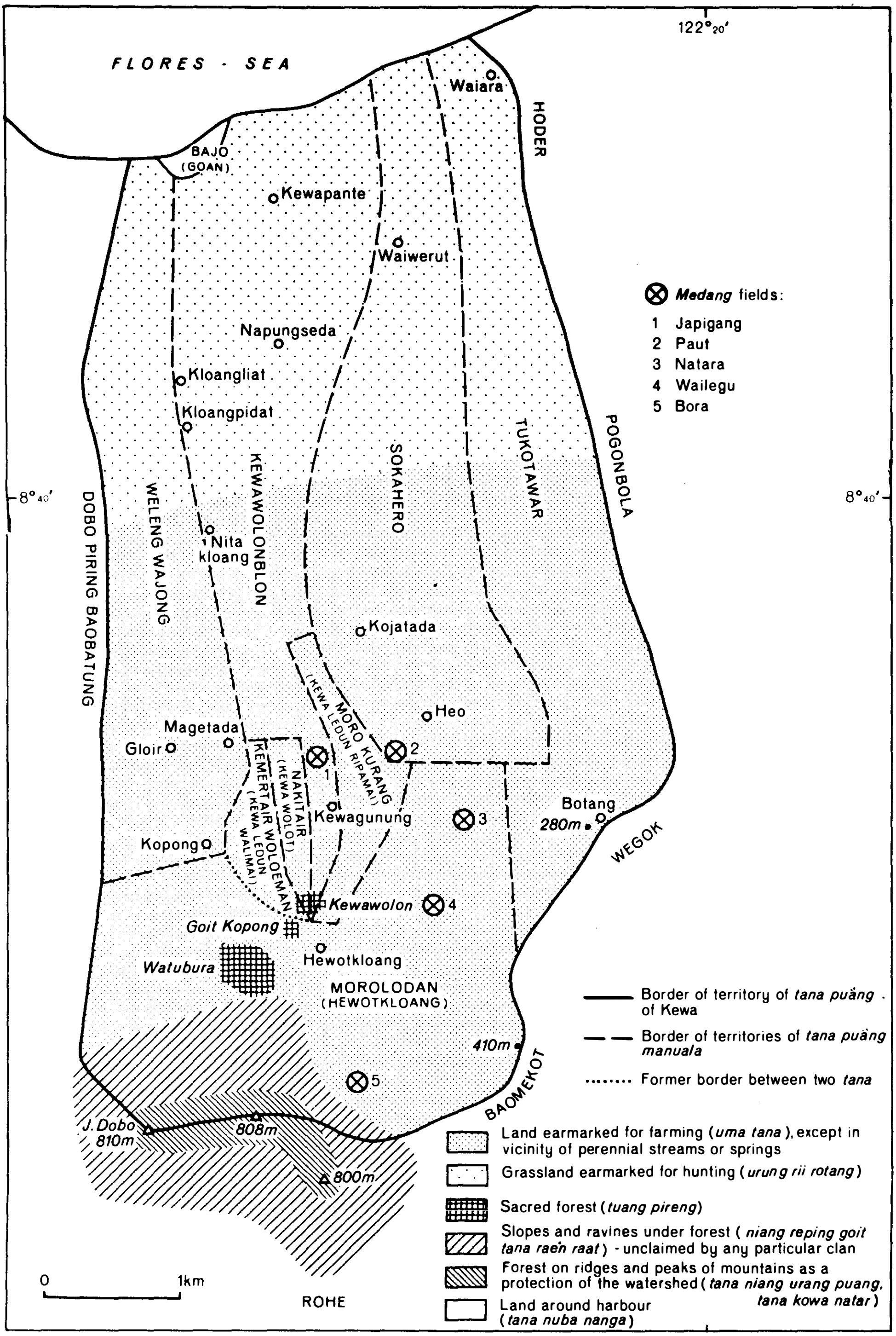

Fig.33 Traditional *tana puăng* territory of Kewa

and *lago* (*Hibiscus tiliaceus*); hence the name *tana luma lago* for land already used agriculturally. These fallow plants served to accelerate the re-establishment of secondary growth. Restitution of soil fertility was thus increased while erosion was checked. One of the main reasons for planting fallow vegetation was to prevent *Imperata cylindrica* grass (*rii*) from encroaching upon land marked for cultivation. In case these rules were not observed harsh punishments could be expected, e.g. the payment of two pieces of gold (*bahar rua sube ai bera bahar, nunga tahi baing bahar*) or a horse (pers. comm., A. Boer Parera, 2 May 1976). The *adat* rule concerning induced fallow vegetation has been less observed on the south coast of Central Sikka. The reason for it remains unclear. Frequently land was 'owned' communally by several clans (*medang*) and as such had to be cultivated together for one or two years (see Fig. 33 for location of *medang* in *tana puäng* area of Kewa before 1918).

2. Grassland (*urung rii rotang* (S)) chiefly found in the northern littoral zone (see Fig.32) and at the northern flanks of Mt Kimang-Buleng and Mt Tarat-Egong, formerly earmarked for hunting. These grasslands have to be considered as anthropogenic. All members of a *tana puäng* area had the right to participate in the hunt (*suwung rakang*). For this purpose the *tana puäng* and the land council determined a certain day in July or Agusut - i.e. after the harvest of the dry season maize (*lelê daran*). All participants of the hunt had to submit betel, areca and tobacco to the *tana puäng* who, in turn, offered these gifts at a sacred spot in this zone (*maha urung suwung rakang*) (Djong 1961:4) in order to reconcile the evil spirits. The most important means by which game was driven into a certain direction was fire. It was intentionally laid and carefully kept under control so that neighbouring fields, houses and forests remained unharmed. During most of the year hunting, with the use of fire, was prohibited.

3. Sacred forest (*tana tuäng pireng* or *olang pireng*) in which according to traditional belief the spirits associated with stones and trees (*nitu, noang*) were living. For this reason sacred forests were also called *niang nitu natar*, *tana noang kloang*. For a detailed account as regards origin and ceremonies related to these forests, reference is made to Arndt (1932:202ff.). Here it suffices to stress that access to these forests was limited to a few families who were allowed to sacrifice.[44]

[44] A traditional offering for a *nitu* was a puppet made of leaves of the *koli* palm. A drawing is found in Jacobsen (1896:55).

4. Forests located on hill tops (*tana niang urang puăng*, *tana kowa natar*) for the protection of the watershed. For this reason these forests were closed for agricultural purposes. Only branches and small trees might be cut. This right (*ou wua pata taa*) as well as hunting was, however, subject to prior approval by the *tana puăng*. Any form of fire use was strictly prohibited. Offences were punished with the payment of a pig (A. Boer Parera, Bola, pers. comm., 2 May 1976).

5. Forested slopes and escarpments (*niang reping goit*, *tana raeng raat*) over which nobody claimed any rights. Since these spots were believed to be inhabited by spirits they were shunned by the population. According to A. Boer Parera (pers. comm., 2 May 1976) a portion of this land category was probably declared crown land (*tana ina*) by the king of Sikka in the twentieth century. *Tana ina* was reported to have existed at Baomekot, Romanduru, Wairgete (east of Bola) and Liangawo (Ds. Aibura). Today these areas have been occupied by individuals.

6. Offering places at the coast (*tana nuba nanga*) where often markets and harbours developed. The members of that particular *tana puăng* area had a right to go to the market, to burn limestones (*nope apur*) for chalk (to be used for betel chewing), to produce salt (*tu hini*) (mostly in the vicinity of estuaries) and to fish. In turn, they made symbolic presents to the *tana puăng* while outsiders had to pay a tax of 10 per cent of their produce (*wake lageng*).

7. Caves (*tana lia goa*) in which the good spirits of the ancestors were believed to live. Specific families were entitled to make offerings at these spots.

8. Rivers, creeks and springs (*tana napung wair ba howeng*, *tana wair matang*) which were excluded from agricultural use. Moreover 50 metres around springs any form of washing of men and animals as well as the dying of cotton was strictly prohibited.

9. Communally owned land (*tana natar*) - e.g. foot paths and villages.

10. Communally owned land (*tana ui umeng*) where markets are held.

11. Sacred places (*tana tena sida wai*) where offerings are made.

12. Land conquered as a result of war (*tana riwa hekang* or *tana dira agang*):

    a) Land conquered as a result of war given to the people of the *tana puăng* area (*tana uma riwung*).
    b) Land conquered as a result of war given to a particularly brave man (*tana ngalang*).

13. Battle ground (*tana boeng alang*) (e.g. at Waudetut near Watublapi).

14. Beach communally owned (*tana têten puket pak rabang*).

These regulations based on land use zoning were, as a rule, carefully observed by the population in most of Central Sikka until the beginning of this century (Djong 1961:9) - and in some parts that were less affected by commercialization even until the 1920s. Environmental damage was thus kept at bay (A. Boer Parera, pers. comm.).

This state of balance in the relationship of the Sikkanese towards their land has become subject to considerable modification since the beginning of this century as a result of population growth. As land became scarcer in Central Sikka fallow periods were shortened. Migration as an outlet of population pressure was not resorted to since the potential areas of settlement along the north coast of Sikka were heavily infested with malaria and elephantiasis. As a result of population pressure the usufruct rights on land, which after abandonment of the plot by a farmer used to revert to the founder descent group, became hereditary. Yet the land could not be sold, nor was it possible for a farmer to cede the usufruct rights on his land to another person outside his lineage group. This family land (*tana gung* or *tana ei lepo*) was administered by the head of the lineage who allotted specific plots of it to the lineage members for certain periods (Rusconi 1940b:87). Yields obtained on these fields were equally divided among the lineage members. The right of disposal as regards land (*hak ulayat*) of the *tana puäng* was initially recognized by the family who worked the land. This right was documented by the symbolic offering of *wawi peping ara piong*. As land became scarcer, enhanced also by the planting of perennial crops (*tana ru supung*) - e.g. coconuts, candlenut tree - the plots came gradually to be regarded as privately 'owned' by the family (*hak kepunyaan pribadi*) which could be leased (*kewe*), pledged (*sadang*) and sold with the approval of all family members. Leasing, also known in Sikka as *kewe lage*, is mostly fixed and made in kind. The symbolic gift to the *tana puäng* was no longer rendered.

From this stage of individualization of land ownership (*tana gung*) it was not far to the next stage characterized by privately and individually possessed land, which, however, was still subject to *adat* regulations. Such land could be acquired

1. through purchase (*tana buku batu*);
2. as bridewealth (*tana utang labu*, *tana patang paling*) (when the 'owner' dies, the land reverts to the clan as *tana gung*);
3. as a gift (*tana tika magang* or *tana nager*).

Only purchased land could freely be bequeathed - that is, without approval of the *tana pučng*. In Central Sikka the eldest son usually inherits the land. He is, however, obliged to give equal portions of it to his younger brothers. This obligation is called *hun wungung keber kuat, neti buku porong buluk* (Radjalewa, Mandalangi *et al.* 1970:6). The land is parcelled out in equal portions (*blon pook, klewang lekah*) (S) provided the size of the field exceeds about a quarter of a hectare. This special form of gavelkind tenure has led to extreme plot fragmentation in Central Sikka. In the absence of a male heir the land reverted to the man's clan. This rule was changed after World War II: instead of the man's clan the widow inherits the land today.

Had *adat* bonds been severed - which occurred only rarely - the land was called *tana klaing*. Around Watublapi the change from *tana gung* to *tana buku batu*, also known as *tana woter* (i.e. purchased land), took place in the 1950s. Today this stage of individualization is typical for most of the fields in the northern alluvial plain of Central Sikka.

Following evangelization local religious beliefs, incorrectly and derogatorily termed as pagan, rapidly ceased to exist. Consequently enlightened Christian farmers encroached upon the sacred forests in search of agricultural land on steep slopes. To a certain degree such behaviour was sanctioned by a decision of some *adat* leaders in 1922. If someone opened a field in a sacred forest without being punished by the evil spirits, this plot could be called his (*tana retu lelet*) (A. Boer Parera, pers. comm., 2 May 1976).

With the *zelfbestuursregeling* (ZBR) of 1938 the *raja* of Sikka was made supreme authority by the Dutch in all matters relating to land (*ina ratu mau nian, ema raja tawa tara*). *De facto* he had already exerted this right of disposition (*hak ulayat*) a number of years before 1938. According to this regulation all land was owned communally by the people (not only by certain lineages). Each family only had usufruct rights for which the village as a whole had to pay a land tax (*tana lageng*). It consisted of a small elephant tusk, some gold pieces, boiled rice and goats. *Tana lageng* used to be paid after the harvest by the village elders without ceremony which documented the character of the payment as a simple tax. Besides that tax a number of people still used to make the symbolic present of *wawi peping ara piong* to the *tana pučng* to whom primarily the farmers addressed themselves in matters relating to land. As the *tana pučng* were not willing to cede their traditional rights to the king, considerable tension ensued. According to van den Ende (1954:18) the Kanilima movement in the early fifties has to be regarded as a direct outcome of these tensions.

These various stages of individualization are still reflected in the present pattern of land tenure to which we shall return in Chapter 3.

Discussion

Signs of land degradation which were found to be particularly striking south of the central divide and on the slopes of Mt Tarat Egong pointed to ecological instability in certain places which could not, however, be conclusively correlated with population pressure.

Central Sikka's extremely high population densities, locally exceeding 500 persons/sq.km, could not be accounted for by physical factors alone. For a fuller understanding of the present settlement and land use patterns we investigated the historical guidelines of human settlement of Flores and specifically Sikka and the local social and political organization of the Sikkanese as distinctly different from other ethnic groups of Flores. Central Sikka's unique position at the isthmus of the island of Flores, offering both easy access north and south across the saddles as well as shelter against invaders because of its knife-edged ridges, helps to explain the demographic concentration reported for this portion of Flores ever since the first documentary evidence for this island. Sikka's north coast benefited from its location at one of the major traditional maritime trading routes of Eastern Indonesia through the Java Sea. Yet until World War I no agricultural development took place in the northern littoral zone because of malaria.

As a result of *Pax Neerlandica* and the introduction of western medicine by the Dutch, malaria became less dangerous and population figures soared. The Dutch as well as the Catholic Mission chose to concentrate their efforts in Central Sikka because of greater accessibility. Hence the present high population densities of Central Sikka are the consequence of both favourable physical conditions and historical developments.

Within Central Sikka the regional differentiation between the north and the south coast was enhanced by the Dutch and the Mission. In the process of modernization traditional belief systems - e.g. the *adat* rules concerning the utilization of the northern littoral plain - were altered. Rapid individualization of land ownership along the northern plain and in the saddles ensued. This process of modernization can also be assumed to have had an impact upon the land use pattern found in Sikka at present.

Agricultural systems

Having outlined Sikka's highly diverse physical environment as well as its colourful history we can expect to find this diversity reflected in the present land use pattern. At first sight one is therefore surprised at the relatively homogeneous rural landscape of Central Sikka, characterized exclusively by dry-land cultivation in which coconut palms form the prominent feature covering the volcanic ridges up to an altitude of 600 metres and above. The wide occurrence of coconut groves does not suggest a high degree of agricultural intensity. As over 90 per cent of all Sikkanese families are farmers (see Table 14, p.97), the apparent dichotomy between high densities of population - the highest rural densities of the eastern Lesser Sunda Islands - and agricultural systems for which a low degree of agricultural intensity is typical, makes one particularly curious for an explanation. No plausible reason can readily be found at this stage of our analysis, and we shall have to wait until we have examined the agricultural systems in more detail. The description of the forms and elements of agricultural activity - for both subsistence and commercial purposes - of Sikkanese farmers will provide the first step in this analysis; subsequently a regional and a temporal differentiation of the agricultural systems will be attempted.

Traditional subsistence agriculture

An understanding of the traditional agricultural practices used by the population of Central Sikka for exploiting its environment requires a brief discussion of the Sikkanese array of agricultural tools. The principal traditional implements are:

Medium sized dibble (*teeng*): made of hard wood, sharpened at the end, about 1 m long; used as planting stick and for loosening the soil, during which the farmer has to squat. Particularly handy on steep slopes. As tilling used to be strictly forbidden, the soil was only slightly scratched at the surface. With this practice, in contrast to hoeing (*sako*), the humus layer (*tana ihing*) was left almost untouched.

Small dibble (*teeng kesik*): made of bamboo for weeding, about 50 cm long.

Large dibble (*teeng gete*): made of hard wood, about 1.50 m long, sharpened at one end, used for digging up tubers and for drilling holes to plant maize.

Metal-pointed dibble (*taka* or *taka hokot*): made of hard wood, with a small iron blade at one end, 50 to 70 cm long. Used for hard and compact soil.

Digging stick (*teeng doling*): made of hard wood, about 2 m long, used for turning the soil (30-40 cm deep), only to be used if soil is slightly moist. This implement has disappeared in Central Sikka since World War II although van den Ende mentions its existence still for parts of Sikka in 1954 (1954:18). It was used preferably on grassy (*urung rii rotang*) level or slightly rolling terrain. Its use was allegedly forbidden on strongly inclined fields because of the hazard of erosion.

Bamboo splinter (*kêke*): halved bamboo sharpened at one end, 15 to 20 cm long, still commonly used for light weeding, for which the farmer has to squat (Plate 21).

Long-handled hoe (*sako*): said to have been introduced before World War II by the Dutch. However, until after the war local *adat* prevented its use because of the hazard of erosion. Encouragement of the hoe by the government met with no success. Today the hoe is the most common agricultural tool used irrespective of topography and soil type - even used on loose *tana wura* (Plate 13).

Various forms of dry-land cultivation are to be found in Sikka at present. These range from different types of slash and burn agriculture (forest *ladang*, bush *ladang* and grass *ladang*) with relatively short rotation cycles to permanent dry-land cultivation.

Until about the turn of this century Sikka's economy was essentially self-sufficient. Shifting cultivation (*ladang*) was the basis of this economy. It is therefore surprising that the Sikkanese do not have a proper equivalent for this type of farming in their language. The general term *hokot uma* (S) (to work a garden) is seldom used and imprecise as it also refers to the cultivation of permanent gardens. Instead of a general term only individual agricultural activities, e.g. tilling with hoes, weeding, etc. are distinguished. *Ladang* cultivation is practised in various forms. Depending on the type of vegetation which has to be cleared, we distinguish forest *ladang* (*uma tuang*), bush *ladang* (*uma utur*) and grass *ladang* (*uma rii rotang*). Since their preparation differs considerably this stage of the cultivation will be described separately, while the subsequent phases from planting to harvesting are described for each crop (maize and dry-land rice).

Preparation of a forest *ladang* (*uma tuang*). This form of a *ladang* - although insignificant today in Central Sikka - must once have been the prevalent form of agriculture. For this the peasant has to clear a piece of forested land which he has selected within the zone assigned for agricultural purposes (*uma tana*) by the *tana puäng* and the council responsible for land issues (*dua moang watu pitu* (S) in Iwanggete). The selection of a particular piece of land which is preceded by a survey (*lako*) by the prospective peasant is not only dependent on physical properties of the site, but to a large extent on dreams (*miping*), cosmological considerations and the outcome of rituals (see Arndt 1932:216ff.). Before the field is actually opened the *tana puäng* is asked to make an offering at the *ai puä* (S) (*ai* = wood; *puä* = to fasten) which is the stump of a tree near the centre of a field (Plate 17). After the ritual (*lobat tubu*) the temporary user makes a present (*wawi peping ara piong*) to the *tana puäng*, as was explained earlier.

With this present the farmer recognizes the usufruct rights he holds concerning the land that belongs to the entire *rechtsgemeenschap*.[45]

Big trees that are cut first (*opi tuang*), as well as bushes and smaller trees (*roa*) are cut up into smaller pieces (*gleting*) and left on the field for drying (*tei*), for only thoroughly dried wood can be burnt (*holo*) (a few trees are spared from the felling such as *Ficus benjamina* and *Canarium commune* (*koja*)). Normally a second burning would be necessary. Wood that is not finally destroyed the first time would be collected at one spot of the field (*pripong nopok klageng*) to which also leaves would be brought (*he roung*) and burnt over again (*holo utung*). Subsequently, anti-erosion devices (*blepeng*) are constructed on the slopes (*hera blepeng*). For this bamboo poles and coconut leaves are put at right angles to the dip of the slope. In order to prevent the bamboo poles from being washed downhill, they are fastened to small sticks dug in the ground (*tokang ai waing*) with fibrous material from coconut leaves (Plate 22).

Before the rainy season begins the field is thoroughly weeded (*dokit*) by means of either a *teeng* or a *taka*. This is done in a squatting position. Forest *ladang* are not tilled. The loose forest soil is found to be highly suitable for straight planting. Rain is eagerly expected (*bui urang*) and after three to four days of consecutive rain dry-land rice and maize are planted (*nona*) by means of a *teeng*.

Preparation of bush and grass *ladang*. Because of land shortage most *ladang* in Central Sikka are made in secondary growth which is usually low bush and grasses. The soil is not as loose as the aforementioned forest soil. Because of the grass the soil has to be tilled (*sako*). While the stages from cutting of small trees to the first burning are similar to those described for the forest *ladang*, more attention has to be paid by the farmer of a bush and particularly grass *ladang* to the elimination of grass. The tussocky grass that escaped the first burning will have to be cut (*tege puang klereng*) and burnt over (*holo hening*) before the soil is tilled. Originally this was done with digging sticks (*teeng doling*). Only after World War II, when *adat* rules were less adhered to, the hoe became the common agricultural tool. Today it has fully replaced the *teeng doling* in Central Sikka (Plate 13).

[45] In order to protect the crops from theft, the farmer erects a sign (*badu* or *tada badu*) made of two bamboo halves which form a cross, at the ends of which coconuts and parts of animals are fastened. I saw signs such as these at the village of Hokor in April 1976. Another type of sign is called *siga*, which are carvings representing evil spirits symbolized by snakes, crocodiles, poisonous fish, or persons. They are believed to punish the trespassers and thieves. A drawing of such a *siga*, probably erroneously called *ai puä*, is given by Jacobsen (1896:54).

Tilling (also called *sako* or *sangko*) is frequently performed in groups (Plate 13). The grass clods are slugged down (*papang*) by means of the *taka* and the roots are separated through shaking (*lajang*). The grass and roots are put on the *blepeng* (*reping*). Before planting young grass shoots and other weeds are pulled by hand (*karit* or *lega waang wong*).

Tilling has to be repeated on all plots irrespective of the original vegetation (forest, bush or grass) in the subsequent two to three years during which a field is under cultivation. Should proper tilling of the entire field not be possible because of a shortage of labour, or because the rains start unexpectedly early the farmers owning fields on level or slightly undulating terrain (e.g. in Nele, Koting, Nita) resort to *magang*. Thereby the soil is tilled only locally where maize or cassava are to be planted. *Magang* is only applied on *tana mita*. On stony ground, for instance south of the village of Hokor, tilling is rendered impossible. Before maize and dry-land rice are planted the weeds have to be pulled by hand (*gemok*) which is particularly time-consuming and requires, at least, 40 man days per hectare. Owing to the lack of tilling the field has to be weeded three times instead of once or twice as is common in most parts of Central Sikka.

Cultivation of maize. Dry upland rice (*pare uma*) and maize (*lelé*) are the main crops. While maize requires less water and hence can be planted during the entire period of cultivation - that is three to four years - and throughout Central Sikka, hill rice is more selective as to water holding capacity of the soil and soil fertility. Hence it cannot be planted on all fields at all times. This aspect will be taken up again later. Because of the long dry season maize is Central Sikka's staple crop. Five to six grains of maize are planted in each hole drilled with planting sticks (*teeng*) and about one to one and a half metres apart from each other. The holes are not closed after planting. After six weeks the field is weeded by means of a hoe (*gajar waang dua gajar waang wong*) (S).[46] Traditionally the farmer spreads the weeded grass, which serves as mulch, evenly over the field (*ajar waang*). For this operation the farmer uses his feet, a practice which has become less common today. After four to five months maize is harvested (*rape lelé*) by hand. The maize cobs (*jagung ontongan*) are stored with the fruit leaves which serve to protect them from mildew. As a protection against mice the large maize cobs are dried (*wori*) and subsequently either stored (*mekot*) in special granaries built on stilts and protected by stone discs or in trees on scaffoldings made of two bamboo poles between which rings of tied-up maize cobs are placed. Ten to 20 rings of maize cobs (*taling*), each consisting of 40 cobs, form one small bamboo

[46]Except on stony ground on which weeding is carried out by hand or with a dibble (*teeng*).

granary (*weking kesik*), while 100 to 200 rings make up a big bamboo granary (*weking getê*). The small maize cobs are peeled in the field.

The Sikkanese distinguish between maize grown during the wet season, called *lelê lêlen*, and that grown during the dry season (i.e. May to September) called *lelê daran*. On freshly opened fields (*uma weru*) only a small portion is planted with maize, mostly near tree stumps called *lelê tubong*. Though it is not quite clear why this location is preferred farmers maintain that the soil is usually moister near tree stumps. The planting of *lelê tubong* and *lelê dolor* which is grown at the periphery of the garden takes place before that of hill rice. Here early varieties are preferred (*lelê ropo*) for rapid yields after the long dry season. On fields which are in use in the second year (*amak weru*) or third year (*amak gung* or *amak rewuk*) maize may, however, be planted on the entire field. Then the maize is called *lelê plalak*. For such a field the Sikkanese use the term *amak plalak* (S).

Cultivation of dry upland rice.[47] Dry upland rice requires more attention than maize. Ten to fifteen rice seeds are planted in a hole by women. The holes are 15 to 20 cm apart. They are drilled (*pahe pare*) by men with a long bamboo (up to 4 m long) which is kept slightly inclined. As it is split at the upper end it generates a sound which serves to encourage the planters. The seed holes are subsequently covered with earth. This is done with the feet (*abo ulun*) or by means of a coconut leaf which is drawn over the field (*ide lepa*). After two weeks when the rice shoots are about 10 to 20 cm (*roung memek*)(S) it is time for the first weeding (*noti gung* or *noti waang dua*) whereby instead of hoes only small dibbles (*teeng kesik*) are used. Frequently the weeds are pulled by hand. A second weeding (*noti wong* or *noti waang nurak*) is carried out 8 to 10 weeks after planting. Sometimes a third weeding follows (*lega waang wong*) whereby only the larger grasses are extracted. Wherever the seed has not germinated, rice seed is resown by broadcasting (*wêhak pare*). No mulching is done on fields planted with hill rice. The grass is simply discarded (*pau waang*). The rice is harvested (*eta*) by hand: each panicle is broken about 15 cm below the top with the fingernail or cut with the help of a split bamboo - e.g. in West Sikka (Lekebai). The

[47]Traditionally agricultural tasks from planting to harvesting were - and to a small extent are still - accompanied by rituals, the most important of which were (see also Mandalangi 1972a):

a. *Song porong*: held on the eve of the day of rice planting.
b. *Pahe nona pare*: offering at the foot of an *ai pua* on three flat stones. Here rice has to be planted first. A soil sample from this spot is taken home (*hokot tana bait*).
c. *Wêhak*: ceremony on the field to scare off pests and diseases.
d. *Poru eta*: harvest ceremony (thanksgiving) whereby rice at *ai pua* is harvested at last.
e. *Togo pare*: threshing ceremony.
f. *Ea lekun saung*: ceremony held when first rice is eaten.

rice panicles are brought to a threshing place, in most cases on the field, occasionally also at home. The rice grains are dislodged from the rice panicles by jumping on the panicles (*togo*). On this occasion a feast is sometimes held and 20 to 30 persons stamp on the rice while dancing (*ri pare*). Following the threshing the rice is winnowed (*tepi* or *taping*) either by means of a fan (*ngiru*) or a tablet. Before it is stored (*nai ei ronang* or *poto mekot*) the rice is dried (*wori*).

A great number of rice varieties is known in Sikka. The most common varieties have been listed in Table 18. It was not, however, possible to ascertain whether some of these varieties were identical and only known under different terms. Traditionally the Sikkanese prefer awnless varieties (*cere*)(I) to those with awns (*bulu*)(I) because of the higher yields. It is only recently that *bulu* varieties became more popular as they were found to be less damaged by birds. Most varieties take 4 to 5 months to mature except for a few fast growing varieties (*pare ropo*), like *seratus malam* (I) and *kortuna* (I). These are grown in areas of water shortage, that is at lower altitudes along the northern flanks of the volcanoes. They are frequently planted on a small portion of the field only, just yielding sufficient rice to last from the time when the farmer's reserves are depleted after the long dry season to the main harvest. Early rice varieties are grown on a small scale only as they yield comparatively little.

Table 18

Rice varieties used in Sikka and their reported length of growing period (months)

Cere varieties (awnless)				*Bulu* varieties (awny)	
Oda	4.5	Pare Heret	4.5	Ndale Bara	3
Lamerea	4	Mita	4.5	Kojawanda	3
Kutea	4	Merang duang	5	Odaledu	4
Sera	3	Merang Biri	5	Odaleko	2.5
Senggo	4	Ropo Rutak	2	Ndale	2
Kea	2.5	Menek	4.5	Ndale Dja	2.5
Asokae	3	Rutun	5	Eko Tepu	2.5
Tukatuna	2.5	Wani	4.5	nDake	5.5
Rebotia	4	Boka	4.5	nDota	4
Reboloo	4	Behar	4.5	Pare Tengah	3
Pare Ae	4	Maros	5	Pare Nida	4
Pare Mengah	5.5	Wair	4	Pare Mbukurawa	4
Tepu	2.5	Rebo	4	Pare Jarang	5
Molio	5.5	Odang	4	Lepu Jarang	5
Kinga	5.5	Odanglite	4	Reget	5
Puhe	5	Toin	4	Iku	4.5
Odanggete	4.5	Koja	4	Jarang Ngiur	4
Kortuna	3	Seratus malam	3		

Cultivation of other crops. Maize and hill rice are never planted in pure stands but in conjection with pulses and tubers. In certain areas - e.g. in the northern littoral plain - green gram (*Phaseolus radiatus*) (*bue*) is grown in rotation with cassava and maize. After or shortly before maize is harvested green gram is planted (*nona bue*) in pure stands as a second crop. After three months the beans are harvested (*pupu bue*) and dried (*wori*) on a rattan mat. The beans are dislodged from the pods by beating (*tutu*) with a stick before they are winnowed (*tepi*) and finally stored. The labour input required for growing one hectare of green gram is given in Table 19. If, as is customary in Sikka, *bue* is planted as a second crop after the harvest of maize, no hoeing and frequently no weeding either is performed, hence only 60 man-days are dispensed for the cultivation of *bue*. Thus it is one of the least labour intensive crops in Sikka (see also ten Dam 1950b:40). The figures of Table 19 are considerably lower than those given by A.J. Koens (cited by Schotanus and Sakiman 1976:54-5) for Java where 182 man-days were calculated for the growing of soybeans (*kedele*).

Table 19

Labour input for growing green gram (*bue*) on a one hectare field

Hoeing	50 man-days
Planting	10 man-days
Weeding (only once)	20 man-days
Harvesting	50 man-days
	130 man-days

Source: Kepala Desa, Ds. Watuliwung, 12 May 1976.

Maize and dry upland rice are also intercropped with ground nuts (*Arachis hypogaea*) (*wewe tana* or *tana uneng*) which are cultivated in Sikka from sealevel up to 600 m (at Koker), cow pea (*Vigna sinensis*) (*wewe*), *Psophocarpus tetragonolobus* (*heo*), cassava (*Manihot utilissima*) (*ai ohu*), yams (*Dioscorea sp.*) (*ohu* and *hura*) (S), sweet potato (*Ipomoea batatas*) (*tuka*) and cereals.[48] Of the

[48]The planting of tubers is particularly common along the south coast (Ds. Hokor, Ds. Wolonwalu, etc.) where they grow particularly well on ash soils (*tana awung*). The growing of tubers also helps the farmer minimize risk as tubers yield in most years. Hunger is therefore seldom encountered. The heavy dependence on tubers along the south coast may be indicative of the comparatively slight impact foreigners had on the population and their diet in this least accessible portion of Central Sikka. Before the arrival of Europeans in Eastern Indonesia tubers rather than maize were the staple crop.

latter sorghum (*Andropogon sorghum/Sorghum vulgare*) (*water* or *gandum*(I)), finger millet (*lelê hoong*(S) or *cantal*(I)), Italian millet (*Setaria italica* or *Setaria viride*) (*wetang*(S) or *jawawut*(I)) are planted widely spaced along the northern littoral plain (Plate 19).

Sikkanese farmers usually own several fields which they keep in different stages of the rotation cycle. Throughout Central Sikka - with the exception of the northern littoral zone - newly opened fields (*uma weru*) are planted with hill rice together with maize, cassava and beans which require fertile soils. On fields that are under cultivation for the second year (*amak weru*) and third or fourth year (*amak gung* or *amak rewuk*) maize and cassava are grown. After three or, at most, four years under continuous cropping the field is abandoned and fallowed for an equal number of years during which it is called *amak loar* or *amak welung*.

Traditionally, Sikkanese farmers were compelled by local *adat* to work a field for at least two and at most three years. In order to increase the restoration of soil fertility they were required to plant legumes and other plants in the third year of cultivation which were left in the field as fallow vegetation. Of particular importance were *luma* (*Sesbania grandiflora*) and *lago* (*Hibiscus tiliaceus*) (Plate 42). Moreover they had to make sure that *rii* grass (*Imperata cylindrica*) did not enter the fallowed plot and thus the area reserved for agricultural purposes (*tana luma lago*) of the *rechtsgemeenschap*. Since World War II, these rules are no longer adhered to. Where fallow vegetation is still strongly controlled in the area, it is less so because of the impact of local *adat* than because of the farmers' individual decisions.

Besides annual crops fruit trees are planted. Depending on whether the trees are planted on a small portion of the field only or over the entire field the Sikkanese speak of *uma ongeng* or *uma kabor gong*. In the latter type of field coconut trees (*kabor*) are grown. If annual crops can no longer be planted because fruit trees and bushes absorb the light on the ground the Sikkanese use the term *ongeng*.

Among the fruit trees the following are particularly common: coconut (*kabor*(S)); candlenut tree (*Aleurites moluccana*) (*gelo*); mangoes (*Mangifera indica*) (pau(S)); pawpaw (*Carica papaya*) (*padu*(S)); lemon tree (*Citrus hystrix*) (*mude*(S)); cashew nut (*Anacardium occidentale*) (*pau parang beda*(S)); breadfruit (*Artocarpus communis*) and jackfruit (*Artocarpus integrifolia*) (*nakat*(S)). More recently introduced were cloves (*Caryophyllus aromaticus*) and cacao (*Theobroma cacao*). Underneath these trees often bananas (*Musa paradisiaca*) (*muu*), yams (*Dioscorea alata*) (*ohu*), *Dioscorea bulbifera* (*bewa*(S)), *Dioscorea hispida* (*pinda*(S)), *Dioscorea aculeata* (*hura*(S)), *Dioscorea pentaphylla* (*kewa hura*(S)) (see Tan 1964a:8); taro (*Colocasia esculenta*) (*wutik*(S)) and sugarcane (*Saccharum officinarum*) are grown.

In permanently cultivated house gardens a number of vegetables, spices, tubers and cereals are planted which are needed for the daily menu. Of these the following deserve to be especially mentioned: red onion (*somu*(S)), white onion (*hunga*(S)), saffron (*Curcuma domestica*) (guni(S)), tomatoes (*dagalais*(S)), red pepper (*Capsicum annuum*) (*korò*(S)), egg fruit (*Solanum melongena*) (*toro*(S)), pumpkins (*Cucurbita* sp.) (*besi*(S)), water melon (*Citrullus vulgaris*) (*dimung*(S)), cucumber (*oto*(S)), pineapple (*pedang*(S)), yambean (*Pachyrhizus angulatus*) (*tuka timu*(S)), cotton (*Gossypium* sp.) (*kapas*(S and I)), Chinese spinach (*arung*(S)), sesame (*Sesamum indicum*), sweet potatoes (*Ipomoea batatas*) (*tuka*(S)), ginger (*lea*(S)).

Fencing. In contrast to Sumba and Timor, no fences are erected in Central Sikka as there is little livestock. If occasionally livestock still threaten the crops, it is kept at bay by consensus of all peasants of a certain area, for instance at Watublapi (Ds. Kajowair) since 1964. Enclosures are widespread. They are made of bamboo or other locally available wood. Formerly, land owned by several clans was worked communally by 10 to 30 peasants. Two of these so-called *medang* which were explained earlier have survived until the present day at Ds. Aibura and Ds. Nitakloang (see Fig. 47, p.226). Each participant cultivates the section assigned to him by the *tana puäng* individually. Sometimes these fields were surrounded by a fence (*niha seng*) built jointly by the group as protection against deer and monkeys.

Spreading of risk is one of the main characteristics of Sikkanese agriculture. To this end, as we have seen, interculture of several crops with different moisture requirements and the maintenance of fields in various stages in the rotation cycle are common. In addition, plots are scattered and located in different altitudinal zones. The Sikkanese speak of *uma reta iling* when fields are located in the hills and *uma lau detung* when fields are found at lower elevations.

The degree of fragmentation of plots under cultivation in 19 desa where interviews were carried out (50 farmers per desa) is shown on Table 20. No conclusive explanation can be provided for the regional differentiation of holdings. These figures are considerably below those given by ten Dam (1950b:38) for Nita in 1950 when he calculated an average of three plots per household (*rumah tangga*). Only in Ds. Nele Lorang and Ds. Nele Wutung do my figures somewhat correspond to his.[49] Lack of privately 'owned' fields does, however, not preclude access to land. Thus farmers may cultivate fields which do not belong to them. These are either pledged (*sadang*) to them by someone else or they may freely use them with the approval of their kinsmen.

[49]For the sake of comparison it has to be borne in mind, however, that a household may comprise more than one farmer.

Table 20

Farmers according to number of plots under cultivation

Desa	1 plot	2 plots	3 plots	4 plots or more
Koting B	41	9	-	-
Hokor	39	11	-	-
Wolonwalu	44	6	-	-
Iligai	39	9	-	2
Watumilok	36	11	2	1
Ipir	43	7	-	-
Nele Wutung	19	27	3	1
Kokowahor	28	17	5	-
Namangkewa	36	8	5	1
Mekendetung	37	10	3	-
Kajowair	37	13	-	-
Rubit	44	6	-	-
Watuliwung	35	9	6	-
Umauta	34	16	-	-
Nele Lorang	15	13	16	6
Bola	38	12	-	-
Aibura	46	4	-	-
Wolomotong	41	9	-	-

A clearer pattern emerges if we analyse the size of the fields under cultivation. The average area cultivated per farmer has been plotted on Fig. 34 for the 19 desa included in our detailed survey. In accordance with Sikkanese usage which ignores square measures, bulk measures were employed to calculate the size of the fields. In one *blek* (a 10 litre oil can) 12 kg of unhulled dry-land rice (*padi*) seed may be kept, with which a quarter of a hectare can be planted. Hence 4 *blek* equal 1 hectare. The smallest fields under cultivation of less than 0.5 ha (2 *blek*) are found along the south coast, Ds. Koting B (saddle of Nita) and the eastern margin of Central Sikka (Ds. Aibura, Ds. Rubit, Ds. Wolomotong) and on the saddle of Blatatating (Ds. Mekendetung). The largest fields under cultivation of over 0.5 ha are found along the north coast (Ds. Watumilok, Ds. Watuliwung, Ds. Namangkewa, Ds. Kokowahor) as well as in Ds. Kajowair, Ds. Nele Wutung and Ds. Nele Lorang.

These data show a correlation with neither population density nor physical resources. What these data reflect to some degree are tenurial conditions, as will be demonstrated in Chapter 3. As human energy - and hence the capacity for weeding - limits the area under cultivation the average area a family could work is roughly 0.5 ha (see also Tan 1964a:15). This size cannot even be increased through mutual assistance. Only along the north coast

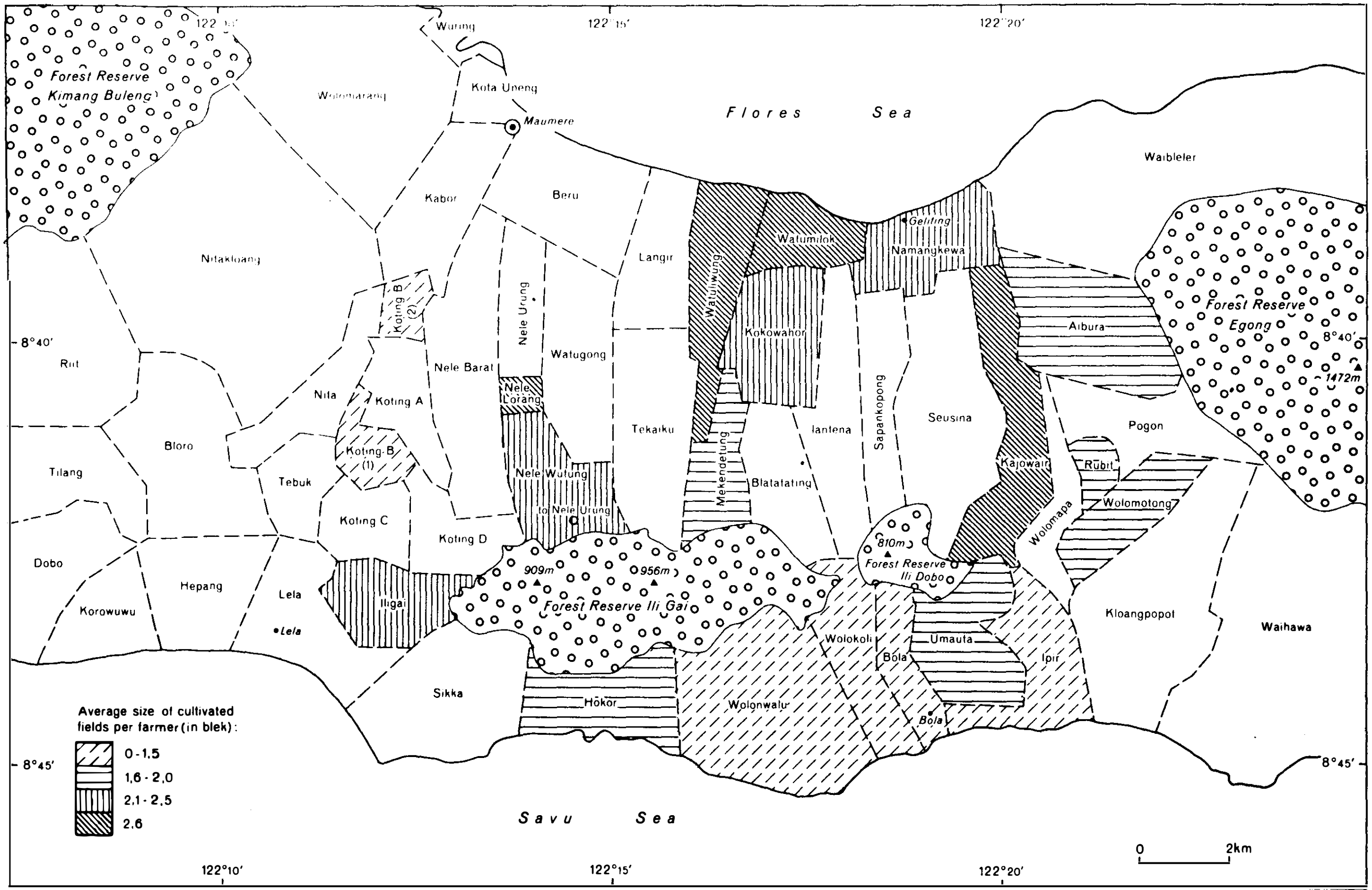

Fig.34 Central Sikka: average size of cultivated area per farmer

where paid labour is recruited or share-croppers are employed does the average size exceed this limit. In Ds. Nele Wutung and Ds. Iligai also the average area under cultivation per farmer exceeds 0.5 ha. The reason for this is that many farmers of these mountain desa maintain fields outside their home desa. Hence farmers from Ds. Nele Wutung work fields in Ds. Nele Urung and Ds. Beru - that is in the northern littoral plain - while farmers from Ds. Iligai cultivate fields in Ds. Koruwuwu, an alluvial plain at the south coast.

It has to be emphasized that despite different environmental conditions rotation cycles differ only slightly in most of Central Sikka. Excepted from this statement are, of course, those parts of the northern littoral plain which are worked permanently. Three years under cultivation and an equal number of fallow years seem to be common practice. Only at the eastern and western margin of the study area (i.e. Ds. Nitakloang, Ds. Pogon, Ds. Wolomotong) adjacent to forests, longer fallow periods (of five to six years) are common.[50]

Yields. Agricultural yields differ widely in accordance with physical conditions and time and skill invested by the farmer in the growing of crops. Some of the relationships have been analysed in detail and will be dealt with in Chapter 3. Without anticipating the results of our detailed economic analysis it seems useful at this stage to convey at least an approximate idea of average agricultural yields (per ha) on *ladang* in Central Sikka (Table 21).[51]

Assuming the entire harvest would be sold (which is highly unlikely) and assuming an average price of Rp. 55/kg (1976) for maize and Rp. 80/kg for dry-land rice, the maize farmer would get Rp. 41,250/ha against Rp. 64,000/ha which the dry-land rice cultivator would get. Under coconut trees returns would be (in Ds. Koting B) Rp. 20,900 for maize and Rp. 24,000 for dry-land rice. The lower yields and returns derived from a potential sale of annual crops grown underneath coconut trees would, however, be somewhat compensated by the sale of copra. Assuming an average production of 500 kg of copra/ha the minimum price of copra would have to be Rp. 41/kg in order to give the *uma kabor gong* farmer the same income as a *ladang* farmer without coconut trees gets. Yet the actual price for copra was only Rp. 25/kg in Maumere in September/October 1975 (see Table 28).

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[50]According to farmers of densely populated Ds. Hewotkloang rotation cycles have been considerably reduced since the 1950s. In 1955 2-3 years under cultivation were followed by 8-10 years under fallow as against 3-4 years under cultivation and 4 years at most under fallow today.

[51]In the course of the cultivation cycle yields may suffer decrease of over 50 per cent from *uma weru* to *amak weru*.

Table 21

Average yields (ton/ha) on *ladang* in Central Sikka if planted exclusively with one annual crop

A. *Ladang* without fruit trees

Maize	0.75[a]	0.9[b]	
Dry-land rice	0.80[a]	1.3[b]	
Cassava	2.70[a]		
Green gram	1.20[a] (?)	0.6[b]	0.5[c]
Sweet potatoes	1.00[a]		
Peanuts		0.8[b]	

Source: a Parera (1971:81).
b Data from Dinas Pertanian, Kab. Sikka (archives).
c Average yield reported by Kepala Desa, Ds. Watuliwung.

B. *Ladang* underneath coconut trees

	Ds. Nele Lorang	Ds. Koting B	Ds. Koting C
Maize	0.56	0.38	0.49
Dry-land rice	0.40	0.30	0.30
Cassava	0.80	0.80	0.61
Green gram	0.17	0.20	-

Source: Fakultas Pertanian, IPB (1975:1-11).

The average returns per man-day for maize, dry-land rice and green gram are shown on Table 22. The table shows that if no account is taken of factors other than labour, the average practice secured a reward of 6.25 kg of green gram per man-day[52] as against 1.82 kg and 1.83 kg for dry-land rice and maize. The value of 1.83 kg/man-day for maize may be too low as the weeding of such fields is performed with hoes. This requires less labour than *noti* which is common for dry-land rice and for which the *taka* or *teeng* are used. Yet even allowing for this modification the relationships between the three crops would not be substantially altered. It is therefore surprising that the Sikkanese do not grow green gram on a wider scale than is found in Central Sikka at present. There seem to be several reasons for this: for one thing, green gram does not seem to yield well in the mountainous parts of Central Sikka above 400 m. Also, the exclusive cultivation

[52] Worth: 6.25 kg x Rp. 100/kg = Rp. 625 if sold to a Chinese merchant in 1976 or Rp. 937 in 1977. Under conditions of permanent cultivation as typical for the northern littoral zone and on the basis of average yield figures from Table 21 the farmer of this zone would derive an income of Rp. 91,250 from a one-hectare field (prices: 1 kg/maize Rp. 55; 1 kg green gram Rp. 100).

of green gram would not fit in with the Sikkanese concept of risk minimization, for maize and dry-land rice, which are staples in the people's diet, would have to be imported. Such a dependence on the whims of the market would not be acceptable to the Sikkanese peasants at present. Moreover, it can be assumed that there is no uniformity in the economic behaviour and farming ability of individual families or entire regions. Chapter 3 gives a detailed analysis of the use of labour and variations in farming ability and productivity.

Table 22

Average returns of maize, dry-land rice and green gram per man-day

	Average yield kg per ha[a]	Average number of man-days per ha	Average returns kg per man-day
Maize	750	409[b]	1.83
Dry-land rice	800	439[b]	1.82
Green gram	500	80[a]	6.25

a From Table 21; lowest figures taken as a basis.
b The calculation of the average labour input for a *ladang* was based on data from ten Dam (1950b:36-8). As he did not differentiate between the cultivation of maize and dry-land rice, we assumed both crops to require the same amount of labour input from the time of preparing a field until harvesting, which ten Dam did not consider. Up to that stage, ten Dam arrived at an average labour input of 399 man-days per ha to which has been added the labour for harvesting of 10 man-days for maize and 40 man-days for dry-land rice (per ha). Attention is, however, drawn to the fact that ten Dam (1950b:24) uses the term *kesatuan tenaga pekerja* (KTP:'labour unit'), whereby an able-bodied man is counted as 1 KTP, a woman 0.5 KTP and a child 0.25 KTP.

Organization of labour. Since traditionally a large part of agricultural activities relating to Sikkanese subsistence agriculture imply co-operation between several persons, it seems necessary to outline the main features of the following types of co-operative work: *hokot seng*, *leta' jung golot*, *woter hokot seng*, *ua têpo*, *kongsi* or *hokot lelêng*.

Hokot seng: This is the most common type of group labour whereby the members of the group (men and women) give mutual assistance for specific agricultural operations, for instance for the preparation of fields for tilling (Plate 18). If hoes are used one may also speak of *sako seng*. *Hokot seng* is not applied to weeding or planting as these types of work ask for precision. The provision of a meal by the owner of the field is subject to prior agreement of all group members but the tendency is for everybody to bring his own food along. In the mountainous parts where traditional *adat* and hence also prestige-thinking are still quite strong group work is more costly than in the littoral zone. Depending on the size of his field and the number of helpers the owner of a field feels obliged by tradition to provide an elaborate meal consisting of pork, dog meat, which is considered a delicacy, chicken, etc.

Each member is entitled to a day's work by the labour group. Should a field require two days of tilling, two members of the family owning the field have to join the group which is dissolved only after all fields of its members are finished. Thus *hokot seng* is of temporary character. In the next season a new group with different persons may be formed. It may take weeks for the group to reach the field of a particular member, sometimes too late for working the garden. Thus quite often only one member of a family is sent to join the group in order to give the family a claim on the group's labour contribution. All other family members keep working the family's field until the group arrives. In order to avoid long waiting periods the size of the group is generally limited to twenty persons.

Hokot seng is preferably done for rough work - like hoeing - and on large fields which need to be finished in a short time. Members of a *hokot seng* group work in a row starting at the bottom of a slope. Their work is accompanied by songs. As frequently food is not provided by the owner of a field, *hokot seng* is done while there is still sufficient food - i.e. September to December. Should a person not be able to fulfill his obligations in the labour group he is required to send someone else of his family as a substitute. Instead of a substitute money may also be given for which paid labour is recruited (ten Dam 1950b:31). From an economic point of view group labour - especially *hokot seng* - is not very efficient. For instance, if a field is worked in half a day there is often no incentive to continue working another. On the other hand social interactions involved in *hokot seng* are probably regarded as equally important as the aspect of production.

Letã: In contrast to *hokot seng*, *letã* does not imply reciprocity. Instead, the owner of a field who asks for help has to provide three meals a day. There is no obligation, however, for the owner of a field to participate actively in the group labour. This form of combined work is very costly and is therefore only practised by wealthier farmers. Nowadays this form is very rarely met with. As one does not have to be a member of a labour group, one may contract the group quickly should the necessity arise after unexpected rainfall. Formerly *letã* was preferably done for work requiring special care - e.g. planting or harvesting. Nowadays it may also be used for tilling the soil (da Cunha 1974:44). Less time is wasted than with *hokot seng*. The persons who join a *letã* group are attracted by the food given to them instead of money. *Letã* is thus done during the period November/December to March/

April when food is in short supply. The costs of *letâ* for the owner of a field are enormous as is shown below and three to four times higher than *hokot seng* or *woter hokot seng*. It is for this reason that *letâ* has largely been replaced by other forms of group labour of either *hokot seng*, *woter hokot seng* or *ua tepo*.

Jung golot(S): This type of group labour is common for community work - for instance for the construction of a village road. No food is provided to the workers.

Woter hokot seng: This is a relatively new form of group labour (*borongan*(I)) encountered on the north coast of Central Sikka. Groups of 20 to 30 persons, usually from one village in the mountains, try to earn some money (in addition to the sale of some produce from their own gardens and fields) by offering their labour for certain agricultural operations. Rp. 5000-6000 per hectare are required by a group of 25 persons - i.e. Rp. 200-250 per person. At times such groups are formed by a number of farmers who intend to work for a common goal. To this end the money is held by the group (*kas umum*(I)).

Ua têpo: Voluntary group labour provided chiefly by relatives for agricultural purposes - chiefly for planting. In return the helpers are entitled to an unspecified portion of the harvest (*tuka puäng lelê malor*). Their portion of the field, called *wini toin*(S) (lit.: small seed) is delimited by bamboo poles, while the major portion is reserved to the owner of the field (*wini gete*) (lit.: big seed). Today *ua têpo* is less frequent and helpers are said to have a greater say as regards the allotment of their share of the fields. Instead of *wini toin* the helpers may be given the opportunity to gather some large maize cobs (*lelê klaing*) or some particularly good rice (*pare klaing*) which they use for seed.

Kongsi or *hokot lêleng*: If the number of active workers in the family is too small in relation to the number of consumers, a farmer may work his garden jointly with another farmer who is in a similar position. Such joint ventures seldom comprise more than two farmers. The yield is evenly divided. This form of co-operation is rare.

In Table 23 an attempt was made at gaining an idea of the degree to which the three main forms of group labour - *hokot seng*, *letâ* and *woter* - are practised in Sikka. Too little is known of social relations which are paramount in the context of labour groups. For the purpose of the present study it suffices to say:

1. *Hokot seng* is the dominant form of co-operative work in desa of the north coast (except Ds. Namangkewa) and at the saddle of Nita and Blatatating (Watuliwung, Kokowahor, Nele Wutung, Nele Lorang, Iligai, Watumilok, Mekendetung, Koting B, Wolomotong, Aibura) - i.e. in desa which are considered to be more commercialized.

Table 23

Group labour in 19 desa of Central Sikka

Farmers owning fields and residents of desa	Total number of fields under cultivation	Fields worked under any form of group labour		Number of fields worked		
		number	% of total fields	*hokot seng*	*woter*	*letá*
Wolomotong	56	19	33	12	3	4
Watuliwung	71	48	67	44	2	2
Wolokoli	26	2	7	-	-	2
Kokowahor	77	34	44	32	2	-
Nele Wutung	88	48	54	47	1	-
Nele Lorang	114	37	32	37	-	-
Iligai	65	28	43	21	5	2
Namangkewa	67	40	59	10	29	1
Wolonwalu	56	16	27	6	2	8
Watumilok	66	50	75	40	10	-
Mekendetung	71	37	52	27	8	2
Koting B	58	22	37	20	2	-
Rubit	57	12	21	1	4	7
Bola	62	6	9	4	-	2
Kajowair	63	17	26	5	1	11
Aibura	54	19	35	12	4	3
Ipir	56	8	14	1	4	3
Umauta	67	19	28	3	3	13
Hokor	61	7	11	5	1	1

2. *Letá* is far less common and practised as the prevalent form of group labour only in the following desa: Wolonwalu, Rubit, Kajowair, Umauta. No explanation could be found of why this type of co-operative work is particularly strong in the desa of the saddle of Baomekot and in remote Ds. Wolonwalu. It seems likely however that prestige-thinking must be quite strong in these desa.

3. Paid labour (*woter*) is relatively new but becoming increasingly popular. It is found where kinship ties and *adat* obligations of mutual help are becoming weak. Thus it is the prevailing form of group labour in Ds. Namangkewa where a non-Sikkanese population from south Sulawesi owns most of the land and hence has to recruit labour for money.

4. If all three forms of group labour are considered together, they are least resorted to (i.e. employed on 30 per cent or less of all fields) in those desa along the south coast (Wolokoli, Wolonwalu, Bola, Ipir, Hokor, Umauta) and the saddle of Baomekot (Rubit, Kajowair). For this phenomenon no adequate explanation can as yet be provided. Group labour is more common in desa along the north coast and the saddles of Baomekot and Nita.

From the questionnaire an approximate idea has been obtained as regards the cost of communal labour. *Hokot seng* seems to be the least expensive form of group labour for which the owner of a field has to spend Rp. 100-150 a day per helper. Although normally food is brought along by each helper, the owner of the field provides additional food and *tua*. Between Rp. 150 and Rp. 200 a day is normally to be paid per person in the case of *woter*, but may reach Rp. 250 in exceptional cases. By far the most expensive form of group labour is *letá* for which the owner of a field has to spend at least Rp. 450 for food per helper. Table 24 serves to demonstrate the financial burden incurred through *letá* in Ds. Kajowair.

The total cost of Rp. 65,250 corresponds to Rp. 691 per helper per day for which 5.5 kg of rice (*beras*(I)) could be bought in Maumere in 1976. Although this figure may be somewhat at the upper end of the scale, it is obvious that a *letá* worker is three to four times more expensive than a labourer contracted *woter*. For 1948-49 ten Dam (1950b:33) arrived at an average cost of a *letá* worker of Rp. 3.20 per day in Nita with which 2.1 kg of rice could be bought on the market at that time. A comparison of ten Dam's and our figures reveals that *letá* has become considerably more expensive since 1948-49.

Our example from Ds. Kajowair also shows that cost for contracted labour alone outweigh returns. This seems to be quite often the case with fields worked *letá*. Although Sikkanese farmers seem to be well aware of the financial burden, the gain in prestige seems, in their minds, to outweigh the costs. These have to be met through other sources. Thus *letá* is usually not repeated every

Table 24

Costs and returns of a garden worked *letá* (example)

Location of the field:	Buret (near Watublapi) (Ds. Kajowair), elevation about 380 m		
Size of the field:	0.75 ha		
Number of participants invited for *letá*:	35 for preparing the field (i.e. before planting in September 1975); 55 for weeding (October 1975)		
Total costs for feeding the helpers:	4 small pigs each Rp.7000	=	Rp.28,000
	2 dogs each Rp.1500	=	Rp. 3,000
	10 *beser* (= 7 kg) maize each Rp.750	=	Rp. 7,500
	10 *blek* (= 16 kg) hulled rice (*beras*) each kg Rp.125	=	Rp.20,000
	Approx. 45 bottles of *tua* each Rp.150	=	Rp. 6,750
Total cost:			Rp.65,250
Yields (tubers and pulses not included):			
	50 *blek* padi = 12 kg (1 *blek* padi = 8 kg hulled rice a kilo of which sells at Rp.125	=	Rp.50,000
	10 *beser* (@ 7 kg) maize at Rp.750/*beser*	=	Rp. 7.500
Total returns:			Rp.57,500

year by the same farmer. The fact, however, that *letá* is less frequently practised in Sikka today points to an increasing economic awareness of the population. In this the non-indigenous coastal dwellers from south Sulawesi seem to have reached a more advanced stage. Mainly *woter* groups or share-croppers (*maa ihing*) are contracted on their fields, while in Ds. Watumilok farmers have reached a consensus that if *hokot seng* is contracted the owner of a field pays Rp. 350 to the *kas desa*(I) (village treasury) instead of providing additional food and beverages to the helpers. The money is allotted as follows:

Rp.50 - *Kas Gabungan Kontas*(I) (Rosary community group)
Rp.150 - LSD - *Lembaga sosial desa*(I) (community centre)
Rp.150 - Contribution for local school.

Commercial agriculture

Most Sikkanese, though basically subsistence farmers, supplement their production by growing cash crops.[53] Thus essentials of life are still mainly produced by the group that consumes them but supplementary production is undertaken in order to secure access to market goods and services not obtainable directly from the group's own resources. Following the terminology of Fisk (1970) this stage of participation in the monetized economy would be characterized by 'subsistence with supplementary cash production'. A more advanced stage of market-orientation is found with a few farmers in the Nita saddle, and more recently also with those in the saddle of Baomekot who are primarily cash oriented with supplementary subsistence.

The degree of commercialization of the 19 desa in which interviews were held may be roughly gauged from Table 26. The highest number of cultivators owning fruit trees - mostly coconut and to a far lesser extent also cacao, coffee and cloves - is found in Ds. Nele Lorang, Ds. Iligai, Ds. Koting B (i.e. in the saddle of Nita); in Ds. Rubit, Ds. Kajowair (i.e. saddle of Baomekot), as well as Ds. Namangkewa. Lowest percentages were found in the following desa: Wolokoli, Bola, Ipir, Wolonwalu, Wolomotong (southern flanks) and Watumilok. This picture is largely confirmed if we regard the hectarage under tree crops. Highest hectarages are found in Ds. Iligai, Ds. Namangkewa, Ds. Koting B, Ds. Watuliwung, Ds. Kajowair, Ds. Rubit, Ds. Nele Lorang, Ds. Nele Wutung (i.e. saddles of Nita and Baomekot and some desa along the northern littoral zone). Lowest hectarages are encountered in the following desa: Wolonwalu, Ipir, Bola, Umauta, Wolokoli, Watumilok, Hokor (i.e. desa of the southern flanks). Moreover, coconuts are essentially produced for home consumption in the desa of the southern flank. *Ongeng* cultivation seems to be typical for desa of the saddle of Baomekot (Ds. Rubit, Ds. Kajowair, Ds. Wolomotong). The two types of land use -

Table 25

Large livestock in Sikka

Year	Cattle	Buffaloes	Horses	Source
1916	100	39	548	Hens (1916II)
1924	46	126	1550	Couvreur (1924)
1932	107	295	3584	Bosselaar (1932:2)
1940	?	304	2705	Rusconi (1940a:40)
1950	490	409	2749	Setyoso (1951:12)
1973	421	168	7060[a]	Inspektorat Dinas Peternakan NTT (1975)

a Of this number only 40 per cent are found in Central Sikka.

[53]Livestock keeping (Table 25) is of minor importance in Sikka - particularly in densely populated Central Sikka. Thus problems associated with big livestock as encountered on Timor and Sumba (see Ormeling 1955, Metzner 1976a) are hardly known in this part of Flores.

Table 26

Perennial crops in 19 desa of Central Sikka

Desa	Farmers owning fruit trees		Perennial crops				Perennial crops per farmer (ha)	
	Number of farmers	% total farmers per desa	*uma kabor gong*		*ongeng*		*uma kabor gong*	*ongeng*
			blek	ha	*blek*	ha		
Makendetung	32	64	46.50	11.60	-	-	0.36	-
Wolomotong	25	50	-	-	78.50	19.60	-	0.78
Aibura	30	60	50.75	12.68	13.50	3.37	0.46	0.67
Nele Wutung	32	64	78.75	19.68	-	-	0.62	-
Wolonwalu	28	56	23.75	5.93	-	-	0.21	-
Ipir	28	56	35.00	8.75	8.50	2.12	0.35	(0.53)
Bola	24	48	24.00	6.00	-	-	0.12	-
Kokowahor	22	44	35.50	8.87	(3.00)	(0.75)	0.42	-
Iligai	42	84	150.50	37.62	6.50	1.62	0.91	0.54
Nele Lorang	45	90	104.75	26.18	2.50	0.62	0.58	0.62
Rubit	40	80	29.00	7.25	122.75	30.68	0.55	0.95
Namangkewa	38	76	103.25	25.81	16.50	4.12	0.78	0.58
Kajowair	38	76	13.50	3.37	98.50	24.62	0.56	0.68
Watuliwung	14	28	17.00	4.25	-	-	0.53	-
			18.00[a]	4.50[a]			0.70	
Koting B	48	96	101.50	25.30	-	-	0.52	-
Umauta	31	62	17.75	4.43	18.50	4.62	0.26	0.30
Wolokoli	9	18	6.25	1.56	0.25	0.06	0.19	0.06
Watumilok	8	16	9.00	2.25	-	-	0.28	-
Hokor	31	62	34.25	8.56	15.25	3.81	0.38	0.31

a *uma koli gong* = field underneath *koli* palms

Note: Figures in brackets are not considered representative as only a very small number of the cultivators interviewed maintain these *ongeng*.

i.e. bush fallow food cropping and tree cropping chiefly for commercial purposes - are increasingly being combined on the same site. Results are, however, often not satisfactory, as is the case particularly with coconut.

While *asam* (*Tamarindus indica*) and *ġelo* (*Aleurites moluccana*) were reported to have been exchanged by the indigenous population for cloth, *parang* (a sort of machete), elephant tusks, porcelain, gold and copper brought to Flores by Buginese merchants (Veth 1855: 164), in Sikka large-scale cash cropping did not begin until 1910. In that year the head tax was introduced (Rp. 2 person) which forced the male population to become more money-conscious. Cash cropping by the indigenous population is based almost entirely on tree crops, with some green gram (*kacang ijo*(I)) (*Phaseolus radiatus*), maize, cassava and palm juice (*tua*) from the *koli* palm (*Borassus flabellifer*) sold if production exceeds subsistence needs. Of these cash crops we shall treat in more detail only those which had a major impact in Central Sikka - i.e. copra, cocoa, cloves and cotton.

Copra. Copra (*kabor*) is the principal cash crop for most farmers of Central Sikka. Sikka is the main producer of copra in the province of Nusa Tenggara Timur (NTT) (about one-third of total production 1975). Already in 1911 copra was Sikka's most important export item (Flores Memorie 1912:123). A number of coconut trees existed in Sikka long before the Dutch expanded their administration into the interior of Flores at the turn of this century. As reflected in copra exports which in 1911 yielded f 184,520 (see Table 27) large-scale coconut growing by the indigenous population was, however, encouraged by the colonial administration (*Binnenlandse Bestuur*) in the second and third decade of this century. With the aim of enlarging the area under coconut each farmer was required to plant at least 50 coconut trees (ten Dam 1950b:23). As a result of this policy copra production soared as is reflected in the copra export figures between 1911 and 1971 which reached a record level of about 12,000 tons in 1964 (Table 27).

This copra boom was accompanied by a number of side effects which, as it seems, had not been foreseen and which heavily contributed to the demographic congestion of Central Sikka. As coconuts were planted throughout Central Sikka's upland (above 100 m), hence the area with high population densities, the area available for the cultivation of subsistence crops was rapidly reduced.[54]

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[54]Sikka was considered by van den Ende (1954:32) to be the chief copra producing area of the isle of Flores. Yet her 300,000 coconut trees (as of 1940) were and to some extent still are in a poor state. In 1940 an effort was made at rejuvenating coconut trees. A trial planting was established at Bebeng (west of Maumere) with high-yielding trees from the Mission plantation of Nangahale (1483 ha) (Rusconi 1940a:18).

Table 27

Copra exports from Sikka

Year	Quantity (tons)		Value (f = Guilders; Rp = Rupiah)
1911	*ca* 1,008,000		f 184,520
1926	1,993,000		f 540,000
1929			f 643,733
1930			f 569,729
1931			f 331,454
1932			f 174,686
1933			f 185,513
1934			f 104,804
1937	3,116,984		
1938	2,935,822		
1939	2,862,114		
1940	2,094,433		
1947	1,952,240		f 83,173
1948	4,031,780		f 538,671
1949	3,816,429		
1951	9,719,977		
1952	6,538,000		
1953	6,976,000		
1954	6,968,346		
1955	6,067,385		
1956			
1957		(6,110,508)	
1958	4,297,162	(4,911,749)	
1959		(6,146,430)	
1960	6,116,189	(5,451,309)	
1961	5,301,524	(6,339,408)	
1962		(2,430,956)	
1964	*ca* 12,000,000		
1967	5,968,094		
1968	3,302,100	(4,102,180)	
1969	3,418,729	(1,834,750)	
1970	1,251,000	(605,003)	
1971	774,233	(2,215,591)	
1972	4,458,540		
1972-73	1,314,672		Rp 19,265,190
1973-74	1,326,064		Rp 23,012,312

Sources: 1911: Flores Memorie (1912:123); 1926: Schultz (1927: bijl.III); 1929: van den Ende (1954:32); 1930-34: Simons (1936:20); 1937-40(Oct.): Rusconi (1940a:21); 1947-49: DPS annual reports, 1947-49; 1951-52: DPRDF (1952:Daftar II); 1953-54; Sastrodihardjo (1956; Lamp. App. IX); 1957-62*:Moeljadi (1963:21; App. 9); 1958: DPRDF, (1958); 1960-61: DPRNTT (1961: App. IV); 1964: da Cunha (1974:54); 1967: Say 1968a:12; 1968-71: da Cunha (1974:56) (figures in brackets represent inter-island exports); 1972: Say (1973:85c); 1973-74: Say (1974:1).

* Figures in brackets represent inter-island exports

Since the trees were too narrowly spaced, their shade impeded the growth of *ladang* crops cultivated underneath. Concomitantly, due to a shortening of rotation cycles, the erosion hazard was increased on those plots on which exclusively food crops were grown. In the absence of effective anti-erosion measures and induced fallow, vegetation yields began to fall. Rusconi (1940a:18ff. and 35) also reports that in parts of Central Sikka the cultivation of subsistence crops was neglected because of the temporarily favourable copra prices.

As a result of forced coconut cultivation the mobility of Sikkanese farmers seriously decreased. For fear of theft of and damage to coconut trees farmers as a rule do not live far from their fruit trees. This is believed to be one of the major reasons why farmers of Central Sikka only very reluctantly leave their congested home desa in search for land away from their homestead. Migration - either permanent or seasonal - has thus to be considered a rather recent phenomenon, as will be shown early in Chapter 3.

The copra boom also had an impact on the tenurial system of land. In order to comply with the administration's order of planting at least 50 coconut trees per farmer, Sikkanese peasants planted these trees frequently on land that belonged to other than their own clans (*tana gung*). Since the owner of coconut trees and those of the land were not identical soil improving measures were not applied. The owner of the trees paid a rent (*kewe*) to the owner of the field. Following a verdict by the local jurisdiction the *kewe* payments became illegal (ten Dam 1950b:53).

With the shift towards commercial cultivation of coconuts the dependence of local farmers on the fluctuations of world prices for copra had grown (Table 28).[55] The substitution of cash crops for subsistence food cropping had disastrous consequences in times of low copra prices - for example during the economic depression after 1930. Farmers neither produced enough food crops to maintain themselves, nor could they, with falling incomes from cash crops, make up for this shortage by additional purchases of food (maize and rice). Moreover, small-scale farmers often pledged *(sadang)* their coconut trees on conditions that prevented their return to the owner. Thereby the pledge taker lent either money, a horse or

[55]For instance in 1940, at the beginning of the war, copra prices fell owing to lack of shipping facilities, so that Sikkanese cultivators found it difficult to pay their taxes (see Overzicht van het Landbouw 1940:3). Many of them went to thinly populated eastern Sikka, to Wodong and Tanahai where they grew food crops which had high prices at the market. Short-term price fluctuations were also due to the availability of shipping facilities. In 1975 copra prices had reached an all-time low which did not induce farmers in Sikka to invest much time in the cultivation of coconuts.

Table 28

Price fluctuation for copra per 100 kg (= 1 quintal) at Maumere

Year			Price range
1937		f	7.25 to 4.10
1938		f	4.25 to 2.25
1939		f	3.85 to 1.85
1940		f	0.90
1947	1st quality	f	15.00 to 27.50
	2nd quality	f	10.00 to 25.00
1948		f	28.00 to 53.00
1949		f	27.00 to 48.00
1950		f	50.00 to 145.00
1951		Rp	75.00 to 125.00
1952			
1953		Rp	92.50 to 135.00
1954			
1955		Rp	100.00 to 110.00
1956			
1958		Rp	200.00 to 250.00
1960		Rp	215.00
1961		Rp	200.00 to 300.00
1963		Rp	300.00
1969		Rp	3,500.00
1971		Rp	3,500.00 to 5,150.00
1972		Rp	20,000.00
1973 (April)		Rp	15,000.00
1974		Rp	12,500.00
1975 (Sept.)		Rp	2,500.00 to 3,000.00

Note: In order to convey an approximate idea of the value of the Rupiah (Rp), the exchange rates based on one German Mark are given for the period 1952-75 (the author gratefully acknowledges the help provided by Holk Dengel, Heidelberg, in compiling the exchange rates): 1952-53: 1:4 (DM 1 = Rp 4); 1954: 1:5-6; 1955: 1:7-10; 1956: 1:15-16; 1957: 1:15-18; 1958: 1:20; 1959-60: 1:25-30; 1961: 1:30-40; 1962: 1:65-225; 1963: 1:270-310 (May); 1969: 1:120; 1975: 1:150.

Sources: 1937-40: Rusconi (1940a:21); 1947-63: DPS (1947-63); 1969: Say (1974:162); 1971: Parera (1971:Lamp.XX); 1972: Say (1974:162); 1973 and 1975: V. Parera, pers. comm.; 1974: Say (1974:162).

food to the pledge giver in exchange for the pledge - that is the coconut trees which the pledge taker could harvest as long as the debt was not repaid. Repayment was rendered very difficult if not made impossible as the debt was doubled every year.[56] As the trees were registered under the owner's name, he had to continue paying taxes while the trees were used by someone else (Rusconi 1940a:20).

Although the shade of the coconut trees impinges upon the cultivation of subsistence crops (average yields: maize 450 kg/ha; dryland rice: 300 kg/ha - see Fakultas Pertanian, IPB 1975:1-11), farmers of the saddle region of Nita frequently intercrop coconuts with maize and hill rice. The growth of the latter crops is not only impeded by the shade but also by falling coconut leaves. Cassava is seldom grown in these locations. On the other hand, *ladang* cultivation is said to affect the growth of the palms (ten Dam 1950b:53). Moreover, fire used to clear the land after years of fallow may harm the trees. Such incidents are likely to lead to conflicts with the owner of the trees when they are not identical with those of the crops underneath. Young coconut plants may be affected also by horses, pigs, and goats - in the absence of pastures livestock frequently grazes underneath coconut trees. Since secondary growth (*belukar*(I)) is regularly eaten by the livestock, the fertilizing effect of the fallow vegetations is reduced. Ten Dam (1950b:53-5) therefore suggested keeping livestock from penetrating into coconut groves by building fences, particularly near the villages. He also suggested abandoning the practice of *ladang* cultivation underneath coconut trees and planting green manure instead. Following this suggestion the thorny leguminous shrub *putri malu* (*Mimosa invisa*) has been planted as a fallow crop underneath the coconut palms at the saddle of Nita since the 1950s.

The quality of copra has been a subject of considerable concern. Because of lack of money farmers used to pick the nuts in an unripe condition. In various parts of Sikka - e.g. Wolokoli (near Bola) - *adat* rules required the population to harvest coconuts only once every three months (ten Dam 1950b:41). Because copra is often not properly dried merchants reduce prices by 10 to 15 per cent (Rusconi 1940a:18) as redrying is required. Hardly any care is given to the coconut trees.[57] It was thus not surprising when

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[56]This custom became illegal after the war. In Sikka's *adat* rules written down in the early 1950s only the following two forms of pledging are mentioned (see Kondi n.d.(c):§§ 101 and 102 (p.9)):
1. *Sada(ng) mateng*: This term applies to items - like an elephant tusk or gold (i.e. unproductive capital) - pledged in exchange for money. 100 per cent interest per year has to be paid by the pledgegiver.
2. *Sada(ng) moret*: This term applies to items like fruit trees (thus also coconut trees) from which yields can be expected, pledged in exchange for money. No interest has to be paid by the pledgegiver.

[57]Most trees have approached 'retirement' age of 60 to 70 years (see Table 29). Some replanting has been encouraged by the government since 1970 (da Cunha 1974:55-6).

pests jeopardized Sikka's copra production. The lesser spike borer (*Batrachedra sp.*), rhinoceros beetle (*Oryctes rhinoceros*) and white fly (*Aleurodicus destructor*) were particularly harmful. *Batrachedra sp.* appeared in Ngada, West Flores, for the first time before World War II (van den Ende 1954:32) from where it moved east to Sikka; here it appeared in the early sixties, affecting the saddle of Nita most severely. Yields dropped from about 7000 tons (1960) to under 2000 tons in 1970; 616,637 coconut trees were reported to have been attacked by pests (da Cunha 1974:155). The massive use of pesticides (particularly Diasinon) successfully combated *Batrachedra sp.* so that by 1974 copra production again reached a level of 5000 tons (see also LPTI 1971, 1972). At the same time trials at devising means of combating the white fly (*Aleurodicus destructor*) effectively have been carried out in Sikka and elsewhere on Flores (Lembaga Penelitian Tanaman Industri, Bogor (LPTI) 1976). The bug attacks the leaves and young coconuts fall. Similarly the rhinoceros beetle attacks the leaves and the stem of the palm and eventually leads to the death of trees.

In an effort to attenuate the effects of price fluctuation government and private organizations have been created. From 1941 copra prices were regulated in eastern Indonesia through a government fund (*Het Copra Fonds*) which also attempted to improve the quality of copra by providing advice (van den Ende 1954:33). After 1950 this organization was replaced by a copra board (*Yayasan Kopra*) set up by the government in the eastern Lesser Sunda Islands with three main branches in Ende, Maumere and Waiwerang/Adonara. In 1957 the first copra marketing co-operative (*Koperasi Kopra*) was created in Flores. In Sikka it started in 1958 with eight branches (*Primair Koperasi*) located throughout the district.

Farmers were required to sell their copra to the co-operative. As a result of the existence of two prices for copra on Java - one fixed by the government, and another, considerably higher, free market price - smuggling of copra became very common. In 1962 the higher free market price was Rp. 1700 to Rp. 2250 per 100 kg against Rp. 900 offered by the government from which Rp. 500 had to be subtracted for the co-operative, leaving the farmer with Rp. 400/kg (Moeljadi 1963:24 and 29). It is thus no wonder that farmers were not very enthusiastic about selling their copra to the co-operative. The government gradually withdrew its control from the copra trade and by 1967 the copra co-operatives had to compete fully with private merchants. As a result the co-operatives went broke in the following year and the copra trade was handled exclusively by Chinese merchants in Maumere.

In 1973 the co-operative idea was revived and the *Koperasi Unit Desa* (KUD) was formed in Maumere; this markets copra and sells food and household necessities to its members. Although the free trade decree of 1967 is still upheld in eastern Indonesia, Sikka has required since 1974 that all copra be marketed through the KUD. Copra thus has to be sold to one of four oil mills in Maumere. The prices are fixed by the local government. The co-operative idea has not really gained a footing in Sikka as evidenced by the low number of members (1974:397 members only - see Say 1974: Appendix L.10.6). As long as prices for copra are satisfactory the co-operatives seem to flourish, but declining prices have had disintegrating effects (see Table 28).

Copra is mostly dried on a simple coconut drier consisting of a platform made of bamboo, about 1.5 m above the ground, on top of which the copra is dried by the smoke from the smouldering fire kindled by the fibrous material of the coconut shells. Rarely is the copra sun-dried (Plate 37). Consequently farmers receive lower prices for their smoked copra. Since 1965 all copra is processed in Sikka by oil mills of which eleven existed by 1973. Together they produced about 200 tons of coconut oil and 10 to 75 tons of oil press cake (*bungkil*) per month (da Cunha 1974:54).

Yields and income. It takes 6 to 8 years before coconut trees reach the fruit-bearing stage. Coconuts can be harvested up to four times a year. The main harvesting seasons are from April/ June to September/October and December to February (ten Dam 1950b: 34-5). Yields per tree vary greatly: 1000 kg/ha of copra is considered a good yield in Sikka. This figure is only obtained if 25 nuts/tree (= 6.5 kg of copra) are harvested per year and if 150 trees/ha are planted. Yet by international standards 1000 kg/ha of copra is a low figure, for which the irregular spacing of 5 to 7 metres is partly responsible. With proper spacing (i.e. 10x10 m) far higher yields of up to 1600 kg/ha of copra could be achieved.

Table 29 shows some results of a recent survey of the copra producing region of the saddle of Nita, stretching as far as Nangablo in the west, and indicates some reluctance on the part of Sikka's farmers to replant coconut trees. Farmers only replant when yields have dropped to zero. Hence coconut palms on almost 80 per cent of the area were too old. Yields had fallen significantly below the Sikka optimum of 938 kg/ha/year (i.e. trees belonging to age group 21 to 40 years).

Assuming an average production of 500 kg of copra/ha and an average holding of 0.5 ha/farmer, each farmer in the saddle sold 250 kg of copra. Given the low prices of Rp. 25-35/kg (second half of 1975) he would have received Rp. 6250-8750 for his copra. Production costs as calculated by the KUD, Sikka (1974) for the third quarter of 1974 amounted however to roughly Rp. 11,000 per 100 kg copra (Table 30). Hence a price of at least Rp. 110/kg of copra would have been necessary to cover costs.

Table 29

Area under coconuts according to age of trees and copra yields in the saddle of Nita, February 1975

Age of trees (years)	Area		Production		
	ha	%	Nuts/tree	Nuts/ha/tree	Copra/ha/year (kg)
0-10[a]	445	14	0	0	0
11-20[a]	0	0	0	0	0
21-30	72	2	25	3,752	938
31-40	144	5	25	3,752	938
41-50	1,272	40	20	3,000	750
51-60	1,212	39	8	1,200	300
	3,145				

a Zero production until the age of 20 years seems quite unrealistic. As Schotanus and Sakiman (1976:62) pointed out in their agricultural survey of Manggarai the following production figures per ha can be expected:
6th to 9th year : 250 kg copra per year
10th to 12th year : 500 kg copra per year
13th to 14th year : 750 kg copra per year
After 15th year : full production.

Source: Fakultas Pertanian, IPB (1975:Tables 1-4).

Table 30

Cost of producing 100 kg of copra (after calculation by *Koperasi Unit Desa* 1974

Cost of 100 coconut seedlings	Rp. 965
Picking of coconuts from 60 coconut trees (each yielding 1.7 kg of copra), opening 500 nuts	4,250
Drying	1,000
Weeding	1,000
Cost of maintaining coconut drier	2,500
Extra costs (sacks, transport from field, etc.)	225
Cost of producing low grade copra (90 per cent dry)	9,940
Cost of drying for export quality	994
	10,934[a]

a These costs do not yet include taxes (IPEDA) to be paid per tree by the farmer.

At the prices prevailing at the end of 1974 and beginning of 1975 copra was produced only because farmers did not calculate the cost of their labour involved in the production process (Table 31).

Table 31

Labour involved in the production of copra from one hectare in the saddle of Nita, February 1975

	Type of activity	Man-days
1.	Preparation of seedbed	-
2.	Weeding	7.8
3.	Drilling holes for planting	4.8
4.	Construction of terraces	10.0
5.	Planting of young coconuts	5.4
6.	Fencing of young coconut plants	9.8
7.	Weeding	30.8
8.	Hoeing	8.2
9.	Fighting pests	8.0
10.	Harvesting and processing of coconuts	44.0
Total		128.8

Source: Fakultas Pertanian, IPB (1975:Tables 1-7).

Cocoa. While coconuts are used both as a commercial crop and for consumption by the native population, cocoa and cloves are without value to the Sikkanese unless they can be converted into money. While the hoped-for economic yields in terms of income to be derived from the sale of copra have eluded most Sikkanese, new expectations have been kindled by cocoa and cloves, particularly since 1975. In contrast to coconut the latter two perennial crops have not been combined with the bush fallow food cropping. Both crops are badly placed from a demographic point of view. Their cultivation was started at the saddle of Baomekot - one of the most densely populated areas of Central Sikka. This had two important consequences. First, a hitherto fairly mobile system of bush fallowing became more sedentary because of the planting up of most agricultural land with cash crops. Thus the population had to shorten rotation cycles on the remaining fields. Seasonal migration was eventually set in motion - e.g. from Hewotkloang to Habibola, to Ds. Aibura, Ds. Waibleler - where traditional *ladang* cultivation could still be practised. Second, with land becoming scarcer, it became valuable in the eyes of the Sikkanese. As a result of the introduction of cash crops inequalities of wealth seem to have become a natural by-product. This process was particularly strong where cash and food cropping could not be combined on the same spot.

Some cocoa was planted in Central Sikka - Kecamatan Bola (Ds. Ipir) and Kecamatan Kewapantai (Ds. Wolomarang) - as early as 1950. The first planters who received their seedlings from Sulawesi and from Java found few imitators since there was no market for this product in Sikka. The agricultural extension service of Flores did not provide any assistance for the cultivation of this plant, so that about 3000 trees were reported to have been slashed by their owners at the beginning of the 1960s (da Cunha 1974:58).

It was only after 1963 when a missionary (Father Heinrich Bollen), in the name of a farmers' co-operative (*Ikatan Petani Pancasila*), became an active proselytizer of cocoa and started to buy wet cocoa beans which were processed in a fermentary and on a sun drier at Watublapi that the local population became aware of the processing of this product, and gradually cocoa planting was resumed. Today cocoa is being planted throughout the mountainous parts of Central Sikka above an altitude of 300 metres on the south flank. The centre of production lies between 300 and 500 m and around the saddle of Baomekot and reaches as far as Ds. Kloangpopot; Maget, Legar (Ds. Wolomotong); Botang (Ds. Kajowair) and along the southern flank: Ian (Ds. Bola), Gedo (Ds. Wolokoli), Ds. Hokor, Ds. Iligai. Here cocoa thrives particularly in sheltered spots which are less affected by strong winds and in which deep humic soils occur. Attempts at growing cocoa at lower elevations - e.g. below Botang at Habenkabor, below Kewagunung and below Kopong - yielded but poor results. Cocoa, of which two varieties are grown in Sikka - *Forastero* and *Criollo*, is grown in *ongeng* or, at least, *uma ongeng* - i.e. together with other perennial crops. Monoculture of cocoa is unknown.

Cocoa produced in Sikka is of high quality (Plate 36). It is marketed today partly through a co-operative (Usaha Bersama Cengkeh-Kakao - 200 members) partly by local traders (see Table 32). In 1976 cocoa prices reached Rp. 100/kg wet beans and Rp. 250/kg dry beans. This upward trend continued in 1977 when Rp. 400-500/kg of dry beans were paid in Maumere.[58] Hence further planting of this perennial was strongly stimulated despite the occurrence of a disease (*Helopeltis antonii*) in 1970. As trees begin to bear fruit after three to five years and since little

[58]According to the head of the Agricultural Service of Sikka, Mr V. Parera (by letter of 30 September 1978), even higher prices can be expected, as one of Indonesia's major areas of cocoa production in Central Java is affected by a disease which caused the local administration to cut down many cocoa trees.

care is given to their cultivation farmers are assured yields in a relatively short period.[59]

Table 32

Cocoa bought in Sikka (kg)

Year	Wet beans traded by IPP			Equivalent of dry beans traded by IPP	Dry beans traded on free market	Total dry cocoa
	from members of IPP co-operative	from non-members	Total			
1971						4,000
1972						6,500
1975	4,317	2,282	6,599 =	2,483	6,000	8,500
1976	19,819	5,789	25,608 =	9,890	5,000	15,000
1977	16,111	1,009	17,120 =	6,378	15,500	22,000

Source: 1971-72: da Cunha (1974:58)
1975-77: Father H. Bollen, pers. comm. March 1978.

Cloves. By far the highest income can be derived from cloves (*Eugenia aromatica*) which are marketed at Rp. 4000-6000 per kilo. Although cloves are said to have been introduced into Sikka (Ds. Wolomapa) in 1951 and distributed by Father Dr van Doormaal (da Cunha 1974:60) only twenty odd trees were grown by six cultivators until 1966. The main reason for this reluctance was the fact that cloves require specific ecological conditions not found in most of Central Sikka and because cloves require ten years at least to reach fruit-bearing stage. Moreover they demand particular care. It was only after 1967-68 that the agricultural service of Sikka began to encourage the growing of cloves by distributing seedlings (variety: *Sansibar* from Bogor) from the experimental farms at Wairgete, Tilang and Woloboa to farmers of Central Sikka. Only a small percentage of these seedlings (around 30 per cent) actually grew. The most favourable ecological conditions are encountered on the southern flanks between 300 and 500 metres as well as at the saddle of Baomekot, that is with its more evenly distributed rainfall of about 2000 mm per year. Five hundred clove trees were

[59]Although production per tree may attain 300 seeds, 25 seeds are averaged. About 35 g of cocoa may be extracted per seed which equals 875 g per tree. If cocoa is exclusively planted about 300 kg of cocoa may be yielded per ha between the 7th and the 25th year when the tree is in full production (see also Schotanus and Sakiman 1976:65 for Manggarai).

reported in Sikka by 1970 of which about 10 per cent were in the fruit-bearing stage. Until 1975 clove production in Sikka originated from the trees planted in the fifties by the six cultivators. In 1977 a substantial number of clove trees reached fruit-bearing stage as reflected in the production figures (Table 33). The increase in purchasing power accruing to the respective cultivators through the sale of cloves has been considerable.

Table 33

Clove production in Sikka, 1975-77 (kg)

Year	Sold to co-operative (IPP)	Sold on free market	Total
1973	30		30
1975	87	75	162
1976	39	200	239
1977	894	100	994

Source: 1973: da Cunha (1974:60.)
1975-77: Father H. Bollen (pers. comm.).

Cotton. The account of coconut cultivation has already highlighted the hazards of cash crop production in Sikka. Cotton represents another example of the high risk involved in the cultivation of commercial crops. The beginnings of cotton cultivation date back to 1912 when a private syndicate (Syndicaat ter Bevordering van de Katoencultuur op Flores) was formed which in 1915 bought a concession for an area at Nangahale (*Gouvernements Besluit van den Resident van Timor en onderhoorigheden* of 11 September 1912, No.264), for which the government gave a grant of f 30,000 (*Gouvernements Besluit* of 16 November 1915, No.2) (see Hens 1916 II:39).

A cotton gin was built at Maumere.[60] Because of financial difficulties the enterprise was handed over in 1917 to the N.V. Amsterdam Soenda Companie for a sum of f 300,000. The cotton gin was moved to Nangahale (Couvreur 1924:29). High prices for cotton on the world market led the managers of the company to assume an over-optimistic outlook. A monopoly in this commodity in the

[60]Trial plantings run by the government at Bebeng (see Hens 1916 II:48) with various varieties introduced from Australia and South America were started in 1912. 'Sea Island' and 'Upland' varieties were found to be of top quality (Abrahamson 1912:53-4).

Lesser Sunda islands was envisaged. Cotton grown at Nangahale, Misir (2 km south of Maumere) and at Lela (10 ha) was not sufficient for running the cotton gin economically. Therefore cotton had to be bought mainly from the indigenous population (*bevolkingskatoen*)[61] at prices fixed by the government (*Directeur van Landbouw, Nijverheid en Handel*). The company's administrative head in Ende strongly encouraged the native population in Sikka to plant cotton. Each kingdom (*landschap*) was required to maintain cotton seedbeds of its own. Agricultural extension and guidance was provided by a government official. Cotton was usually grown in conjunction with maize by the Sikkanese. As cotton is a perennial crop cultivated for two to three years on Flores before it is replaced, *Imperata cylindrica* grass (*alang alang*(I)) was kept at bay (van den Ende 1954:36). The cotton from Flores (*Caravonica* variety)[62] was of good quality and comparable to one of the best qualities from the United States.

The high price obtained at Liverpool stock exchange encouraged the Companie to build a second cotton gin at Ende at the cost of f 50,000. Developments took a different turn, however. When cotton prices began to fall at the beginning of the 1920s, the company was no longer able to buy all *bevolkingskatoen* offered by the population at fixed prices. A demand by the company for a credit of f 100,000 was refused by the government. The company subsequently went bankrupt in 1924. Part of the Nangahale concession (1483 ha) was sold to the mission which planted coconut trees.

The confidence of the native population of Sikka in the cultivation of cotton was seriously upset. Although the government continued to support the cotton price in Sikka through substantial payments from the *landschapskas*, farmers became increasingly less interested in growing cotton.[63] For one thing low prices - particularly during the world-wide economic depression - did not warrant

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[61] Mainly grown at cotton plantings maintained by the *landschap* at Bebeng, Kewa, Wetakara, Guru, Ribang and Letet (west of Ribang) (Hens 1916 II:48). Here chiefly low-yielding indigenous varieties were grown.

[62] Introduced by the Companie but particularly subject to the pest *jassid (Empoasca lybica)* because of its hairless leaves (Ploeg 1938:391). *Jassid* belongs to the great family of *Cicadellidae* which is divided into the two subfamilies *Delphacidae* and *Jassidae*.

[63] This trend could not be significantly halted by a number of measures introduced by the Dutch administration (see Ploeg 1938). These measures included the introduction in 1926 of two new varieties (*Peradeniya* and *Cambodia*) with hairy leaves which, however, the indigenous population was not willing to cultivate. Large amounts of *bevolkingskatoen* (= indigenous varieties) were bought by the government after 1935 at a fixed price of f 3/62 kg (= roughly one *pikul*) of raw cotton. Ginning costs for these varieties proved to be three to five times higher than for

(continued p.154)

the large-scale cultivation of this crop. Instead a small quantity was considered sufficient for home consumption and for barter at the local market. Moreover, in 1925-26 cotton, particularly in Sikka, was attacked by a pest (*Cicadellidae*), which destroyed the harvest in 1926 (Nijs Bik 1934:30). Physical factors - e.g. climate and soils - were also made responsible for the decline of this crop. Mohr (1934 II, 1:76), who visited Flores in 1930, argued that Flores' northern littoral region, which is characterized by a long dry season, but also by soils having a high soil moisture level, is particularly suitable for the growing of cotton.

This was evidenced by experiments during World War II when Flores was under Japanese occupation (1942-45) and a Japanese company cultivated cotton in Sikka. In 1943 1000 ha were planted with cotton (variety *Akara*) at Ahuwair (Wairgete) and Wailiti (west of Maumere) (Cornelis da Silva, Lela, pers. comm. 10 March 1976). *Cicadellidae* destroyed this crop. Yet in the following year 800 tons were produced (van den Ende 1954:34). Mohr's optimistic view as regards groundwater conditions in the northern coastal plain needs to be qualified, for rainfall conditions were comparatively favourable during the war years.

After the war the cultivation of cotton was given less attention by the government, and was restricted to sporadic and small trial plantings at Woloboa (Kecamatan Lekebai), Nangameting (east of Maumere) in 1949, and Wairgete 1958-63 (Cornelis da Silva, Lela, pers. comm. 10 March 1976).

It was not before 1963 that a new effort was made by the government to stimulate the cotton cultivation in Flores. One hundred hectares of land near Wairgete were put at the disposal of a government-owned company (PPNT Centra) called *Kapas Centra* until 1964 when its name was changed to PPN Serat (*Perusahaan Perkebunan Negara Serat*). However, only 5 ha were actually planted, which yielded no more than 3 tons of cotton (variety *Cambodia*) (Djojopranoto 1972:7). In order to encourage the planting of *bevolkingskatoen* in Sikka in 1963 about 1200 farmers from Maumere (44 ha), Nele (80 ha), Wetakara (110 ha), Ili (40 ha) and Wairgete (26 ha) were required by the government to plant cotton on *ladang* plots (total of 300 ha) either in pure stands or in interculture

[63] (continued)
introduced (but hardly grown) varieties. Hence only a calculated price of f 1.43/62 kg could be paid for *bevolkingskatoen* as against - for instance - f 4.58/62 kg of *Peradeniya* variety (Ploeg 1938:393). The low price made people increasingly uninterested in the growing of cotton (except for home consumption) as evidenced in falling export figures of cotton from Maumere (Rusconi 1940a:23):

1938	7688 kg
1939	3680 kg
1940 (until Oct.)	1116 kg

with maize. The plan - conceived under a big-push-forward program, called *Komando Operasi Gerakan Makmur* (KOGM) - failed entirely as the Sikkanese farmers concerned were unwilling to run the risk of investing so much effort in the cultivation of a single commercial crop. In view of the low prices paid for cotton and in view of rampant inflation their attitude seemed to be justified. The unsatisfactory results enhanced by experiments with several other varieties of cotton led the company to concentrate its activity in the plain of Mbai (Ngada-West Flores) between 1968 and 1969 until it had to close down entirely in 1970.

Although some trial plantings with cotton were carried out by the agricultural service of Sikka at Wairgete, Wolomarang, Pigang (3 km west of Maumere) and Nangahure between 1972 and 1975, no large-scale planting by the population was initiated because of marketing problems. The little cotton that is still planted today in housegardens by the indigenous population is used for home consumption - i.e. for weaving of traditional *ikat-sarong*(I). For 1968 the area under cotton planted by the population was estimated at 1860 ha at 3 quintal/ha (1 quintal = 100 kg) (DPS Annual Report 1968:3).[64] Detailed descriptions of the traditional techniques of sowing, harvesting, spinning, dying and weaving of cotton in Sikka are given by Tietze (1941) and Heekens (1944).

Regional differentiation of agricultural systems

The preceding section has acquainted us with the main features of traditional subsistence and commercial agriculture in Central Sikka. We now come to analysing the interrelationship of these factors by regions. With the help of my detailed map of place names, at a scale of 1:25,000, a regional differentiation of Central Sikka's dry-land cultivation was attempted on the basis of eight distinct cropping patterns (Fig.35).[65]

1. Northern coastal zone, 0-100 m (Fig. 36 and Table 34): In this most fertile zone of our area permanent dry-land cultivation (*hokot nane*) is conspicuous. Permanently cultivated land in the northern plain is called *tana magat*.

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[64] Average yields of 3 q raw cotton/ha seem to be exaggerated as the Sikkanese grow cotton only in conjunction with other crops. The *landbouwvoorlichtigsdienst* estimated the yield on Flores to be 175 kg/ha, which seems to be nearer to reality.

[65] For reasons of scale locally very restricted deviations from the regional pattern outlined below could not be included in Fig. 35. For instance at the saddle of Nita in Ds. Rubit, Ds. Wolomotong and Ds. Mekendetung (agricultural systems IV, V and VI) a number of fields were already cultivated permanently, instead of on the basis of land rotation.

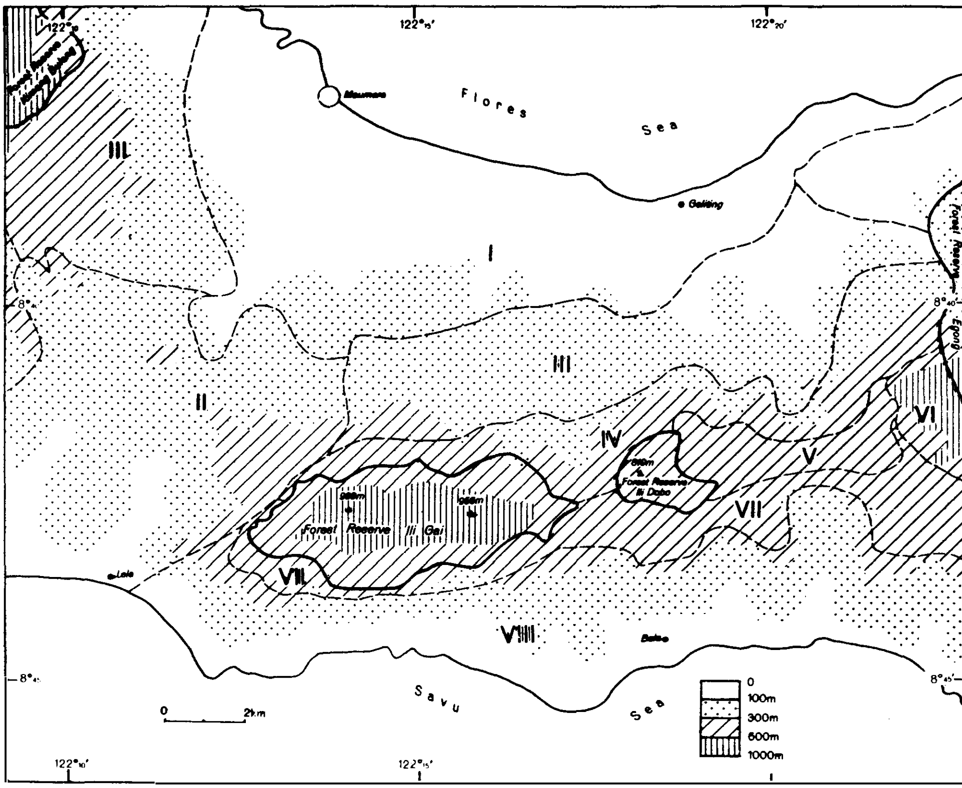

Fig.35 Central Sikka: regional distribution of agricultural systems (I - VIII)

Permanent cultivation is rendered possible by periodical floods which carry nutrients from the mountains to the plain. In addition crop rotation with legumes reduces the rate of depletion of soil fertility. In contrast to favourable edaphic and topographic conditions the extremely low and highly erratic rainfall seriously limits its agricultural potential. It is for this reason that commonly only maize (*lele*) is planted during the *warat* season. One or two slight weedings are performed by means of a hoe in which the soil is only slightly scratched (*garu*(S)). A third weeding is done shortly before the harvest of the maize in preparation for the new crop of green gram. The beans are planted in between the maize either before the latter is harvested - mostly in the western portion of Central Sikka's northern plain - or immediately after the latter is harvested.

While most alluvial and colluvial soils are sandy and thus highly porous, a few isolated clay patches for which a higher water holding capacity is typical are found in the coastal plain - for example at Kloanglagot (Ds. Watumilok), Waiwerut (Ds. Namangkewa),

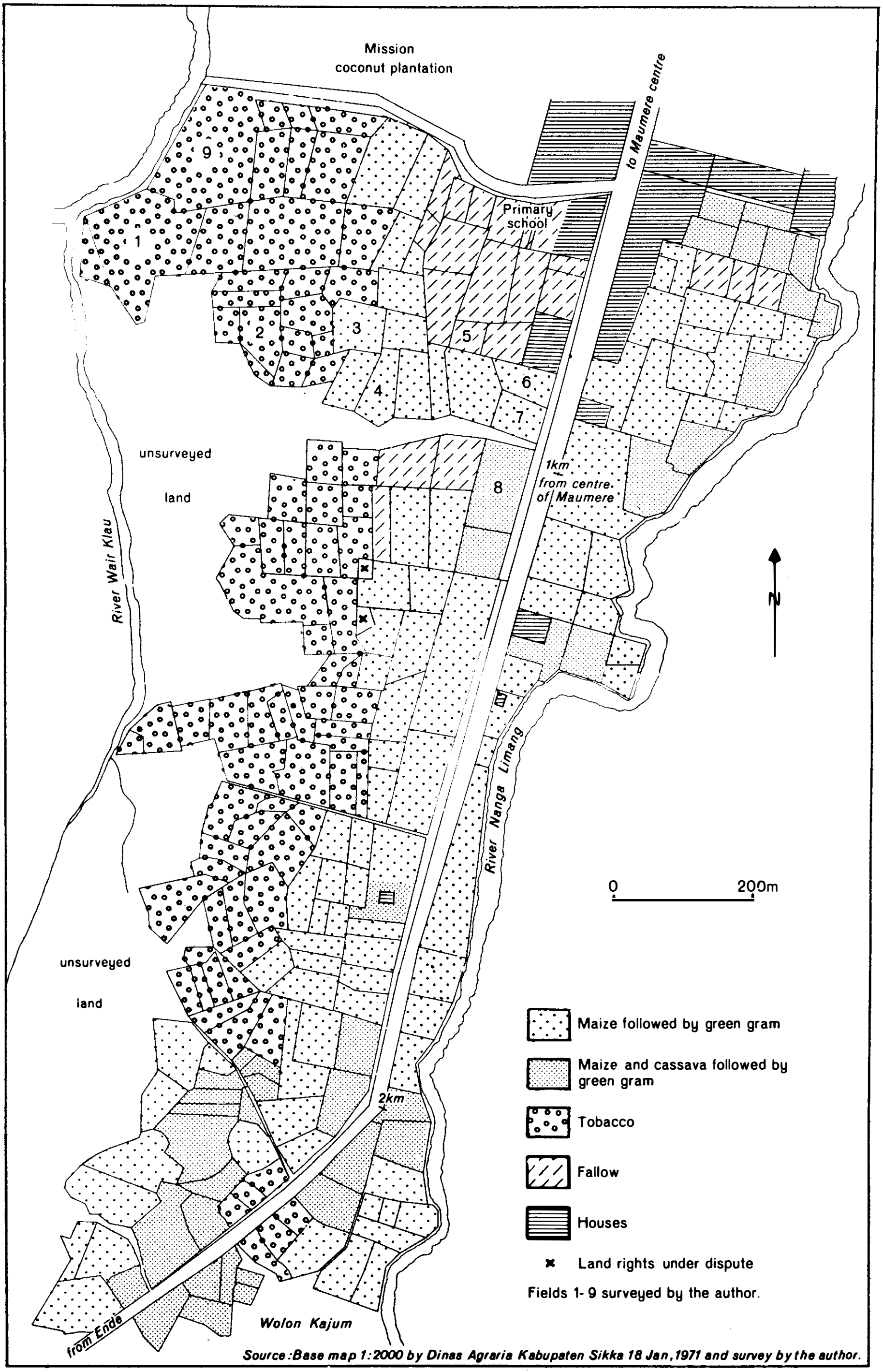

Fig.36 Desa Kabor: land use pattern (surveyed by the author in April 1976) as an example of agricultural system I (see Table 34)

Table 34

Surveyed fields at Desa Kabor as an example of agricultural system I (see Fig.36)

Field number	Size of field surveyed by Dinas Agraria Kab. Sikka (1 Oct. 1971) m^2	Date of planting. maize	Maize yield (*bakul*)[a]	Date of planting green gram	Green gram yield (kg)	Labour input (man-days) for: hoeing	Labour input (man-days) for: weeding	Tobacco yield (*lempang*)[f]	Remarks
1	17,512	6.11.1974	35(1974/75)	7.2.1975	200	30[b]	35[b]		Sharecropping (50:50)
		16.11.1975	32(1975/76)	16.2.1976	200	34[b]	29[b]		
2	4,355	10.11.1974	44(1974/75)	13.2.1975	100	29[b]	20	20	Sharecropping (50:50)
		15.11.1975	41(1975/76)	21.2.1976	100	23[b]	21	15	
3	4,582	10.11.1974	10(1974/75)	11.2.1975	50	14	13		Sharecropping (50:50). Same for cultivation period 1975/76.
4	8,058	10.11.1974	10(1974/75)	14.2.1975	45	28[b]	42[b]		
		20.11.1975	10(1975/76)	10.2.1976	45	28	28		
5	2,275	15.11.1974	7(1974/75)			14	14		
		18.11.1975	7(1975/76)			14	14		
6	2,756	10.11.1974	17(1974/75)	16.2.1975	100	29	25		Same for cultivation period 1975/76.
7	3,021	16.11.1974	15(1974/75)	9.2.1975	75	20[e]			
		12.11.1975	18(1975/76)	10.2.1976	75	20[e]			
8	10,040	7.11.1974	20(1974/75)	5.2.1975	100	Tractor Rp.4000	28[c]		No sharecropping. At end of 1976 only cassava is to be planted.
		6.11.1975	17(1975/76)	10.2.1976	100	"	28[d]		
9	ca.24,000[h]	5.11.1974	10(1974/75)	10.2.1975	35	24[g]	20[g]		
		6.11.1975	10(1975/76)	10.2.1976	35	24	20		

a *Bakul* = 28 kg maize on the cob or 19 kg maize kernels
b *Sako seng* = co-operative work
c *Letâ* = co-operative work
d *Woter seng* = paid labour @ Rp.150/person/day
e *Woter seng* = paid labour @ Rp.4000
f *Lempeng* = common measure for tobacco: flat bale of tobacco
g *Woter seng* = paid labour Rp.7000 (hoeing and weeding)
h No official figures available from Dinas Agraria, Kab. Sikka; measured planimetrically.

Field 1 Paulino Ota, Kabor
" 2 Alfonsus Mitang, Kabor
" 3 Esau Moning, Kabor
" 4 Leo Nenong, Nele Barat
" 5 Petrus Boging, Kabor
" 6 Johakim Duminggu, Kabor
" 7 Urbanus Duminggu, Kabor
" 8 Lodang Lado, Kabor
" 9 Mariada Gomez, Kabor

Waiara (Ds. Namangkewa), Kloangbolat (Ds. Watumilok), Wolong Kliting (Ds. Watuliwung) and Guun Dogon (Ds. Kabor). In the eastern half of the plain which benefits from a slightly higher rainfall occasionally in moist years hill rice may be cultivated on these clay patches. Yet even here farmers normally refrain from planting hill rice as it does not allow them to plant green gram (*bue*) in February. Thus they are well aware of the beneficial effects of crop rotation on soil fertility. Only in the western portion around Maumere is tobacco planted on fertile clay soils. Hence tobacco is never grown on fields on which cassava (*ai ohu*) was cultivated in the previous year.

An exception to the permanent type of agricultural land use is found on low denuded hills in the plain where, because of shallow soils, bush fallowing is common, e.g. at Mageluhu (Ds. Kabor). These spots are too small to be mappable. The same applies to the clayey spots mentioned earlier.

Along the coast and behind beach ridges on sandy soils coconut trees are grown in clusters. Further inland these are found only occasionally as permanent cultivation does not seem to be feasible here since shade greatly reduces yields. They are completely absent on a strip east of Waioti airport where quarternary limestone is found near the surface.

Until the end of the second decade of this century this zone was not used for agricultural purposes but for hunting, as was explained earlier. From reports by early travellers (Wichmann 1891, Kleian 1891, De Missie van Midden-Flores in vogelvlucht 1901) it becomes clear that *koli* palms abounded in this zone. These stands were depleted as the wood was used for house construction. Today some *koli* palms still exist and form an additional source of income for a few farmers.[66]

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[66]This palm is the chief source of a palm-wine called by the Sikkanese *tua bura* or *tua mi*, drunk fresh from the tree or sold fresh on the market at Maumere for Rp. 10 per glass. The palm is not planted. The owners often lease the trees to tappers on a sharecropping basis (*neni kare*). Among these half a dozen Savunese are considered master tappers. In contrast to the practice on their isle of origin - Savu, located between Timor and Sumba - the palm juice is not used for the production of syrup which can be stored for years and be eaten as a side-dish. In Sikka the juice of the *koli* palm may either be drunk fresh, as described above, or turned into a cider-like drink (*tua waa habi*) which is particularly popular with unorthodox Moslems on Sikka's north coast (5 litres sell for Rp. 100). The bark of *habi* (*Schleichera oleosa*) is added to the palm-juice for four days and serves to retard fermentation. The palm-juice may also be distilled in a *kuwu* (native distillery) into an alcoholic drink (*tua*) of about 33 per cent alcohol which sells for Rp. 150

(continued p.160)

II. Saddle of Nita, 100-300 m (Fig. 37 and Table 35): Bush fallowing with short rotation cycles of R(2-3/2)[67] under coconut trees, called *uma kabor gong* (*uma* = field, garden; *kabor* = coconut; *gong* = shade). Since the trees are often planted less than 5 metres apart the shade impairs the growth of the annual crops underneath.[68]

Because of land shortage a transition towards permanent dryland cultivation can be observed locally. Efforts have been made since the 1950s to increase soil productivity by planting legumes as fallow crops, above all *putri malu* (*Mimosa invisa*). More recently since the sixties terraces have been constructed to reduce the erosion hazard. To the same end *lamtoro* (*Leucaena leucocephala*) is planted along contour lines beneath the coconut palms.

In the first year of cultivation (*uma weru*) hill rice is planted during the *warat* season wherever trees are more widely spaced, thus allowing sufficient light to reach the ground. When green gram (*bue*) is planted on *uma weru* as well as on *amak weru* and *amak* (second and third year of cultivation), no hill rice is planted, as its harvest would postpone the planting of green gram to April, too late for the beans to mature in most of Central Sikka. Along with the beans some maize is cultivated as a subsidiary crop.

III. Lower portions of northern volcanic slopes (Fig. 38 and Table 36): Ranging from 50 to 100 m in the east and 50 to 300 m in the west, as well as from 50 m to over 500 m on the eastern slope of Mt Kimang-Buleng. Predominantly bush fallowing R(3/3). On account of higher rainfall hill rice is grown on *uma weru* besides maize during the *warat* season. Green gram is also planted on *uma weru* (provided no hill rice is grown) as well as on *amak*.

IV. Middle portions of northern volcanic slopes: up to an altitude of 500 m: Bush fallowing with maize and hill rice (on *uma weru* only). Owing to a higher and more evenly distributed rainfall a second maize crop (*lelê daran*) is produced on *uma weru* during the southeast monsoon. It is in this zone that attempts at planting legumes as fallow vegetation are being made by the local population - e.g. *luma* (*Sesbania grandiflora*). This is done by

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[66] (continued)
per bottle. It is preferred locally to the alcoholic drink derived from the *aren* palm (*Arenga saccharifera*) which traditionally formed the chief source of *tua* in Sikka and is found in moist valleys of the mountains (ten Kate 1894:229). It is believed that the Sikkanese gradually learned the technique of tapping *koli* from Lamaholot-speaking people from the Head of Flores (Tanjung Bunga), the centre of *tua* production on Flores' north coast.

[67] The coefficient R(R=rotation) denotes the number of years under cultivation to the number of years under fallow.

[68] For instance 60 coconut palms were counted on 2100 m², field No. 1 (Fig. 37) owned by Petrus Koting, hence more than double the number of palms had these been properly spaced at 10 m.

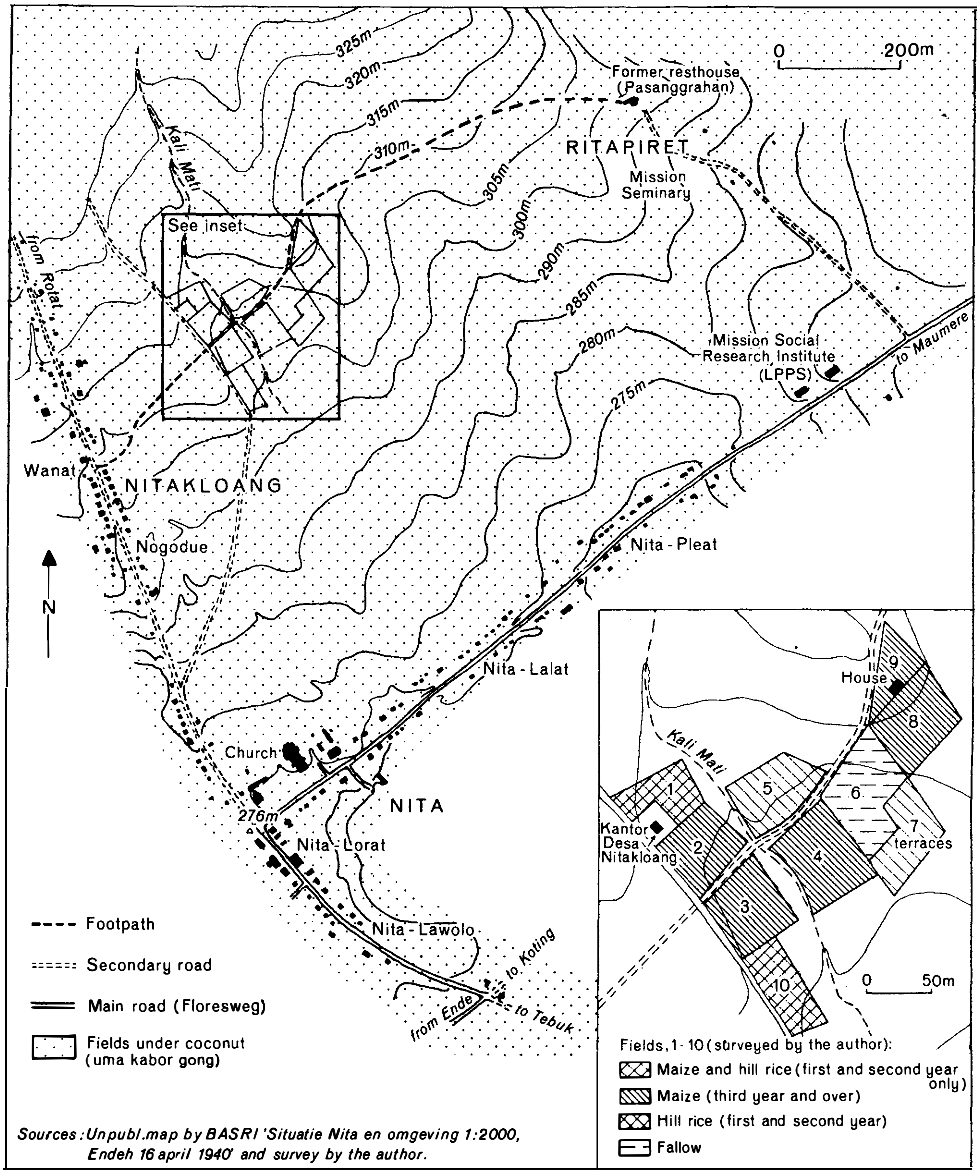

Fig.37 Desa Nitakloang: land use pattern (surveyed by the author with RK I Wild theodolite in April 1976) as an example of agricultural system II (see Table 35)

Table 35

Surveyed fields in Desa Nitakloang as an example of agricultural system II (*uma kabor gong*) (see Fig.37)

Field number	Calculated size of field (m^2)	Field continually cultivated or fallowed since	Crop planted	Amount of rice seed used[a]	Rice variety used	Rice yield (*blek*)	Maize yield (*beser*)	Labour input (man-days) Hoeing	Weeding	Harvesting a) maize	Harvesting b) hill rice	This season's date of planting rice/maize	Intended length of cultivation
1	2,100	1975/76	hill rice	1½ *blek*	*Rebo*	7		26	25		10	15.10.75	permanently
2	3,100	permanently used for more than 10 years	maize				12	10	7	6		10.10.75	permanently
3	3,700	"	maize				no data						
4	4,500	1971	maize				24	16	9	8		12.10.75	permanently
5	3,000	1973	maize and hill rice	1 *blek*	*Rebo*	6	24	23	30	5	12	12.10.75	permanently
6	4,700	since 1974 under fallow	-	.									
7	3,400	1973	maize and hill rice	4 kg	*seratus malam*	30	4	16	5	6	10	12.10.75	permanently
8	4,400	permanently used since 1966	maize				20	15	24	3	-	15.9.75	permanently
9	1,700	permanently used	maize				4	7	3	-	-	15.9.75	permanently
10	2,700	1974	hill rice	3 kg	*seratus malam*	20		15	10	-	10	16.10.75	permanently

Note: a Frequently only a portion of the field is cultivated.
1 *blek* hill rice = 9.6 kg grain equivalent
1 *beser* (6 kg) maize kernels = 4.5 kg grain equivalent
1 *beser* = 100 maize cobs

b Participant of Bimas program

Field 1 Petrus Koting, Nitakloang
" 2 Dura Siga, Nitakloang
" 3 Wendel Hure, Nitakloang
" 4 Andreas Lesu Riat, Mitakloang
" 5 Lukas Hure, Nitakloang
" 6 Nado Bak,[b] Nita
" 7 Masel Tana[b], Nitakloang
" 8 Suleinan Mi, Nitakloang
" 9 Sawe Desa, Nitakloang
" 10 Bati Hale[b], Nitakloang

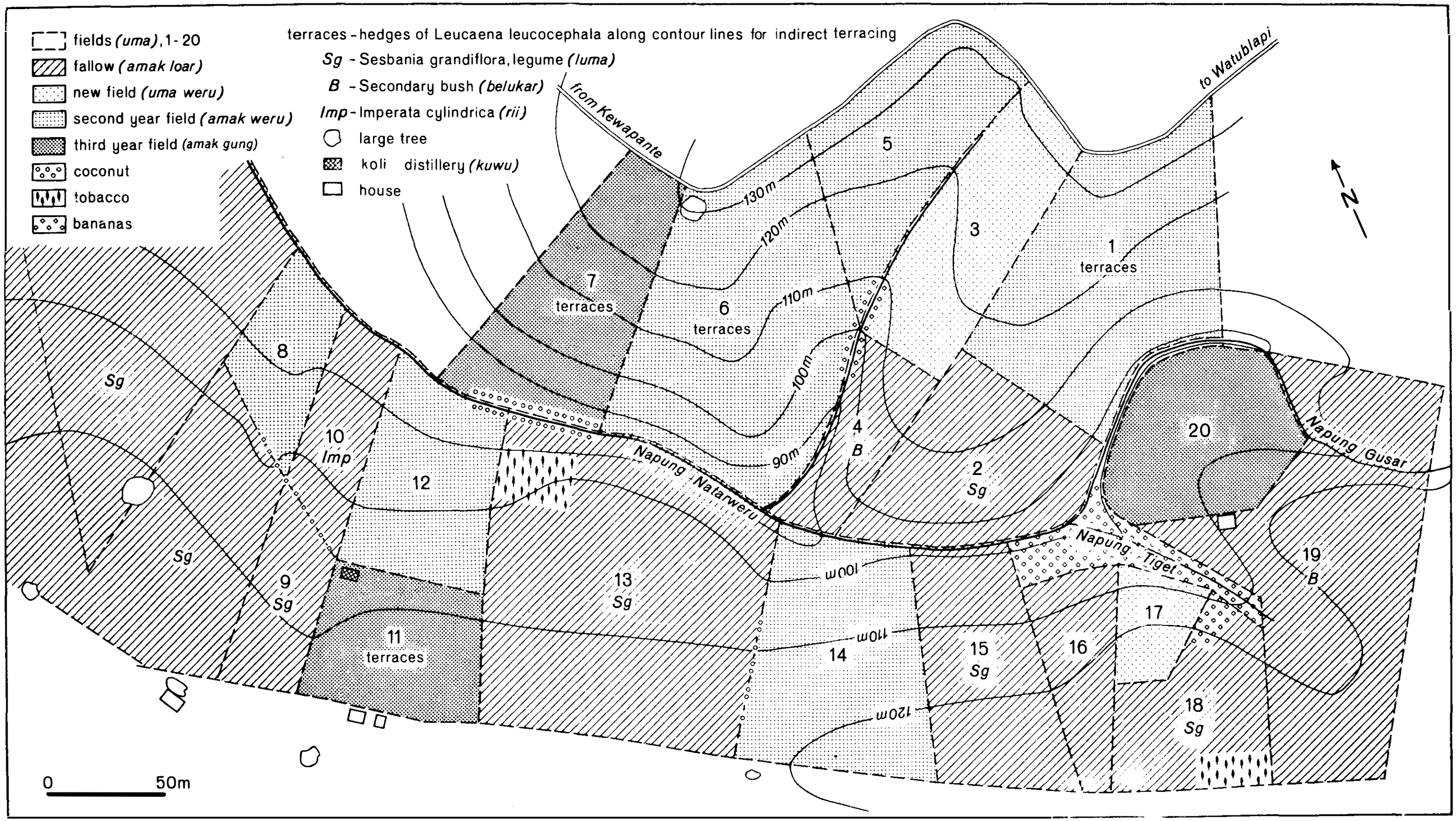

Fig.38 Napung Natarweru: land use pattern (surveyed by the author with RK I Wild theodolite in April 1976) as an example of agricultural system III (see Table 36)

Table 36

Surveyed fields at Napung Naterweru as an example of agricultural system III (see Fig.38)

Field	Calculated size of field (m^2)	Type of land use	In use/ fallowed since	Amount of rice seed used (*blek*)	Rice yield (*blek*)	Maize yield (*beser*)	Frequency of weeding	Green gram planted	Usual length of fallow (years)	Remarks
1	8,421	*amak weru*	1974-75	3	42(1975) 25(1976)	25(1975) 40(1976)	2x			*Lamtoro* hedges (indirect terracing), *Sesbania grandiflora* sticks planted in between crops. Fallow burnt annually.
2	5,305	Fallow (*Imperata* and *Sesbania grandiflora*)	1972							
3	4,906	*Uma weru*	1976			24	1x	Jan./Feb. 1976	4 (under *Sesbania grandiflora*)	
4	2,453	Fallow/*belukar* (*Imperata*)	1966							Fallow burnt annually.
5	5,546	*Amak weru*	1974-75	2	25	30	2x		4	5 rows of *lamtoro* hedges (indirect terracing), spacing
6	11,093	*Amak weru*	1974-75	2	7	20	2x		4	2 rows of *lamtoro* hedges (indirect terracing)
7	5,557	*Amak*	1972-73	2	15	15	2x		3	
8	1,936	*Amak weru*	1974-75			6	1x	Jan. 1976	3	
9	2,273	Fallow/*Turi*	1974						3	
10	2,189	Fallow/*Imperata* grass	1974						3	
11	3,705	*Amak*	1973	1	15	10	2x		3	4 rows of *lamtoro* hedges, 9 *koli* palms and distiller 1975, rice planted too late on 5 Dec.
12	4,294	*Amak weru*	1974-75	1	15(1974-75) 5(1975-76)	5(1974-75) 3(1975-76)	2x		3	
13	13,304	Fallow (*Sesbania grandiflora*)	1973						4	
14	6,484	*Amak weru*	1974-75	2-1/4	4(1974-75) 15(1975-76)	20(1974-75) 15(1975-76)	1x		4	
15	5,333	Fallow (*Sesbania grandiflora*)	1976						4	Pledged to somebody else between 1974 and 1975
16	2,560	Fallow	1974							
17	1,347	*Uma weru*	1975-76	1/2	6	5	2x			
18	3,705	Fallow (*Sesbania grandiflora*)	1974						5	
19	11,626	Fallow (*belukar*)	1971						6	
20	4,906	*Amak*	1973-74	2(1973-75)	20(1973-74) 5(1974-75)	8(1975-76)	2x			Maize and rice in the first two years and maize only in the third year

Field 1 Mitan Roja, Kajowair
" 2 Mitan Roja, Kajowair
" 3 Piet Dewan, Kajowair
" 4 Piet Dewan, Kajowair
" 5 Piet Dewan, Kajowair
" 6 Piet Dewan, Kajowair
" 7 Fransiskus Daru, Seusina
" 8 Josef Kedo, Seusina
" 9 Hotung Odang, Seusina
" 10 Hotung Odang, Seusina

Field 11 Marine Letong, Seusina
" 12 Marine Letong, Seusina
" 13 Karokuli, Seusina
" 14 Karokuli, Seusina
" 15 Nagung Temung, Seusina
" 16 Alolirong, Kajowair
" 17 Poling Liwu, Seusina
" 18 Lucas Langor, Sapankopong
" 19 Hiwin Wair, Kajowair
" 20 Maling Wong, Seusina

either inserting cuttings of this tree in the soil or by broadcasting seed on *amak weru* or *amak*. At the time of abandoning the plot, *luma* has already outgrown the fast growing grasses. This induced fallow is called *luma lago*. A functional change can be observed in this agricultural zone: a substantial portion of the agricultural land formerly reserved for the cultivation of food crops for subsistence has been covered with perennials and semi-perennials - e.g. fruit trees under which no annual crops can grow. This mixed form is called *uma ongeng*. Locally contour planting with *lamtoro* hedges can be observed (for description see under V).

V. Saddle of Baomekot, 400 to 500 m (Fig. 39 and Table 37): A functional change to the cultivation of perennial crops (*ongeng*) is widespread. Cacao, cloves, coffee and coconuts are the most common commercial crops. Bush fallowing is gradually disappearing. Annual food crops are grown by the local population on the western slopes of Mt Tarat-Egong(Ds. Aibura, Ds. Pogon) outside the saddle region and on the southwestern slopes of Habibola. Seasonal migration is therefore common. In order to reduce slope wash and gully erosion *lamtoro* has been planted along contour lines since 1972. These *lamtoro* hedges which now cover most of the steep slopes of the saddle of Baomekot prevent the top soil from being washed downhill, thereby facilitating the formation of indirect terraces (Metzner 1976c). So far contour planting with *lamtoro* is restricted to the fields under annual crops in contrast to the practice on the saddle of Nita. As regards the growing of food crops the same cropping pattern as mentioned under IV applies here except that instead of green gram (*bue*), long beans are grown.

VI. Upper volcanic slopes, above 500 m at Mt Tarat-Egong: Bush fallowing with short rotation cycles R(2/2). Maize can be grown throughout the year because of the higher rainfall figures (annual rainfall: over 2000 mm). On *uma weru* three maize crops are possible: except for maize of the *warat* season, called *lelé lélen*, and maize of the southeast monsoon, called *lelé daran*, a third crop of maize called *lelé plalak* can be grown. In addition, hill rice is cultivated - however, only once a year, exclusively on *uma weru* - e.g. at Koker, Maget, Legar, above Kloangpopot. Instead of green gram which do not thrive in this zone groundnuts (*wewe tana*) are planted. Only scattered coconut trees are found here. Since 1975 vegetables and potatoes have been planted near Kloangpopot for the markets at Ohe and Maumere.

VII. Upper southern volcanic slopes from 200/250 to 500 m: Bush fallowing of maize and hill rice during the *warat* season and maize (*lelé daran*) during the southeast monsoon on *uma weru*. Hardly any soil conservation devices; neither *lamtoro* nor fallow vegetation with *luma* (*Sesbania grandiflora*) are common in this zone.

VIII. Lower southern volcanic slopes from sealevel to 200/250 m: Bush fallowing of maize and hill rice only. No *lelé daran*. The

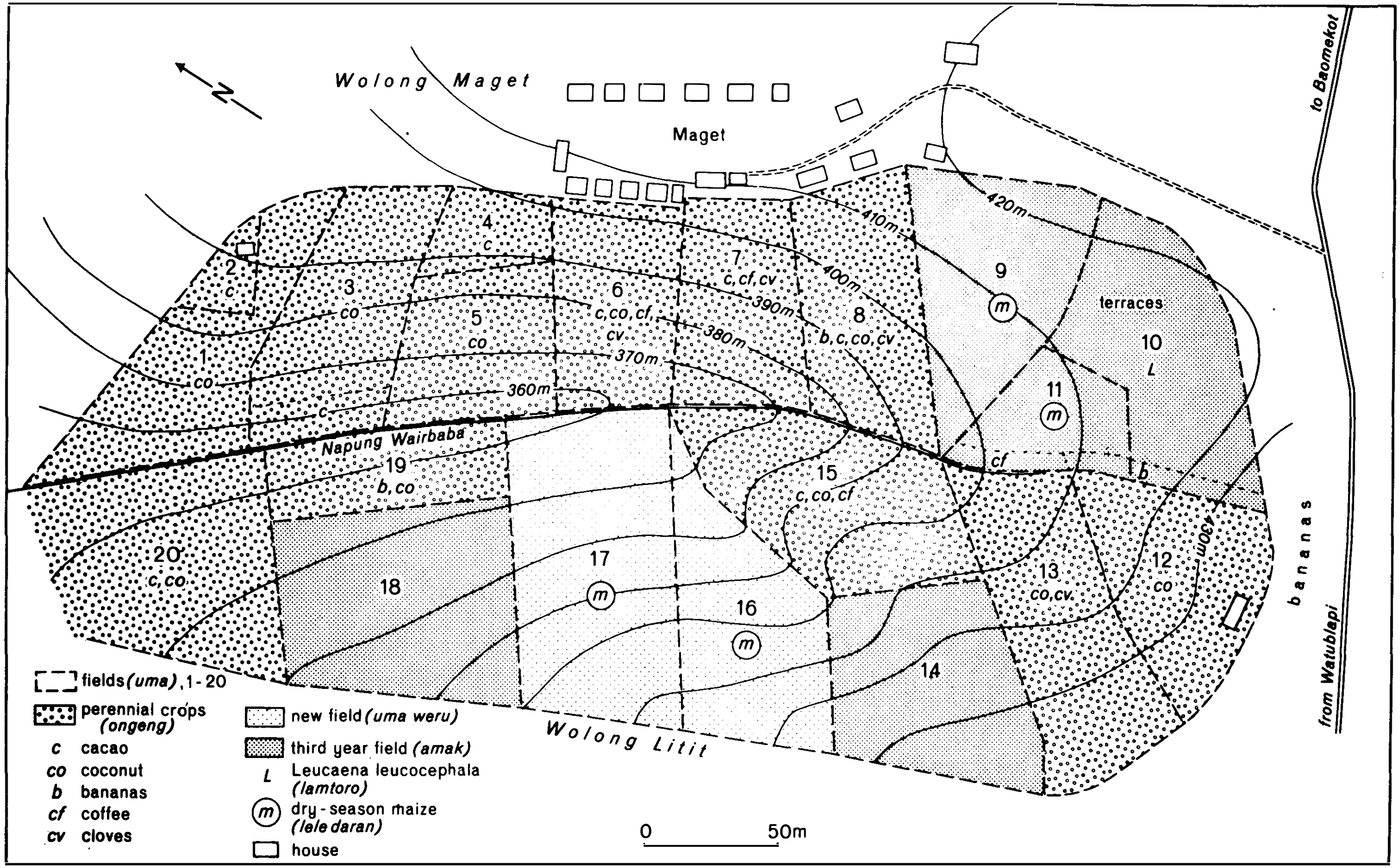

Fig.39 Maget/Baemekot (Ds. Wolomapa): land use pattern (surveyed by the author with RK I Wild theodolite in April 1976) as an example of agricultural system V (see Table 37)

Table 37

Surveyed fields at Maget/Baomekot as an example of agricultural system V (see Fig.39)

Field	Size (m²)	Type of land use	First planted	Rice seed needed (*blek*)	Rice yield (*blek*)	Maize yield (*beser*)	Frequency weeding	Frequency of length of fallow (years)	Dry-season maize	Month when dry-season maize is planted	Remarks
1	3,800	*ongeng*/coconut	1950s								
2	500	*ongeng*/cacao	1970s								
3	4,400	*ongeng*/coconut cacao	1950s 1970								
4	1,300	*ongeng*/cacao	1970								
5	3,200	*ongeng*/coconut	before 1940								
6	3,700	*ongeng*/coconut cloves coffee cacao	1950s 1970								
7	3,600	*ongeng*/cacao cloves coffee	1960s 1970								
8	4,400	*ongeng*/coconut bananas cloves cacao	1970								
9	4,600	*amak*	1973-74	2	25		2x	3	yes	Beg. March	*Lamtoro* hedges since 1974
10	5,100	*amak*	1973-74	2 (2)	20 (10)	20	2x	3	(partly)yes	Beg. April	*Lamtoro* hedges since 1953, 51 clove trees planted 1976
11	2,200	*uma weru*	1976					3	yes	Beg. March	
12	4,000	*uma ongeng*/coconut and maize/taro									Lower portion planted with coffee
13	5,300	*ongeng*/coconuts cloves									
14	5,000	*amak*	1974	2	15	35	2x	3	no		Rice was seriously affected by stink hopper (*Leptocorixa acuta*)(Indones.: *Walang sangit*; Sikkanese: *raon*). Field is being converted to *ongeng*, for which coconuts had been planted three years before.
15	5,200	*ongeng*/coconut cacao coffee	1950s								
16	4,900	*uma weru*	1976					3	yes	Beg. April	
17	6,700	*amak*	1974			20	1x		(partly)yes	Beg. March	
18	6,200	*amak*	1974								
19	2,500	*ongeng*/coconut bananas	1974 1974								
20	no data	*ongeng*/coconut coffee	1960s								

Field 1 Bako Wege, Wolomapa
" 2 Bako Wege, Wolomapa
" 3 Jaro Renang, Wolomapa
" 4 Biong Lusi, Wolomapa
" 5 Biong Lusi, Wolomapa
" 6 Sius Soro, Wolomapa
" 7 Luis Lose, Wolomapa
" 8 Amatus Bemu, Wolomapa
" 9 Amatus Bemu, Wolomapa
" 10 Amatus Bemu, Wolomapa

Field 11 Amatus Bemu, Wolomapa
" 12 Peturus Poran, Wolomapa
" 13 Bernardus Bura, Wolomapa
" 14 Rugut Jalo, Kajowair
" 15 Rugut Jalo, Kajowair
" 16 Anton Jawa, Wolomapa
" 17 Gorius Raga, Wolomapa
" 18 Kunibertus Kowan, Wolomapa
" 19 Kunibertus Kowan, Wolomapa
" 20 Bera Kloang, Wolomapa

absence of soil conservation and induced fallow vegetation is conspicuous. The production of *tua* from *koli* palms constitutes an additional source of income, particularly in Ds. Wolonwalu and Ds. Wolokoli.[69]

Temporal differentiation of agricultural systems

I want now to outline briefly the temporal differentiation of the crop sequences. An understanding of the timing of agricultural activities seems to be important for several reasons. First, the labour force must be reserved for the cultivation work according to the requirements of particular crops at the proper season. Second, the knowledge of the timing of agricultural activities is imperative in order to be able to evaluate the impact new agricultural techniques - such as the planting of *lamtoro* hedges and direct terracing - may have on the farmer's work.

Traditionally the Sikkanese farmer divides the year according to events which have a significant bearing upon agriculture. Since these events do not occur at the same time throughout the area, neither is there a common Sikkanese terminology for these stages nor do these stages correspond to specific months throughout the area.[70] As an example the traditional calendar of Hewotkloang (elevation 400-500 m) west of the saddle of Baomekot has been recorded with the months approximately corresponding:

October	-	*Mapa watan* (= rain falls on the coast)
November	-	*More* (= beginning of life)
December	-	*Duru* (= name of a flower)
January	-	*Bleke getê* (= period of hunger)
February	-	*Bleke doi* (= hunger abates)
March	-	*Kowo* (= rain continues to fall)
April	-	*Balu goit* (= getting rid of diseases)
May	-	*Balu epâ* (= getting better)
June	-	*Blêbo pupun porun* (= to harvest hill rice)
July	-	*Blêbo hewot* (= no working)
August	-	*Blêbo oin aling* (= to begin to dig up tubers)
September	-	*Mapa iling* (= rain falls in the mountains)

In order to convey an idea of the temporal differentiation of agricultural systems we have characterized the agricultural year by the major farming activities. These are the planting and harvesting of maize, hill rice, tubers and beans (green gram and peanuts), preparation of the fields (slashing trees, cutting grass, burning), tilling and weeding. The sequence of these decisive stages in the agrarian cycle has been distinguished for newly opened fields (*uma weru*), fields in the second (*amak weru*) and third year

[69]As *koli* palms are left in the fields farmers speak of their fields as *uma koli gong*.

[70]For more information on the Sikkanese calendar see article in *Java Post* (1908:359-60).

of cultivation (*amak gung*) under maize, hill rice and under green gram (Tables 38-44). Agricultural calendars have been presented for seven of the eight agricultural systems. Only the agrarian calendar of the saddle of Baomekot has been omitted: there perennial crops which do not show the seasonality typical of the cultivation of annual food crops are dominant. Wherever cultivation is practised on the saddle of Baomekot it follows the pattern of agricultural calendar IV.

The agricultural calendars found in Central Sikka are essentially determined by climate; to a lesser degree only by edaphic conditions. In order to avoid lengthy repetition the calendars are not described separately. Instead attention is drawn to striking regional deviations in the agricultural year. The agricultural year starts in October/November with the planting of maize and hill rice as well as tubers in most parts of Sikka. Second and third year fields (*amak weru* and *amak*) have to be planted first as they require more moisture owing to the reduced level of humus.

At elevations above 500 m, e.g. at Koker (agricultural calendar VI), fields are already planted in September. On the northern littoral plain, however, where rain sets in comparatively late, only maize is planted. The planting season usually begins in December; in exceptional years the beginning may have to be postponed until January.

Weeding requires most of the farmer's time during the weeks and months following the planting. While the planting is frequently still performed by women only, weeding is done by men and women alike. The first weeding is done two to four weeks after planting. This is usually followed by a second weeding about three to four weeks later. After two to two and a half months some early maize (*lelé ropo*) and early hill rice (*pare ropo*) is harvested, usually planted in a small section of the field. After three months - normally in February and March - the main crop of maize is harvested, followed by harvesting of hill rice in late March to April.

On permanently used fields of the north coast (agricultural calendar I) and on third year fields (*amak*) on the northern slopes at lower elevations (agricultural system III) - hence the driest parts of the area - green gram (*bue*) is planted following the harvest of maize. In the eastern portion of the plain - i.e. around Kewapante, Ds. Waibleler - green gram is even planted between the maize plants a few weeks before the latter is harvested. Most likely this is because of the Föhn-like winds during the southeast monsoon which may be somewhat stronger here than further west - i.e. at Maumere - and hence jeopardize the crop. Consequently the farmers at Kewapante plant *bue* as early as possible. Yet the planting of *bue* as a second crop is always a risk. In May 1976, for instance, *bue* did not thrive at all because rains ceased to fall after April. This cropping sequence is common also for

Table 38

Agricultural calendar (I): Northern coastal plain

Month	Agricultural system: permanent dry-land cultivation (*hokot nane*)			
	Western portion (Maumere) Permanent *uma lelê/uma bue*	Permanent *uma wewe tana*	Eastern portion (Kewapante) *uma lelê/uma bue*	Special locations: moist hollows (Woloklibing, Guun Dogon) *uma lelê/uma pare*
Oct.	Tilling (*sako*)	Tilling (*sako*)	Tilling (*sako*)	
Nov.	Planting of maize, sorghum, tubers at the rim of the field	Planting of peanuts (*nona wewe tana*)	Planting of maize and tubers	Planting of maize, dry-land rice and tubers
Dec.	Weeding (twice) (*gajar*)		First weeding (*gajar*)	Weeding (*noti*) twice
Jan.			Second weeding (*gajar waang dua*)	
Feb.	Harvesting of maize (*rape lelê*)			
Mar.	Planting of green gram (*nona bue*) or tobacco (*nona bako*)	Harvesting of peanuts (*aha wewe tana*)	Planting of beans (*nona bue*) harvesting of maize	Harvesting of maize
Apr.	Weeding (*noti*) (with *taka*) Harvesting of sorghum (*watar*)			Harvesting of dry-land rice (*eta pare*)
May			Weeding (*noti*)	
June	Harvesting of green gram (*pupu bue*) or tobacco		Harvesting of beans	
July	Harvesting of cassava (*wake ai ohu*), burning of garden refuse (*holo*) and cleaning (*tege*)			
Aug.			Burning of garden refuse (*holo*) Cleaning (*tege*) Harvesting of tubers, tilling (*sako*) (Aug.-Oct.)	
Sept.	Harvesting of tubers Tilling (*sako*) (Aug.-Oct.)			

Table 39

Agricultural calendar (II): saddle of Nita-Koting

Month	Agricultural system: bush fallowing under coconut (*uma kabor gong*) *uma lelê/uma pare uma weru*	*uma lelê/uma bue uma weru*	*uma lelê/uma bue amak*
	D r y i n g o f c o p r a		
Oct.	Tilling	Light scratching of soil (*gaking*)	
Nov.	Planting of maize, occasionally also of dry-land rice on better soils, tubers (on margin and at *blepeng*)	Planting of maize, tubers (on margin)	Planting of maize, tubers (on margin only)
Dec.			
		Weeding (*gajar*) (once only)	Weeding (*gajar*) (once only)
Jan.	Dec.-Feb. P i c k i n g o f c o c o n u t s (n o d r y i n g)		
	Weeding (twice) (*noti*)		Planting of beans and tobacco (on less shady fields only)
Feb.	Harvesting of maize	Harvesting of maize, planting of beans	Harvesting of maize
Mar.	Harvesting of dry-land rice	Weeding (*noti*)	
Apr.			
May	D r y i n g o f c o p r a	Harvesting of beans	
June			Harvesting of beans or tobacco
July	Preparation of field		
Aug.	H a r v e s t i n g o f t u b e r s		
Sept.	Tilling (*sako*)	Light scratching (no tilling) of soil (*gaking*)	Tilling of small spots (*magang*) on black soil and level ground only
	Sept.-Oct. D r y i n g o f c o p r a		

Table 40

Agricultural calendar (III): Northern slope, lower elevation and eastern slope of Mt Kimang-Buleng (up to 500 m)

Month	Agricultural system: bush fallowing, single cropping		
	uma lelé/uma pare uma weru	*uma bue uma weru*	*uma lelé/uma bue amak*
Oct.	Planting of maize, dry-land rice and tubers	Planting of peanuts (at Kimang-Buleng)	Planting of maize and tubers
Nov.			
Dec.	First weeding (*noti gung*) Second weeding (*noti wong*) or (*lega waang wong*) [except at Kimang-Buleng]		First weeding (*gajar*)
Jan.			Second rough weeding (seldom) (*lega waang wong*)
Feb.	Harvesting of maize	Harvesting of peanuts (at Kimang-Buleng) Planting of beans or tobacco (on northern slopes)	Harvesting of maize, planting of beans (at Kimang-Buleng)
Mar.			
Apr.	Harvesting of dry-land rice		
May	Harvesting of dry-land rice (at Kimang-Buleng)	Harvesting of beans or tobacco (on northern slopes)	Harvesting of beans (at Kimang-Buleng)
June			
July	Harvesting of tubers Preparation of field: cutting grass (*opi*) and small trees (*roa*) first burning (*holo*) second burning (*holo haning*) Tilling (*sako*)		Harvesting of tubers
Aug.		Tilling (*sako*)	Tilling (*sako*)
Sept.	Rough weeding before planting (*lega waang wong*)		

Table 41

Agricultural calendar (IV): Northern slopes, higher elevation

Month	Agricultural system: bush fallowing, double cropping — *uma lelê/uma pare uma weru*	*uma lelê/uma pare amak weru*	*uma lelê amak rewuk*
Oct.	Planting of maize and dry-land rice, tubers (on margin and at *blepeng*)	Second light tilling (*gajar*) (Sept.-Oct.) planting of maize and dry-land rice, tubers	Sept.-Oct. planting of maize
Nov.	Planting of maize and dry-land rice, tubers (on margin and at *blepeng*)	First weeding (*noti*)	First weeding (*gajar*)
Dec.	First weeding (*noti gung*)	Second weeding (*noti*) Third weeding (*lega waang wong*)	Second weeding (*gajar*) Third weeding (*lega waang wong*)
Jan.	Second weeding (*noti waang nurak*) (omitted at saddle of Blatat-ating)		
Feb.	Harvesting of maize	Harvesting of maize	Harvesting of maize; Planting of beans, green gram (at lower elevations only - e.g. below 300 m)
Mar.	Harvesting of maize	Harvesting of dry-land rice	Planting of beans, green gram (at lower elevations only - e.g. below 300 m)
Apr.	Harvesting of dry-land rice, planting of dry-season maize (*nona lelê daran*)		Weeding (*noti*)
May	Harvesting of dry-land rice, planting of dry-season maize (*nona lelê daran*)		
June	First weeding (*gajar*)	First weeding for sweet potatoes and cassava (*noti waang tuka ai ohu*)	Harvesting of beans (at lower elevations only)
July	Second weeding (*gajar*); Harvesting of dry-season maize (*rape lelê daran*)	Second weeding for sweet potatoes and cassava; Harvesting of tubers	Harvesting of tubers
Aug.	Harvesting of dry-season maize (*rape lelê daran*); Harvesting of tubers	Harvesting of tubers; First light tilling (*gajar*)	
Sept.	Harvesting of dry-season maize in Blatatating, preparation of new field, first light tilling (*gajar*)	Second light tilling (*gajar*), planting of tubers, mainly cassava (*paat ai ohu*)	

Table 42

Agricultural calendar (VI): Higher slopes of Mt Tarat

Month	Agricultural system: bush fallowing, triple cropping			
	Northwest slope (Koker)		Southwest slope (Kloangpopot)	
	uma lelé/ uma pare uma weru	*uma lelé/ uma wewe tana amak*	*uma lelé/ uma pare uma weru*	*uma lelé/ uma wewe tana amak*
Oct.	Sept.-Nov. Planting of maize and dry-land rice tubers (on margin and at *blepeng* only)		Planting of maize, dry-land rice and tubers (on margin and at *blepeng* only)	
Nov.		Harvesting of early maize (*rape lelé plalak*)		Harvesting of early maize (*rape lelé plalak*)
Dec.	Weeding (*noti*)		Weeding (*noti*)	Planting of peanuts
Jan.		Planting of peanuts (*nona wewe tana*)		
Feb.	Harvesting of maize(Jan.-Mar.)		Harvesting of maize	Harvesting of peanuts
Mar.	Harvesting of dry-land rice		harvesting of dry-land rice	Tilling (*sako*)
Apr.	Planting of dry-season maize (*nona lelé daran*)	Harvesting of peanuts (*aha wewe tana*), planting of dry-season maize	Planting of dry-season maize	Planting of dry-season maize
May				
June				
July	Harvesting of dry-season maize (*rape lelé daran*) Harvesting of tubers	Harvesting of dry-season maize Harvesting of tubers	Harvesting of dry-season maize Harvesting of tubers	Harvesting of dry-season maize Harvesting of tubers
Aug.				
Sept.	Planting of early maize (*nona lelé plalak*) and tubers		Planting of early maize (*nona lelé plalak*) and tubers	

Continued: see *amak*

Table 43

Agricultural calendar (VIII): Southern slopes, mid-altitude

Month	Agricultural system: bush fallowing, double cropping				
	Eastern portion (Kloangpopot, Ipir, Umauta, Hokor)		Western portion (Iligai, Sikka)		Eastern and Western portions
	uma lelê/uma pare uma weru	*amak*	*uma lelê/uma pare uma weru*	*uma lelê/amak*	*uma bue/uma weru*
Oct.	Planting of maize, dry-land rice and tubers	Planting of maize, dry-land rice and tubers	Planting of maize and dry-land rice	Harvesting of early maize (in Teongbakut, Sikka)	Planting of tubers (on margin of field only)
Nov.			weeding (once only (*noti*)	Harvesting of early maize (in Iligai)	
Dec.	Weeding (*noti*)	Weeding (*noti*)			
Jan.	Light weeding (*lega waang wong*)	Light weeding (*lega waang wong*)			
Feb.	Harvesting of maize	Harvesting of maize	Harvesting of maize		Planting of beans
Mar.	Harvesting of dry-land rice	Harvesting of dry-land rice	Harvesting of dry-land rice		
Apr.	Planting of dry-season maize (in Ipir at Watu-denak)				
May	Planting of dry-season maize (in Hokor)				Harvesting of beans
June	Harvesting of dry-season maize (in Ipir)		Harvesting of tubers, tilling (*sako*), planting of early maize (in Teongbakut, Sikka)		
July	Harvesting of dry-season maize (in Bokor)		Planting of early maize (*nona lelê plalak*) (in Iligai) and tubers		
Aug.				Tilling (*sako*)	Tilling (*sako*) Harvesting of tubers
Sept.	Harvesting of tubers Tilling (*sako*)	Harvesting of tubers Tilling (*sako*)			

Table 44

Agricultural calendar (VIII): Southern slopes, lower elevation

Month	Agricultural system: bush fallowing, single cropping *uma lelê/uma pare* *uma weru*	*uma bue* *uma weru*	*uma lelê amak* *(amak weru/amak rewuk)*
Oct.	T a p p i n g o f *k o l i* p a l m s Planting of maize and dry-land rice, tubers	Planting of tubers (on margin of field only)	Planting of maize, tubers and peanuts (occasionally)
Nov.	Weeding (once only) (*noti*)	Planting of maize and hill rice in forest	Weeding (*gajar*)
Dec.	in Hokor: weeding (3 times) (*gemok*)		
Jan.	Weeding (*lega waang wong*)		Harvesting of peanuts
Feb.	Harvesting of maize Planting of green gram	Planting of beans	Harvesting of maize
Mar.	Harvesting of dry-land rice		
Apr.			
May	T a p p i n g o f *k o l i* p a l m s	Harvesting of beans	
June			
July			
Aug.	H a r v e s t i n g o f t u b e r s		
Sept.	Tilling (*sako*) (except below Hokor, where *gemok* is common) T a p p i n g o f *k o l i* p a l m s		Tilling (*sako*) (except in Hokor)

agricultural system II (*uma kabor gong*) wherever only maize is planted on *uma weru* and on *amak* between November/December and February/March.

As we climb the mountains from the northern littoral plain the cropping patterns clearly reflect the impact of increasing humidity. The first change that we observe is that at lower elevations (agricultural system III) maize is planted together with dry-land rice on *uma weru*. Hence on first year fields green gram has to be planted separately in February/early March, since neither could the beans be planted between the unharvested hill rice at that time, nor could the planting of *bue* be postponed until April/May after the hill rice has been harvested. In that case the rainfall and the small amount of moisture stored in the soil would not be sufficient for the beans to reach maturity. This dilemma between the growing of hill rice and beans may serve to demonstrate the difficulties of intensifying hill rice cultivation in Central Sikka which is only possible at the expense of the growing of green gram. Even with fast growing rice varieties this dilemma would remain.

At even higher elevations (agricultural system IV.) hill rice may be cultivated on *uma weru* and on *amak weru*. Another significant change is found on fertile first year fields on which a second maize crop (*lelē daran*) is grown from May to July/August. On the saddle of Blatatating *lelê daran* may be harvested as late as early September. Edaphic conditions may also play a role in the growing of *lelē daran*. According to farmers at Wutik (Ds. Koting D) *lelê daran* can only be grown above Wutik (450 m) where clay soils dominate, and where the typical moisture holding capacity is higher than for *tana wura* in most of the mountains. Frequently, where only a thin humic layer has accumulated during the fallow years, the first crop to be planted on that field is *lelê daran*. Under such ecological conditions farmers cannot always plant *lelê daran* since shortage of land does not allow them to open up new fields every year.

The cropping sequence outlined for agricultural system IV somewhat resembles that of the eastern portion of agricultural system VII of mid-altitude parts of the southern slopes. Here, however, *lelê daran* is already planted towards the end of March and beginning of April. A more striking difference to agricultural system IV is encountered in the western portion of agricultural system VII. While farmers in Taongbakuk (Ds. Sikka) and Ds. Iligai maintain that they too could plant *lelê daran* from April to June, they prefer to plant a second maize crop from June/July until August which can be harvested in October and November. During that period rainfall is said to be less variable.

As we descend further towards the south coast rainfall incidence decreases so that below 200 m no more *lelê daran* is planted.

But unlike the drier north coast maize is grown together with hill rice on the southern littoral. Hence *bue* has to be planted separately on *uma weru*. It is usually not planted on *amak* because yields are comparatively poor. Here again the dilemma between the growing of green gram and hill rice on the same field is evident. As rainfall sets in earlier on the south coast than in other parts of Sikka maize cultivation commences in October and lasts until February, hence a few weeks earlier than elsewhere.

The most favourable rainfall conditions are found at elevations above 500 m - e.g. at higher slopes of Mt Tarat (agricultural calendar VI). Here maize could be produced throughout the year. Yet since the harvest of hill rice somewhat impinges upon the successive planting of maize only two crops of the latter are planted on *uma weru*: October/November to February/March and April/May to July/August. A third crop of maize (*lelé plalak*) is planted at the end of August/beginning of September, to be harvested in November, after which peanuts are grown which somewhat help restore soil fertility (January to April at Koker; November/December to February above Kloangpopot). The somewhat distinct cropping patterns of this zone are explained by the different exposition towards the monsoons.

Discussion

As we have seen, neither population pressure nor cash cropping can causally be correlated with the process of intensification of traditional cropping systems. A case in point is the northern littoral zone where we might have assumed that permanent farming practised here was attributable to the high population density found in the coastal desa. Such a strictly causal relationship does not exist as a large portion of the fields of the coastal desa are worked by sharecroppers from the hinterland and not by the coastal people themselves.

Neither could population pressure have been the variable determining the average size of the plots actually cultivated by each farmer (compare Fig. 26 with Fig. 34). These were smallest in the less densely populated southern coastal zone. It rather seems that the small size of the fields here is conditioned by the limited amount of labour available per family. No more than 0.5 ha can be worked by the members of each family under these particular environmental conditions. Mutual assistance does not materially increase the size of the plots cultivated. A greater degree of land parcelling may also have had an impact in this context. On the north coast, however, the plots under cultivation are considerably larger and normally worked by sharecroppers or paid labourers. This additional expense is justified only by the comparatively higher yields.

With respect to cash cropping we concluded that although its introduction reduced the area available for food cropping for subsistence needs (for instance, on the saddle of Nita), it did not induce farmers to work their fields underneath the fruit trees more often or even permanently nor did they invest more labour to restore soil productivity.

As physical factors, demographic pressure or the introduction of certain cash crops may not strictly be considered causal to the process of intensification of agricultural systems it seems useful to look at the various essentially external sources of change in more detail.

Chapter 2

Sources of change of the ecosystem

No agricultural changes have occurred in Sikka for which purely indigenous sources can be called responsible. On account of insularity, topographic seclusion and linguistic barriers agricultural techniques from other parts of Flores or the eastern Lesser Sundas hardly influenced Sikka's agriculture. The lack of diffusion of agricultural techniques and the spread of ideas even within Sikka is reflected for instance by the fact that until World War II neither maize nor tubers but only hill rice was grown and eaten by the population of Tanah Ai, eastern Sikka (Tan 1964a:11). Although maize and tubers - like cassava - have been introduced since, owing to the unbalanced array of cultivars this area is still frequently and far more severely hit by seasonal hunger - for instance in 1955, 1960, 1961 and 1965 - than densely populated Central Sikka. Hence changes brought about in Sikka's ecosystem have to be attributed largely to alien sources, as will be demonstrated in the subsequent paragraphs.

Foreign traders

Before the colonization of Sikka by European powers the population of Sikka's central portion was already brought into contact with the outside world through Buginese traders. In exchange for tamarind, candlenut and green gram the Sikkanese received cloth, knives, etc. from Sulawesi and islands further west. The main benefit of this trade seems to have gone to the inhabitants of the three saddles: that of Nita in the hinterland of the port of Alok (Maumere), that of Blatatating in the hinterland of the coastal settlements of Waipare and Bolong Bolong and that of Baomekot in the immediate hinterland of the port and Buginese settlement of Bajo (Geliting). Hardly involved in this trade were the inhabitants south of the central divide. As we have seen a number of Sikkanese from Sikka-Natar even moved permanently to the north coast and became middlemen between the wealthy foreign traders and the indigenous population of the mountains.

When at the turn of this century Pax Neerlandica was established in Sikka the Buginese monopoly was challenged by the arrival of Chinese who established themselves chiefly in Maumere and Geliting as merchants. Although the Chinese community in Sikka is still small by comparison with that of other commercial centres in eastern Indonesia - e.g. Kupang, Ende, Waingapu, Dili, etc. - commerce is noticeably controlled by this group today. The Chinese achieved this position by taking greater risks and frequently by engaging in business on a large scale. They buy indigenous crops and at the same time they purvey goods for sale, partly satisfying needs they themselves helped to create. Chinese may sell directly or finance Sikkanese small-scale merchants (*papalele*(I)) who purchase cash crops from the indigenous population at local markets (Plate 38). The *papalele*'s role has become increasingly important since the late 1950s when the Chinese (most of them non-Indonesian nationals) were prohibited from trading outside the commercial centre.

Yet Buginese have not been pushed out of business completely. They still hold an important position in Sikka's trade as owners and operators of trading vessels (*perahu* or *prau*) (Plate 49). Their position in providing transport to Surabaya and Makassar has, however, decreased steadily. Once already, during Dutch times, it was challenged by the steamers of the KPM (*Koninklijk Pakeetvaart Matschappij*) which called at Maumere and Geliting once a month and occasionally also at Nangahale (Hagenaar 1934). Although after World War II and particularly after 1957 when the KPM ceased to exist *perahu* transport increased a bit, it has become less significant today. This is partly due to the fact that Chinese traders are less prone to ship valuable commodities from Surabaya. *Perahu* shipping is considered more risky after entire shipments have disappeared. Since Maumere is called upon regularly by mission boats and freighters from Java, *perahu* freight rates have become less advantageous to shippers: freight rates from Maumere to Surabaya in 1976 were Rp. 5-6/kg for *perahu* against Rp.5-7/kg on regular freighters. The loading fees at Surabaya also differ slightly: Rp.2/kg for *perahu*; Rp.3-3.50/kg for freighter.

Hence the Buginese and Chinese merchants provided the means by which Sikkanese from the northern flanks of Central Sikka and the three saddles could sell their produce and indirectly reach larger markets. In exchange for crops or money the Chinese offered wares of the world. As a result of increased sales of commodity surpluses and increased circulation of money, expectations have been raised. Trade from distant places within Sikka was also furthered - road conditions permitting - through Chinese owned trucks which collected the produce for Maumere or Geliting. Since 1967 trucks of a peasant organization (Yaspem - Yasasan Pembangunan Maumere) founded by the Mission have significantly increased transport facilities. These trucks became forerunners of the minibuses (*bemo*) which were first introduced in 1974 (in 1976 there were over 50). These buses have greatly altered Sikka's transport structure (Plate 40). The minibuses have meanwhile brought most desa north of the central divide including the saddles into closer contact with the commercial centre of Maumere. This development was largely initiated by the Chinese of Maumere who had the capital to buy these minibuses. As in Indonesia *bemo* must not be operated by foreign nationals, the Chinese (mostly foreign nationals) have the *bemo* registered under the names of Indonesians whom they use as paid dummies. Ironically, the circumvention of this regulation increases costs which eventually have to be paid by the indigenous population who use the *bemo*.

The south coast not only of Central Sikka but also of its eastern and western portions was hardly touched by this development. Because of the lack of all-year communication over land as well as the lack of shipping links this portion of Sikka became a real backwater of economic development. This was recognized by the *raja* of Sikka who in 1948 made an abortive attempt at encouraging the Dutch administration to open up a coastal shipping service around Flores, thus encompassing also the south coast of Sikka. In his proposal (deposited in Sikka's archives, No.318 - *Coastal bedrijf in de Timor archipel* - dated 20 August 1948) he mentioned the following potential ports of call in Sikka: Mauloo (in Paga) from which about 30 tons of copra could be shipped, and Nemita (Ds. Waihawa) from which copra from the southern parts of the Iwanggete region could be shipped. According to the *raja* copra in this region was fed primarily to pigs. The *raja*'s proposal was not accepted. This negative reaction on the part of the Dutch authorities was probably also influenced by the virtual absence of traders - either Buginese or Chinese - at the two places mentioned.

The Portuguese

The success of the traders - particularly of the Chinese merchants - is intricately linked with the arrival of the Europeans. The first were the Portuguese who, though having come chiefly for religious purposes to Sikka, introduced a number of important cultigens - above all maize and cassava - to this part of the archipelago.[1] As evident from a report on Solor and Timor of 1624 cited by Gomes (p.182) maize seems already to have been well established on the isle of Solor, the headquarters of the Dominican Mission at that time. Here it had become a staple food with hill

[1]These as well as the following plants are believed to have been introduced into the archipelago from America by the Portuguese in the sixteenth century (see Ruy Cinatti Vaz Monteiro Gomes, 'Useful plants in Portuguese Timor. An historical survey', in *Actas do V Coloquio International de Estudos Luso-Brasileiros, Coimbra 1963*, Vol.I, Coimbra 1964:177-89): pineapple; cashewnut (*Anacardium occidentale*); musk-melon (*Cucurbita moschata*), sweet potatoes (*Ipomoea batatas*), groundnuts (*Arachis hypogaea*); Guayaba (*Psidium guajava*) known in Indonesia also as *jambu Portugis*; papaw (*Carica papaja*), etc.

rice. To what extent the Portuguese Dominican priests have introduced new agricultural techniques is not reported. In an agricultural survey report on Nusa Tenggara a FAO team (1960:62) conjectures:

> The more intensive agricultural activities at Maumere may be due, it is believed, to the influence of the Portuguese who cleared land and established themselves in the area in an agricultural settlement.

Although unfortunately no historical evidence could be found to substantiate the above statement, there is much to be said for it, for while most of the crops introduced into the archipelago by the Portuguese are found in Sikka proper - i.e. where the Dominican Mission was most active - in Tanah Ai, eastern Sikka, where the Mission's impact was but slight and limited to the coastal settlement of Krove (see Fig. 19, p.68), until quite recently only hill rice was cultivated. Cassava and maize were not grown - allegedly on grounds of local *adat*. On Central Sikka's south coast - e.g. at Hokor and Wolonwalu which had hardly been reached by Portuguese missionaries - yam growing plays a far greater role than anywhere else in Central Sikka. Yams (*Dioscorea* sp.) are known to be an old-world tropical tuber, and the staple food of the islanders before the arrival of the Europeans in Southeast Asia.

The Dutch

While the impact of Portuguese missionaries on Sikkanese agriculture cannot be fully elucidated, more convincing evidence is found for the influence of Dutch rule, which set the stage for agricultural changes. These changes have been brought about indirectly - e.g. through the imposition of taxes which forced the Sikkanese into the labour market or into cash crop production, and directly - e.g. through laws aimed at the protection of natural resources as well as through the introduction of new crops and agricultural techniques.

Resettlement. As a result of Pax Neerlandica people felt more secure. Instead of pallisaded nucleated villages a more dispersed settlement pattern began to evolve. This development was, however, reversed in the 1920s and 1930s. In order to facilitate administrative control scattered hamlets were joined in larger villages, often strung on both sides of a path or a road. This pattern, described earlier, is still common today. Central Sikka north of the watershed was particularly subjected to this policy, as evidenced by several examples.

After a trip around Mt Dobo the Catholic priest Sevink (1914: 11-12) reported that the population of more than twenty small villages and hamlets was resettled by the *civiel gezaghebber* of Maoemere in the seven larger villages of Brai, Habigahar, Ara, Habigete, Liangtahon, Ili and Higetegera. Also ten Dam (1950b:11) mentions the resettlement of people living in scattered locations in the mountains to villages at lower elevation for the Nita area: from Kelong to Tour (west of Tilang), from Nerulero to Bei, from Koligahar to Wukak and Bloro, from Natarwulu to Rotat and from old Wolomarang (formerly in the mountains) to new Wolomarang (presently located near Bebeng at sealevel). He emphasizes that many hamlets (*kloäng*) have entirely disappeared following this policy. Similar information was given to me by village elders of other desa - for example in 1910 people who lived around Nilo (Ds. Nitakloang) were ordered to move to Rotat (Ds. Nitakloang) from where they returned to their old abodes after 1922 when Rotat turned out to be too small for everybody to make a living. Also people from Lirikelang had to move to Wolomarang (on the west). Similar reports were heard at Nele where *kapitan* Nurak was said to have ordered the population of the mountains to move to lower locations in the second decade of this century.

In 1916 Koting, Nita and Nele were the most densely populated villages of Sikka, each having about 300 houses. For the same year most people of Central Sikka north of the watershed were already reported to be living in villages along roads (Hens 1916 I:210). As mentioned earlier (pp.104ff.) the settlement pattern found here differed significantly from that in eastern Sikka (Tana Ai) where the population lived and still largely lives in hamlets composed of three to four houses at most. Although plans existed also for Tana Ai to concentrate the population in villages, only four villages were formed in the east until 1916 (Natarmage, Werang, Ndettung, Mudebali). The resistance of the local population against such efforts of the administration was due to the high degree of mobility of the population which was said to move its settlements along with their *ladang* fields every three to four years (Hens 1916 I:209).

Administrative control was also the chief objective when the Dutch administration resettled thousands of hill farmers along the Flores road which was completed in 1926. An example of local resettlement is given for Lekebai in the eastern portion of Sikka in Fig.40. In the 1930s resettlement reached major dimensions when forest reserves were established from where the native population was removed. The population was thus brought into closer contact with the administration, facilitating agricultural extension, education, etc.

Road construction. Under Dutch administration road construction had a major impact upon the economic development of the island. Central Sikka in particular derived by far the greatest benefits from the road construction program. Before 1916 a number of secondary roads had already been constructed from the main Maumere-Geliting road along the north coast, thereby linking most of Central Sikka's highland north of the central divide with the commercial centres on the coast. These secondary roads were

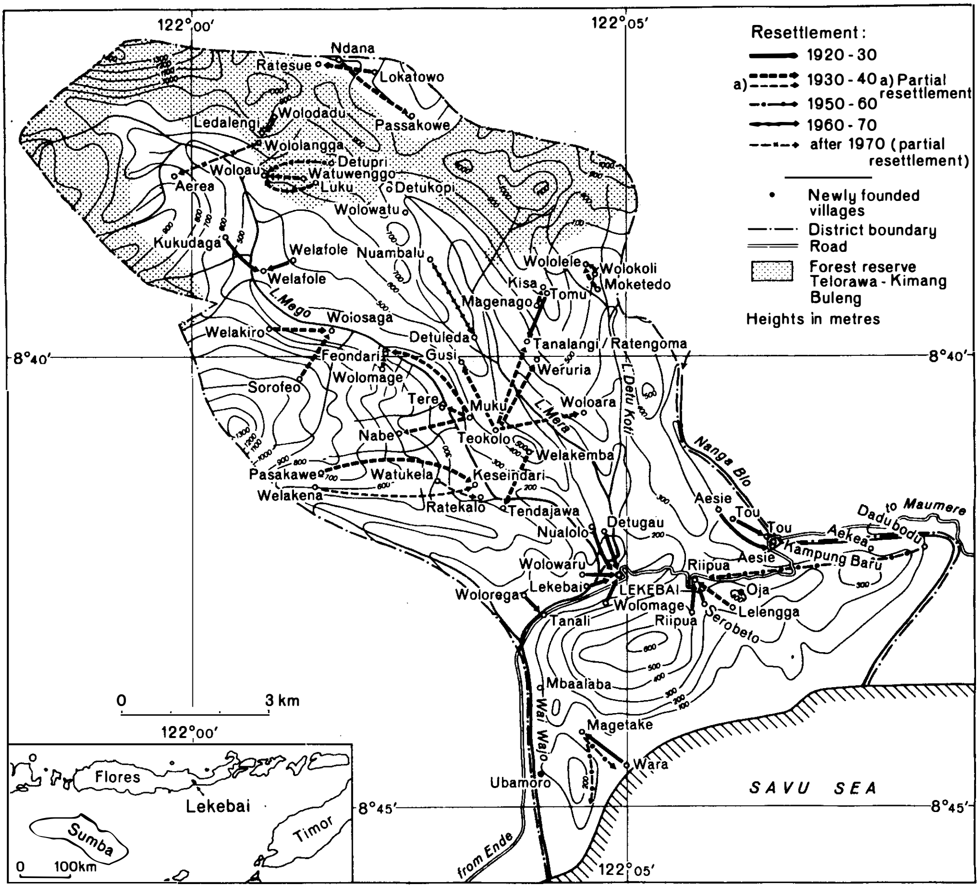

Fig.40 Lekebai: demographic mobility since 1920

between Maumere and Nele, Waioti, Brai and Kloangkoja, Waioti and Wetakara, Waipare and Ili, Koting and Nele, and Koting and Nita. Another road from Maumere to Koting and ultimately to Lela was completed before 1920. The saddle of Nita was clearly far better equipped with roads than the rest of the *onderafdeeling*. Its position was further strengthened through the Floresweg (main road) in 1926 which linked Reo in the west (Manggarai) with Larantuka in the east over a distance of 607 km. This road was basically constructed for political reasons as evidenced by the fact that it runs mainly through the interior of the island. Its economic significance was limited. An exception to this rule was the saddle of Nita where the road crosses the isthmus. The main road was usually kept in better condition - at least until the 1950s - through statute labour (*herendiensten*) used for its maintenance. In contrast to it were secondary roads, e.g. to the south coast (Waipare to Ili and Bola and later Geliting to Bola) which often became impassable for longer periods. This situation has not changed. The lack of economic development due to the absence of roads on the southern portions of Central Sikka is still noticeable today.

Indirect change: taxation. In 1910 the Dutch administration sought to replace the various forms of tribute (*upeti*) hitherto paid by the indigenous population to the local *raja* on Flores (Missive d. Gouvernements Secretaris v. 2 Dec. 1910, Bijblad No. 7328). No standardized tax system for the entire island was envisaged at that stage. In Sikka all able-bodied men were required to pay the following two types of taxes:

1. An annual head tax (*uang badan*) initially of f 2 which changed to about f 5 after 1918;
2. Commodity taxes (*uang harta*) of f 0.50 per horse and 4 per cent on the estimated yield of f 2 copra per coconut tree - i.e. f 0.08/tree.

As mentioned earlier (p.80) in the wake of the imposition of these taxes local resistance flared up in various parts of the onderafdeeling Maoemere which made it necessary for government troops to intervene. Yet as Sikka was considered economically far more advanced than other parts of Flores commodity taxes were exclusively levied in Sikka until 1918 when a government regulation (Besluit v.d. Resident van Timor en onderhoorigheden v. 29. Juli 1918 No.393; see van den Ende 1954:44) made the payment of both head and commodity taxes compulsory throughout the island. Yet not only had Sikka's tax revenue been among the highest in absolute terms on Flores, but her tax burden per taxpayer also ranked first in the *Residentie Timor en onderhoorigheden*.

At the same time fixed salaries were introduced for the three *raja* for their services as government officials. A monthly salary of f 400 was paid to the *raja* of Sikka in 1916 which was the highest monthly salary paid to a *raja* anywhere in Flores. It underlines the political significance the Dutch attached to this central figure in eastern Flores. In addition the three *raja* of onderafdeeling Maoemere received an annual payment from the Dutch government in exchange for rights to levy customs duties.[2] They were the only *raja* of Flores who were given this annual indemnity by Gouv. Besluit v. 11 April 1904 No.7 (see Hens 1916 II:129). Heads of subdistricts (*kapitan*) were likewise given fixed monthly salaries which varied between f 30 and f 50 (Hens 1916 II:134-5). According to several reports by *residents* (Nijs Bik 1934; Bosch 1938) Sikka was the only *landschap* of the *afdeeling* Flores where governmental instructions were carried out without difficulty.

In contrast to most other parts of Flores Sikka usually managed to attain a net surplus in its budget. But instead of using these funds herself for improving her infrastructure Sikka

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[2]In 1915 import taxes of f 477,78½ and export taxes (for forest products) of f 57.90 were levied by the Dutch in Maumere (Hens 1916 II:123).

Table 45

Tax revenue in onderafdeeling Maoemere

Year	Amount	Number of taxpayers	Tax burden per taxpayer	Taxpayers in per cent of population	Source
1912	f 81,000.00				Flores Memorie (1912:148)
1924		21,731[a]	f 5.55[a]		Couvreur (1924)
1931	f 103,047.62	27,762		22.7	
1934		27,409[b]			van der Ende (1954:15, 45-6)
1939	f 73,997.97	28,607			

a	taxpayers	taxburden per taxpayer
Sikka and Kangae	19,037	f 5.03
Nita	2,694	f 6.07
	21,731	

b Slight decrease in the number of taxpayers due to the fact that between 1932 and 1937 Sikka was solely ruled by the local *raja* as *zelfbestuurer* while the Dutch *controleur* was stationed in Larantuka (East Flores).

Table 46

Salaries paid to *zelfbestuurer* (*raja*) in onderafdeeling Maoemere in 1916

Raja of *landschap*	Monthly salary	Monthly travel allowance	Annual payment in exchange for rights to levy customs duties
Sikka	f 400	f 30	f 100
Nita	f 150	f 30	f 60
Kangae	f 300	f 15	f 250

Source: Hens 1916 II:129-35.

had to transfer the money from her *landschapskas* to the common *Floreskas* from which other districts on Flores were subsidized. Various attempts by the *raja* of Sikka to separate the *Sikkakas* from the *Floreskas* were of no avail (Bosselaar 1932:56ff). As a result of taxation the Sikkanese were forced either to produce crops for sale or to enter the labour market.

An additional source of change was brought about by the imposition of compulsory labour (*herendiensten*) (Brieven d. Residenten v. Timor en onderhoorigheden v. 6 Nov. 1909 No.2934; juncto 10 Dec. 1909 No.2451; see Maier 1918:Appendix), according to which every man between 16 and 60 years of age was initially required to work a maximum of 40 days per year without pay. In 1922 this regulation was slightly modified and standardized for the *Residentie* as a whole (Besluit v.d. Resident v. Timor en Onderhoorigheden v.1. Jan. 1922 No.7 cited by Couvreur 1924:166ff). In the late 1920s the number of days required as *herendiensten* was lowered further to 24 days in Sikka, of which in 1932 only 12 to 15 days were actually rendered (Bosselaar 1932:63).[3]

Table 47

Men subject to *herendiensten* in Sikka

Year	Men	Source
1924	17,546	Couvreur (1924)
1926	25,014	Schultz (1927:Appendix X)

In Sikka *herendiensten* were usually rendered for the construction and the maintenance of the Floresweg. On account of their comparatively stronger economic position the Sikkanese largely availed themselves of the possibility of paying an annual severance pay per person of 10 guilders (1920-30), 3 to 4 guilders (1930-38) and finally 2.50 guilders (1939-40) instead of *herendiensten* (van den Ende 1954:79).

Table 48 shows to what extent this alternative was resorted to by the Sikkanese until 1940 when the *herendiensten* (also called *gemeentedienst*) were abolished (van den Ende 1954:79). It also makes evident that Sikkanese, because of their comparatively strong economic position, availed themselves of this possibility long before people of other parts of Flores followed. Finally the figures reflect the worldwide depression of the 1930s.

After the war the ardently disputed *herendiensten* regulations[4]

[3]These figures differ slightly from those of Rusconi (1940a:9) who reports a decrease in the number of compulsory labour days from 32 to 28 in 1939 (citing *Zelfbestuursbesluit* of 31 July 1939 No.18/L).

[4]One of the objections against *herendiensten* was that farmers had to render these labour services at a time when they ought to have been working on their fields. These fields were often badly neglected on account of *herendiensten*, a situation which led to food shortage. In the absence of general control the time at which

were replaced by the *weggeldordonnatie*, according to which the people were free to choose between either the payment of a tax or the rendering of labour for road construction. As too few Sikkanese opted for the latter possibility, road construction was endangered. In 1950 the *raja* decreed that only those Sikkanese were allowed to redeem themselves whose household taxes (*pajak rumah tangga*) exceeded Rp. 30. As this was but a small fraction of all households most Sikkanese men had to render labour for road repair (ten Dam 1950b:25).

Table 48

Labour release fee (*afkoopgelden*) in lieu of *herendiensten* on Flores by onderafdeeling (in guilders)

Year	Maoemere	Manggarai	Ngada	Ende	Oost-Flores en Solor eilanden
1925	22,738.00				
1926	16,315.00				
1927	6,295.00	6,150	1,310	9,022.50	860.00
1928	6,230.00	7,430	470	7,230.00	317.50
1929	4,240.00	5,215	800	5,000.00	2,316.50
1930	4,223.75	1,825	120	4,666.20	343.75
1931	2,826.50	830	-	2,505.00	436.50
1932	502.50	-	-	-	75.00
1933	222.00	-	-	-	17.00
1934	73.50	-	-	-	22.10
1938	1,635.00	-	-	-	-
1939	3,464.85	-	-	-	-
1940[a]	1,120.97	-	-	-	-

a Until October 1940.

Sources: 1927-31: Bosselaar (1932:64) (except for Maoemere and East Flores, 1930-31).
1930-34: Simons (1936:20) (for Maoemere and East Flores).
1938-40: Rusconi (1940a) (for Maoemere).

[4] (continued)
herendiensten had to be rendered was fixed at random by the *zelfbestuurer*. Abuses by the latter frequently occurred (see de Apostolische Vicaris van de Kleinen Soenda Eilanden 1939:3-5).

Forest reserves. A significant change was brought about in Sikka by the creation of forest reserves, most of which were demarcated in the 1930s and followed by a few smaller additions only after World War II. The main purpose for setting aside forest reserves was the protection of water catchments. Human intrusion was henceforth declared illegal. People living in the areas demarcated as forest reserves were induced to move to places outside. The protection of these reserves against illegal encroachment by *ladang* farmers became a major concern of Dutch authorities. In Manggarai (West Flores) an abortive attempt was made in 1934 at introducing the concept of collective guilt in case of trespassing (van den Ende 1954:20). Severe punishments and permanent control made sure that these regulations were carefully enforced during the Dutch administration. Yet after independence land-hungry farmers penetrated into forest reserves where they opened new fields. Although by now conditions have slightly improved, illegal encroachment is still reported.

Regulations (e.g. Bouwkruinbeschermingsverordening of 1937; Endert 1938:24) aimed at curbing *ladang* agriculture in forests outside the forest reserves (*hutan cadangan*) seem to have been of comparatively little effect. If such regulations had hardly been observed under Dutch rule, they were completely ignored after World War II. Not even the introduction of collective guilt in case of fire in a *gemeente*, as stipulated in a regulation by the council of *raja* of Flores dated 8 July 1947 No.4 (DJKP 1973:91), yielded positive results.

Since 1953 Sikka's forestry service has stressed the importance of demarcating additional reserves (at least 1880 ha) which would link the main existing forest reserves and would provide fuller protection of the watershed - for example at the saddles of Blatatating and Baomekot. Yet such plans never materialized since population density had reached such dimensions that too many families would have to be removed from the proposed reserves.

The creation of forest reserves under Dutch rule thus had a similar effect with respect to raising agrarian densities as had the introduction of tree crops for commercial purposes. These, as we have seen, forced the population either to cultivate their subsistence food crops on new hitherto uncultivated land away from their homes or to adopt more intensive agricultural techniques. On the island of Flores the pressure caused by both, the creation of forest reserves and the introduction of perennial crops for cash, was particularly strong in Central Sikka. That this portion of Sikka benefited comparatively more from agricultural advice than other parts of Flores will be shown in the following section.

Agricultural extension. The Dutch government contributed heavily to the regional differentiation with respect to the degree of market-orientation of the population through its agricultural extension activities. The first two decades after pacification were characterized by a strong emphasis and a support given by Dutch authorities to large-scale commercial agricultural enterprises. Comparatively little expenditure was made for agricultural extension (in 1931: only f 20,000 for the whole of Flores: van den Ende 1954:22). Yet experience with such enterprises on Flores had been negative - for example in Sikka with cotton, as was shown earlier, and in Lambo (Ngada) with a plantation held in hereditary tenure by a Dutchman whose endeavours to grow coffee, rubber, kapok and sisal failed (Bosselaar 1932:14).

A thorough change in the attitude of the Dutch was brought about in 1929-30 when a food shortage of alarming dimensions hit the islanders. In the wake of this incident an agricultural extension service (*landbouwvoorlichtingsdienst* - LVD) was created in the *residentie Timor en onderhoorigheden* headed by a *landbouwconsulent* who was stationed in Kupang, the regency's capital on Timor. Subordinate agricultural staff was placed on Flores: a *landbouwkundig ambtenaar* at Ende as head of the LVD on the island;[5] a *landbouwopzichter* in Manggarai where the food shortage was particularly severe; and 11 *mantri* or *mandur* - i.e. agricultural assistants - who were stationed throughout the island. The onderafdeeling Maoemere received only one *mantri* as this district was considered least hit by hunger (Bosselaar 1932:24 and 27). Agricultural extension, however, rapidly improved in Sikka during the 1930s when the official policy under *resident* Nijs Bik at Kupang put a somewhat greater emphasis on the cultivation of cash crops. The government's policy aimed at increasing production of food and commercial crops was implemented by force (*perintah keras*).

Among the earliest government steps in the sphere of traditional agriculture was a law which in the 1930s required every farmer to plant a fixed number of about fifty coconut palms (Dam 1950b:23). As these palms were often planted on foreign clanland lengthy quarrels ensued in the 1950s when individualization of land ownership began.

In order to ensure a sufficient supply of food crops a regulation (Zelfbestuurslandbouwverordening v.22 Sept. 1936) was introduced under *raja* Thomas da Silva of Sikka which required each farmer, among other things:

1. to regularly cultivate a garden of at least one *bahu*(I) (*porong ha*(S)) (= 0.71 ha);
2. to work the garden according to specific agricultural calendars differentiated for each village and according to which the months for preparing (slashing trees or bushes; hoeing) and planting the fields, distinguished for first-year and second-year fields, were determined;

[5]Only in 1948 did the Dutch create a separate agricultural extension service on Flores which was independent from Kupang (DPS Annual Report of 1948:1).

3. to consult the head of the village for the exact date of preparing the field and for planting;

4. to prevent soil and gully erosion on fields located on steep hillsides by constructing *blepeng* (bamboo poles supposed to harness erosion);

5. to erect boundary marks;

6. to build strong fences against livestock and game.

Severe punishments ensured the observation of these regulations.

Moreover, in the late 1930s compulsory planting of bananas, mangoes and breadfruit trees in housegardens was introduced in Central Sikka as a means to forestall seasonal hunger (van den Ende 1954:35). The government was encouraged to make this decision on the grounds of positive experiences gained from similar housegardens at Nangahure, Nangarasong, Gute, Wolokoli and Magepanda (Overzicht van het landbouw 1940:4).

Along with these measures the Dutch made increased efforts at raising agricultural productivity of subsistence food cropping. To this end they propagated various techniques of terracing: either direct terracing with stones and wood or indirect terracing whereby *lamtoro* is simply planted in contour lines (Plates 43, 44, 45). Such efforts had been made already before World War II in Bola and Nangalimang (Overzicht van het landbouw 1940:5) and in 1946-47 at Watublapi, Lekebai, Napung Liti, Wolon Betan and a few other places (Tomasoa 1947, Appendix 2:15).[6] Moreover legumes[7] were introduced, the seed of which was multiplied at the government experimental fields (*proeftuin*) at Bebeng/Wolomarang and subsequently distributed to the farmers. Emphasis was also laid on the introduction of new plants serving as fallow vegetation. Experiments at developing suitable combinations of fast growing plants were started in 1939 at Watublapi and Wairpelit (Overzicht van het landbouw 1940:5). These experiements were continued after the war with *Leucaena leucocephala, Sesbania grandiflora, Acacia oraria, Acacia villosa, Cassia timoriensis, Desmodium chevalotus* and *Erythrina* sp. (*dadap*(I)) (Tomasoa 1947, Appendix 2:14).

Agricultural extension officers acted as purposeful agents of change. By 1940 Sikka counted more agricultural extension officers

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[6]*Lamtoro* was not readily accepted by farmers as its seed production was so prolific that it threatened to impinge upon food crops. The terraces with *lamtoro* hedges found today in Sikka are all of more recent origin.

[7]*Lamtoro (Leucaena leucocephala), Centrosema plumieri, Tephrosia hookeriana, Tephrosia vogelii, Calopogonium mucunoides, Tephrosia vestita,* soy beans, *Dolichos lablab, Cajanus cajan* (names encountered on a sketch map of experimental fields of Wolomarang/Bebeng dated 1939).

than any other *onderafdeeling* on Flores: one *landbouwopzichter*, 2 *mantri*, 2 *mandur* and one *proeftuinbewaker* (guardian of an experimental field) (van den Ende 1954:22). A number of new crops and new varieties were introduced. Experimental plantings of coconuts, cotton, kapok (*Ceiba pentandra*), coffee, onions and green gram were opened at Bebeng. These were maintained by *mandur*. The coconuts used as seed were selected and originated from a mission plantation at Nangahale (Rusconi 1940a:18).

A direct result of Dutch policy has been the diffusion of the cultivation of a number of cash crops in Central Sikka's more accessible parts. This portion of Sikka had an additional advantage, for after the war the major local markets received a remarkable impetus through the opening of new and cheaper transport facilities. Trucks brought the farmers and their products from great distances to these markets (ten Dam 1950b:13-14). Thereby food crop production (e.g. maize, green gram, yams, etc.) on a cash basis became possible. The less accessible south coast, however, hardly received any agricultural extension and its isolation prevented its participation in this commercial development.

The experience with cash crops, however, has taught a lesson to the indigenous population. The hazards of pests and price fluctuations have induced them to adopt a cautious attitude. Spreading of risk is thus the result and this helps to explain why monoculture is not practised in Sikka. Cash crop production - particularly that of coconuts - has locally also led to a disintensification of agriculture. Less labour is invested in the cultivation of food crops. As farmers prefer to keep a close eye on their trees - for fear of theft and illegal burning - they are usually reluctant to move their home to distant locations. Cash crop cultivation has thus contributed to cementing the settlement pattern.

The mission

Although Portuguese Dominican priests are reported to have missionized Sikka from the sixteenth century their impact with regard to the economic life and education of the native population was but slight. Around 1860 only 3800 Christians were reported in Sikka against 7200 in Larantuka (Vriens 1972:106). Evangelization began to bear fruit only when Dutch administration established itself in central Flores. Missionary activity concentrated in the region of the kingdom of Sikka whose founder Alesu is said to have been converted to Christianity as the first ruler of Flores. Therefore in this portion of Sikka prospects looked brighter for the Jesuit priests who, until 1874, had been visiting Sikka from Larantuka.

The development of the mission in Sikka was a very rapid one. After the founding of the first missionary station in

Maumere in 1874 a number of other stations were opened, all of them concentrated in the Sikka-Natar-Maumere isthmus. These were Sikka-Natar (1884), Koting (1888), Lela (1893) and Nita (1912).[8] Only after 1911 did missionary activity extend beyond the kingdom of Sikka. In 1914 a priest wrote of his first trip around Mt Dobo (Sevink 1914). In 1912 there were already six priests in Central Sikka, in addition to twelve sisters at Lela (Flores Memorie 1912: 89). Missionary activity in this part of Flores is evident from the fact that although evangelization started first in Larantuka (1859: about 9000 Christians at Larantuka according to Winokan 1960:3), central Flores (i.e. the present Kabupaten Sikka) had more Christians and more village schools in 1919 (BDP 1974:1158-61). The fruit of the missionaries' untiring efforts is reflected in the growth of the number of baptized persons (Table 49).[9] In 1913 the Catholic mission in the eastern Lesser Sunda Islands was handed over to the Divine Word missionaries of Steyl (SVD) who, because of World War I, did not take up their work in Sikka until 1919.

Table 49

Number of baptized persons in Sikka, 1873-1971

Year	Number	Source
1873	6,376	Heynen (1876b:87). Of this figure 5750 lived in Sikka-Natar, 576 in Maumere and 50 in Nita.
1902	8,346	Ijsseldijk (1920:109) (only 7494 in East Flores)
1916	17,509	Hens (1916: II:23 and 29), Maier (1918 I:10) (35,010 Christians were reported for Flores)
1924	32,164	Couvreur (1924:App.)
1926	37,264	Schultz (1927:App. X) (= 31% of population)
1930	49,950	van den Ende (1954:62)
1940	78,756	Rusconi (1940a:30)
1950	103,137	van den Ende (1954:62)
1960	130,700	Braun (1968) (= 80% of population)
1971	159,666	Parera (1971:26) (= 84% of population)

[8]Yet according to Jacobsen (1896:45) cannibalism was still said to have occurred in Koting (formerly known as Kotta) in 1885.

[9]In fact Sikka has the highest percentage of Christians of any part of Flores.

The role of schools in the spread of Christianity was recognized by the mission from the beginning. The first mission school with twenty pupils was opened at Maumere in 1877 (Kondi: (b) n.d.: 1). Elementary schools were subsequently opened at all of the mission stations: two boys' schools in Lela and Koting and a girls' school in Maumere founded by sisters of Tilburg (Zusters van de Liefde) in 1892, which was moved to Lela in 1899 because of Maumere's unhealthy climate (Piscaty 1964:65). In addition to mission schools government-run schools were opened in Flores.

The parallel development of different school systems throughout the eastern Lesser Sunda Islands finally led to the conclusion of a contract (*Flores-Soemba Regeling*) between the Catholic mission, the Protestant mission and the Dutch East Indies government in 1913. It stipulated that all forms of education be left to the Catholic mission on Flores (with the exception of Adonara) and to the Protestant mission on Sumba. All lower elementary schools (three years) (*Volksscholen*), although in the hands of the mission, were subsidized by the government, while higher elementary schools (four years) (*Standaardscholen*) were financed partly by the government (75 per cent), partly by the mission (25 per cent). It was further agreed that, although the mission was free in its educational approach, nobody should be forced to undergo religious education. In predominantly Islamic regions religious classes were therefore not held at all. Schools which were not run by the mission were not entitled to receive governmental support. All schools were subject to regular control by government supervisors (van den Ende 1954:66). Although this contract was subsequently modified its essence was not changed and remained effective until 1942. The mission on Flores was thus given the monopoly of education. On the basis of the contract of 1913 (Staatsblad v. Ned. Indie 1913 No.309), and the modified version of 1915 (Staatsblad v. Ned. Indie 1915 No.620), education developed rapidly throughout Flores and particularly in Sikka.

Before education on Flores was handed over to the mission in 1913 the following schools existed on the island (Hens 1916 II:75):

a. Mission schools:
- 2 boarding schools at Larantuka (one for girls, one for boys)
- 2 boarding schools at Lela (one for girls, one for boys)
- 2 ordinary primary schools at Maumere and Sikka.

b. Government-run primary schools:

3	in *onderafdeeling*	Ende
2	" "	Ngada
6	" "	Maoemere
2	" "	Oost Flores
3	" "	Manggarai

These figures already underscore Sikka's dominant position in the field of education. The Lela/Sikka-Maumere region has been the focus of all educational activities of both the government and the mission. That position was further strengthened in the following years.

The development of education in Sikka was quite remarkable, as exemplified by the figures in Table 50. In 1932 Sikka's percentage of pupils of the total population was already the highest (5.1 per cent) on Flores, while average figures for Flores (3.47 per cent) exceeded those of Java and Madura (2.73 per cent) and considerably exceeded those of the Indonesian average (2.78 per cent) (Bosselaar 1936:6).

This remarkable development would probably not have been possible had the population not exhibited such a strong desire for education. The costs of running the schools were met through a school fund (*schoolfonds*) into which also flowed compulsory contributions from taxpayers. These annual educational taxes varied between f 0.25 and f 0.80 per taxpayer. People who lived in a place where a school had been built had to pay twice that amount on the grounds that they benefited more from the existence of a school than families who did not have that facility near their residence. In an effort to strengthen the financial position of the schools, school gardens were set up by the pupils and the teachers. In the onderafdeeling Maoemere where the population was particularly active in this respect ten school gardens already existed in 1916. In each of these gardens 2000 coconuts were planted, A total of 12,000 coconut trees finally yielded fruits which together amounted to a harvest of 124 *pikul* (1 *pikul* = 62 kg) of copra (Hens 1916 II:84).

In addition to *volksscholen* and a *standaardschool* in Lela a vocational school (*ambacht school*) for carpenters, masons, shoemakers and blacksmiths was opened by the mission in Maumere. Graduates from these schools were usually offered a job in the mission; some of them also found employment with Chinese entrepreneurs. Vocational education has been further emphasized by the mission in the last two decades. Thus the comparatively high level of education existing in Sikka at present has to be largely attributed to the mission. The Sikkanese proper were at an advantage as the first mission stations and the first schools were established on their portion of Sikka (see Rusconi 1940a:26). The indelible imprint of Christianity - and hence education - may account in part for the early acceptance of cash crops, particularly coconuts, in that region.

The Christianization of the Sikkanese led to a gradual disassociation of the native population from traditional *adat* rules. The process was, of course, strongest in the Maumere-Lela strip. It was here that such traditional institutions as communal landownership and hence the role of *tana puăng* soon became obsolete. What this meant for agricultural land use as well as for the

Table 50

Education in Sikka

Year	Schools	Teachers	Pupils: Boys	Pupils: Girls	Pupils: Total	Source
before 1913	10					Hens (1916 II:74-5)
1916	15[a]					Hens (1916 II:81)
1924	(Sikka) 19		1,570	859	2,429	
	(Kangae) 12		892	359	1,251	Couvreur (1924:App.)
	(Nita) 4		322	223	545	
	35		2,784	1,441	4,225	
1930	53	116	4,550	2,503	7,053	Bosselaar (1932:2)
1939	45	113	3,879	3,119	6,998	van den Ende (1954:68)
1940	45	117	3,966	3,026	6,992	Rusconi (1940a:52)
1948	56	145	4,641	3,583	8,224	van den Ende (1954:68)
1950	54	65	5,768	4,219	9,987	ten Dam (1950b:15)
1953	63	190	7,380	4,934	12,314	van den Ende (1954:68)
1960	102 (1)	n.d. (1)	7,374 (2)	6,197 (2)	13,571 (2)	Braun (1968:4)
1967	176 (1)	705 (1)	10,398 (2)	9,455 (2)	19,853 (2)	(1) Say (1968:24-5)
						(2) Braun (1968:6)
1971	201	887			27,420	Parera (1971:43-4)

n.d. = no data

a At the end of 1916 there were 14 elementary schools in the onderafdeeling Maoemere, i.e. more than twice as many as in any other subdistrict of Flores (total number of elementary schools: 39). In that year the first schools outside the Lela-Maumere region were founded in Bola and Wetakara (Hens 1916 II:81).

environment as a whole has been demonstrated in previous chapters. Christianization also played a major role in the reduction of the forests: *adat* regulations which served religious as well as conservational purposes were increasingly less observed, the native population being encouraged by priests who condemned the old religion including the offerings that were made in sacred forests.

After the Dutch colonial government had withdrawn from Indonesia the church stepped into the vacuum thus created on Flores and enlarged its influence. If the government had led the drive to improve agriculture in the 1930s, it was the church that played the major role in such projects from the late 1950s and particularly from the second half of the 1960s when the national government of Indonesia stabilized. The basis of the church's activities in the field of socio-economic development not only in Sikka but in the entire Flores-Timor area has been the 'Flores-Timor Plan', conceived in 1963. Under this plan financial assistance is provided from overseas - mainly from the Federal Republic of Germany. In Central Sikka the church has been particularly active in the field of agricultural extension. Since 1966 the agricultural staff - known today as *Biro sosial* - of a farmers' organization (*Ikatan Petani Pancasila* - IPP), founded by the mission and since the 1970s reorganized as a foundation called *Yayasan Pembangunan* Maumere, has been carrying out agricultural training courses in the villages. Such courses were unique on Flores. Over 6600 farmers had participated up to 1974 (da Cunha 1974:25). Among other things they were taught the cultivation of new crops (e.g. vegetables), new varieties, techniques of composting and crop rotation, terracing, etc. Between 1966 and 1973 alone 750 ha were terraced. Additional teams of instructors were set up for specific purposes - a nutrition team (*kursus gizi*) and a pest control team (*team pemberantas hama*) for cacao and cloves - while the government's efforts were directed towards the control of pests affecting coconuts.

One of the most spectacular results of missionary activity in the field of agriculture in Sikka has been achieved by an anti-erosion campaign, which was launched in 1971 as a joint venture with the local government (Neunhäuser 1974). In view of the slow progress made with the time-consuming method of direct terracing which, moreover, is hardly feasible on sandy slopes of over 30 per cent gradient, a quicker, less laborious and less costly method of controlling erosion was needed. In this situation 'indirect terracing' with *lamtoro* planted along contour lines (Plates 43) on which the washed off soil collects, thus forming terraces (Plates 44 and 45) offered a solution. The fast growing leguminous shrub or small tree which grows wild in the eastern Lesser Sunda Islands is particularly suitable for this purpose as it makes few demands on soil and climate. It tolerates rainfall of 700 mm and its long taproot reaches water that other plants cannot get to. The evergreen *lamtoro* improves the soil structure. Its roots are even able to penetrate hard layers of clay soils. Since it can fix nitrogen in the soil - provided certain bacteria are present - it serves as a most suitable green fertilizer. Its leaves also provide excellent fodder.

Special anti-erosion teams (*team penanggulangan erosi*) propagated the planting of *lamtoro* hedges along contour lines in villages of Central Sikka. The high educational level in Central Sikka, specifically north of the watershed and on the saddles, may have been a strong catalytic factor in the spontaneous acceptance of this plant. Its acceptance moreover coincided with a certain high degree of population pressure, for earlier efforts aimed at introducing this plant for such purposes shortly before and after World War II were rejected by the population on the grounds that it spread too fast and jeopardized the growth of the crops in the fields. Likewise its deep roots were found too hard to pull.

When 'indirect terracing' was demonstrated by the anti-erosion team, Central Sikka's farmers were more open to suggestion. Until 1977 about 12,000 ha of the estimated 30,000 ha of slopes to be stabilized had been planted with this legume (Parera 1978:34) at a cost of Rp. 3900 to Rp. 5400 for 65 to 80 kg of *lamtoro* seed per hectare. Some of the seed was gathered by the people and paid for by the mission in *bulgur* (i.e. a form of wheat supplied by the 'Food for Work' program of the American Catholic Relief Service). Although the chief aim of the *lamtoro* scheme (also known as *lamtoronisasi* in Flores) is soil conservation, its adoption also presents opportunities for more intensive land use and increased productivity. Unterraced fields need a recovery period of three or more years because of the great loss of the soil due to erosion. Terraced slopes can be worked with shorter fallow periods and even permanently, particularly if cut *lamtoro* leaves have been worked into the soil. So far comparatively little success with *lamtoro* is recorded in those parts of Sikka where one or the other form of communal land tenure is still typical; hence in Central Sikka's southern flanks - i.e. *tana gung* land - and in eastern Sikka (Tana Ai) where long-fallow *ladang* cultivation predominates.

Another noteworthy example of the church's successful projects in the socio-economic development of Sikka is the improvement of transport facilities. Since 1966 when the IPP introduced its first truck (there were six in 1976) on the Watublapi-Maumere route, the scheme has significantly contributed towards an increasing market-orientation of Central Sikka's farmers. As the trucks are permanently stationed in the villages from where they leave for Maumere in the morning and return to Watublapi in the afternoon, the farmers are given an opportunity to sell their produce on the market. The improved transport facilities have led for instance to an increased production of coconuts and vegetables in and around the saddle of Baomekot. Until the first half of the 1960s this region was significantly less developed than the saddle of

Nita. Ziesel's (1966) comparison of the formerly somewhat backward region of Iwanggete around the saddle of Baomekot with Nele makes this clear.

The Indonesian government

It is only recently that the Indonesian authorities in Sikka have become agents of agricultural change. Although the Indonesian government has launched a number of projects since sovereignty was gained from the Dutch, these efforts have been of no duration and have failed to exert any lasting influence upon the Sikkanese way of farming.

An erroneous assumption of the government was, for instance, that erosion, which had reached appalling dimensions in the 1950s, could be kept at bay merely with legal measures. Since traditional agricultural methods were considered destructive, the following laws and regulations were promulgated in Sikka:[10]

1. Regulation No.8 of 1954 regarding the protection of the main roads, according to which

   - it is an offence to work a garden located in sloping topography less than 20 metres above the road and less than 10 metres below the road. This zone has to be extended by 5 metres on either side if the slope gradient exceeds 45 degrees.
   - it is an offence to work a garden located on level land less than 1 metre from the road.

2. Regulation No.4 of 1955 regarding the protection of precipitous escarpments. At such locations - designated as such by the forestry service - it was an offence

   - to grow annual crops including bananas and taro;
   - to graze livestock;
   - to burn perennial crops, scrub or grass;
   - to collect wood or perennial crops, including bark, without permit;
   - to collect soil, rocks, stones and sand without permit.

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[10] Legal measures were already common in Sikka under the Dutch administration which, however, had the means to enforce them (*perintah keras*). One of the first regulations passed by the forestry service (*Dienst van het Boschwezen*) of the regency *Timor en onderhoorigheden* dates back to 1917 when it was strictly prohibited to burn *alang alang* grass (*Imperata cylindrica*) (Residentsbesluit v.15 Feb. 1917 No.41: see Maier 1918: Appendix).

In 1960 an administrative reorganization took place, and these two regulations were rephrased by the legislature in 1962 (Peraturan Daerah Tingkat II tentang perlindungan djurang, Sikka No.9 tahun 1962) and in 1967 (*Peraturan Daerah Kabupaten Sikka No.2 tahun 1967 tentang perlindungan jalan raya terhadap kerusakan jang disebabkan karena hujan*). In addition a regulation was passed regarding the construction of anti-erosion devices, made of bamboo poles placed perpendicularly to the dip of the slope (*Peraturan Daerah Kabupaten Sikka No.1 tahun 1967 tentang kewajiban membuat sengkedan dan oleh semua peladang ditanah miring didalam Daerah Kabupaten Sikka*). According to this regulation:

- every farmer was required to construct such *sengkedan* (also called *blepeng* in Sikkanese) using stones, *Leucaena leucocephala*, *Sesbania grandiflora*, commercial crops, fruit trees and other plants according to climate.
- the distance between these rows had to be between 5 and 10 metres according to slope gradient.
- the village heads were obliged to register all fields and to supervise the construction and maintenance of such anti-erosion devices.
- the construction of such devices could also be required on level land if the agricultural or forestry services considered it necessary as a means of combating flooding.

In essence these regulations sought to stabilize the traditional itinerant systems of farming and decrease their assumed destructiveness. However, these regulations were broken with impunity since they could not be enforced effectively and in the case of infraction proof could not be established. In the face of population growth and cash cropping, the available land for food crops was reduced, hence more intensive agricultural systems had to evolve.

Agricultural intensification was repeatedly attempted under special programs. For instance, under the special welfare program (*Rencana Kesejahteraan Istimewa*) conceived for the whole of Indonesia in 1949, experimental farms for dry-land agriculture (*Perusahaan Percobaan Tanah Kering* - PPTK) were to be founded. On such farms families under the guidance of the agricultural extension service were expected to develop more sedentary forms of agriculture and, ultimately, forms of mixed farming (i.e. integration of farming and livestock keeping). According to these ideas permanent cultivation should be achieved through the increased use of fertilizer, mechanical ploughing, new cropping sequences, etc. Of the thirty PPTK farms - each 50 to 10 ha in size - planned for the province of Eastern Nusatenggara (NTT), ten on each of the major islands of Timor, Sumba and Flores, only eight were actually opened: six on Sumba, two on Timor (Metzner 1978b:34-6).

According to ten Dam (1950a) five PPTK farms, each comprising an area of 8 ha, were to be established in Sikka, preferably in the mountains where the bulk of the population lives instead of along the sparsely populated coast. As a result of a shortage of financial resources and particularly of unoccupied cultivable land the PPTK idea never gained a footing in Sikka, although in 1953 10 ha of land at Wairita belonging to the *raja* were earmarked for two PPTK farms (Tomasoa 1953:9). It was even envisaged that after a period of 4 to 5 years, when the particular families had gained sufficient experience in permanent cultivation, they should be replaced by other families (DPS Laporan tahunan 1953). Yet these plans never materialized.

In the late 1950s and early 1960s when the scheme under the special welfare program of Indonesia had been given up, another abortive attempt was made towards increasing agricultural production. After a few years this program (*Komando Operasi Gerakan Makmur* - KOGM) had to be discontinued as Sikka's farmers were not convinced of the benefits of increasing production while selling prices for cash crops were frozen by the government at low levels.[11]

Similarly discouraging experience was gained with resettlement schemes which the government - with the help of a mission-run farmers' organization (IPP) had initiated during the 1950s. Under this project several hundred farmers from the densely populated saddle of Nita (i.e. mainly from Tebuk and Bloro) were encouraged to cultivate wet rice fields (*sawah*) in the plains of Magepanda, Nangarasong and Koro. Yet most of them returned to their old abodes after a few years when the dams (built by the farmers themselves) and irrigation channels were destroyed by floods caused by the continued slash and burn agriculture of neighbouring groups in the adjacent mountains (see pp.221-4).

Likewise the government's experience with the co-operatives has not been as satisfactory as one is led to believe by recent efforts at reviving the idea. Co-operative associations were first created on Flores - particularly in Manggarai and Ngada - by the mission in the 1930s (van den Ende 1954:42-3). Although most of them failed after a few years some of them survived until a few years after the war. Similarly short-lived was a co-operative society at Lela (*Koperasi konsumsi*) founded in 1948 (ten Dam 1950b:49). The co-operative idea has been carried farthest with respect to the production and marketing of copra, as was outlined in Chapter 1. Repeated severe rebounds caused by soaring inflation, rapidly decreasing prices for copra on the world market, as well as by inadequate funds have not diminished the government's

[11]Similarly abortive attempts were made with drive-for-food programs in 1957-58 (*Rencana Istimewa Menambah Hasil Bahan Makanan* - RIMHBM, 'Special program to increase food yields') and in the late 1960s (*Lumbung Desa*, 'village granary' program).

optimism with respect to the co-operative idea, which in 1973 was given a new chance. Since 1973 all copra produced in Sikka has to be marketed through the *Koperasi Unit Desa* (KUD) which fixes the price and which sells it to one of several oil mills in Maumere. The peculiarities of the price fluctuations for copra have not readily encouraged the farmers to increase copra production. The agricultural extension service of Sikka therefore attempts to encourage rejuvenation in conjunction with improved spacing of trees. Moreover, a coconut working centre at Koting, established in 1977, provides coconut seedlings of high yielding strains. Still, Sikka's farmers have learned to adopt a more cautious attitude. Copra is no more considered as the only source of cash.

For some years, however, the government of Sikka has been able to record a remarkable success with its locally adapted version of the national Bimas program (*Bimbingan Masal*). Under this program, the Indonesian government aims to increase rice production using 'foreign' inputs - like mineral fertilizers, insecticides, high yielding rice varieties, etc. In Sikka where a dry-land Bimas program (Bimas Tanah Kering) has been deliberately modified, a system of multiple cropping is pursued. From this program, started in 1974, *uma kabor gong* farmers of the saddle of Nita have derived most of the tangible benefits. Instead of 300 to 400 kg of unhulled dry-land rice (*padi bersih*) per hectare (see Table 21, p.132) commonly produced under coconut, yields of 1750 kg/ha are common under the new scheme (Parera 1978:34). These spectacular increases were achieved under massive application of mineral fertilizers and through high-yielding rice varieties - e.g. *Kortuna, Seratus Malam, Gama* - given to the farmers on favourable conditions.[12] Notwithstanding these encouraging results it seems doubtful whether this program which also includes the growing of maize and green gram can be continued with the increased dependence on foreign inputs (Table 51). The head of Sikka's agricultural service therefore tries at least partially to replace mineral fertilizer with green manure. As a first step in this direction farmers willing to participate in the program are required to terrace their fields either directly or with *lamtoro* hedgerows. Currently a new strain of *lamtoro* with more favourable qualities (Hawaiian giant - also called *Lamtoro gung*(I)) is being experimented with in Sikka.

Discussion

In this chapter we looked at the potential impact of external factors of change upon the stability of the agricultural system.

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[12]One of the problems, however, has been the repayment of government credit (1976-77: Rp. 34, 123, 540) by the farmers, as the price for maize in particular usually drops at harvest time - e.g. from Rp. 70/kg to Rp.20/kg (December 1974).

Table 51

Bimas Program in Sikka

Period of cultivation	Type of crops grown	Area to be planted (ha)		Participating farmers	Input of mineral fertilizer		Number of kecamatans in which the program has been carried out
		Target	actually planted		Triple superphosphate (kg)	Urea (kg)	
1974-75	wet rice	20	20	58	1,000	2,000	1
	dry-land rice	50	50	104	2,500	5,000	2
1975-76	maize	500	295	671	14,750	29,500	4[a]
	wet rice/dry-land rice	400	300	584	14,975	39,925	4
1976-77[b]	maize	1,000	907	1,899	45,332	90,665	
	green gram	500	810	667	37,362	18,681	all kecamatans and perwakilans
	wet rice/dry-land rice	no data	no data	no data	no data	no data	
1977-78[c]		4,350					

a As an example demonstrating the larger number of participants from the saddle of Nita in this program the origin of the participants by kecamatans and desas (number of participants in brackets) was as follows (data provided by Dinas Pertanian Sikka, 2 Feb. 1976): Kec. Nita: Ds. Nita (136), Ds. Tebuk (133), Ds. Nitakloang (155), Ds. Bloro (80), Ds. Tilang (31); Kec. Maumere: Ds. Koting A (34), Ds. Koting B (30); Kec. Lela: Ds. Hepang (20), Ds. Lela (10); Kec. Kewapante: Ds. Watumilok (42).

b Probably preliminary figures as they differ substantially from final figures received by personal communication from V. Parera in letter of 9 August 1977. 1976-77: total 2016 ha with 4150 participants.

c V. Parera, pers. comm., 9 August 1977.

Source: Parera (1978:35) and pers. comm., 9 August 1977.

It was demonstrated that foreign traders from Sulawesi exerted a strong influence on the economic development of Central Sikka's north coast and the hinterland of the major coastal settlements, particularly in the saddles. The south coast, on the other hand, received comparatively little attention. This regional imbalance was enhanced during Dutch colonial rule as reflected in road construction (Floresweg), agricultural extension and introduction of cash crops on the north coast and the saddle of Nita.

The south coast of Sikka continued to be a backwater also as far as missionary activity - i.e. in the fields of Christianization, education and socio-economic development - was concerned, as it concentrated on the more accessible north coast and the saddles - particularly that of Nita. As a result the inhabitants along the south coast remained less exposed to new ideas, less commercialized and less motivated towards modernization than the rest of Central Sikka's population. This aspect of motivation which is considered pivotal in our analysis will be treated in greater detail in the final chapter, where we shall attempt a quantitative substantiation of our qualitative findings.

Chapter 3

Stability of agricultural systems

Having become acquainted in the first two chapters with the components of Sikka's ecosystem and their interaction in space and time, we turn our attention now to finding out which of the factors discussed have had a major bearing on the stability of the agricultural systems distinguished in Central Sikka.[1] In order to be able to place the Sikkanese situation within more generally applicable approaches it seems useful to view the Sikka ecosystem from the following perspectives: a population-centred, a resource-based, an economic and a geoecological. In the latter an attempt will be made at integrating all previous interpretations.

Population-centred perspective

The correlation between population growth and change of agricultural systems has been a subject of considerable interdisciplinary interest - above all among geographers, anthropologists and economists.

By no means is there agreement as to the causal weight of population pressure either upon agricultural systems or agricultural intensification. From this population viewpoint the work of Boserup (1965) has been particularly stimulating. Her basic premise is that population growth is an independent variable which determines intensification of traditional agricultural systems from

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[1]The term 'stability' is used in the sense of ecological stability. The stability of an ecosystem is defined here as the ability of a system to maintain or to return to its original state of balance if exposed to disturbing influences from outside. Since most of the relationships among the elements of the agricultural ecosystems (briefly referred to in this study as agricultural systems) of Central Sikka are based on qualitative information, following May (1973), the term qualitative stability may be used. A quantitative approach of measuring ecosystem stability has been attempted by several ecologists (see Stöcker 1974:239). Stöcker tried to quantify structural changes of ecosystems by monoparametric stability measures. This attempt made clear, however, that present knowledge concerning the structure and function of ecosystems is insufficient to allow such quantitative approaches to be universally applied.

long fallow to short fallow and finally to multicropping. Since such intensification involves an increase in labour input labour productivity is likely to fall. The relevance of Boserup's thesis to the process of agricultural change in Sikka is now briefly reviewed.

Labour intensity according to size of holdings is demonstrated for 23 desa in Table 52. From this table it becomes evident that on the whole the smaller the plot the more labour is usually dispensed. However, no correlation emerges between population density and labour intensity;[2] for example, in plots up to 0.5 *blek* in size Ds. Hokor and Ds. Wolonwalu emerge as having the highest labour input (436 and 416 man-days/year/ha respectively) though both desa only have a comparatively low population density. Agrarian densities, which unfortunately could not be calculated because of lack of reliable material, such as recent airphotos, would of course have been far higher than density figures indicated in Table 13 for both desa. Yet desa with extremely high population densities (and also agrarian densities) - e.g. Ds. Rubit and Ds. Nele Lorang - display comparatively low labour inputs. The same observation can be made in the next category of size of holdings - i.e. 0.6 to 1.0 *blek*. What is conspicuous in that group is the comparatively high labour input in desa along the south coast (Ds. Bola, Ds. Hokor, Ds. Iligai, Ds. Umauta, Ds. Ipir, Ds. Wolonwalu, Ds. Kloangpopot, Ds. Waihawa). These desa are characterized by roughly similar ecological conditions. High labour inputs can also be observed in Ds. Rubit and Ds. Wolomotong.

These data lend support to the observation that the southern flanks of Central Sikka are strongly disadvantaged ecologically. Much more labour has to be invested in order to make a living. The environment rather than the population density may be considered as the determining factor of labour intensity. Thus the environment has to be thought of as forming certain threshold levels which determine the minimum labour input necessary for making the land productive for human needs.

From this analysis Boserup's thesis could not be proved in Central Sikka. It appears that Boserup ignored environmental constraints. Many environments require special treatment if they are to be made productive. In the case of the southern flanks, where for historic reasons people have tended to concentrate, the environment requires a comparatively larger labour input for a given output than in other parts of Central Sikka. For a number of reasons the population of this portion of Sikka has not succeeded in passing upward through a hierarchy of successively more intensive systems

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[2]Similar negative results were obtained by Datoo (1976) in a study of agricultural systems and population density in the Uluguru mountains of Tanzania.

Table 52

Labour intensity (man-days/year/ha): median values according to size of plots (1 *blek* = 0.25 ha)

Desa	Size of holdings (*blek*)				
	>0.5	0.6-1.0	1.1-2.0	2.1-3.0	3.1-4.0
Aibura	236	216	152	170	-
Beru[a]	232	118	111	-	-
Bola	196	304	109	-	-
Dobo[a]	-	364	189	-	-
Hokor	436	232	174	120	-
Iligai	288	224	120	78	-
Ipir	312	192	118	82	-
Kajowair	-	146	208	112	94
Kokowahor	328	156	115	75	79
Koting B	268	142	64	44	-
Mekendetung	344	164	123	100	-
Namangkewa	336	168	114	-	-
Nele Lorang	320	160	120	-	-
Nele Wutung	242	152	106	113	52
Nele Urung[a]	192	163	95	-	-
Rubit	224	188	200	124	-
Umauta	304	192	108	117	-
Waibleler[a]	-	168	160	-	-
Watuliwung	288	164	133	67	80
Watumilok	272	190	105	51	63
Wolokoli	184	152	-	-	-
Wolomotong	360	306	296	229	-
Wolonwalu	416	252	146	-	-

a Data from these desa were obtained indirectly as farmers of the 19 desa interviewed had some of their fields in these 4 desa.

as needs increased - if one disregards palm tapping done by a small portion of the population.[3]

On the other hand, the environment is not static. It may be modified by vegetational changes caused through human occupation as well as through the introduction of new crops. The alternative of either intensifying agricultural production or introducing new crops has not been taken up by the local population of Central Sikka's southern flanks. As will be demonstrated later, the situation along the south coast can best be explained by institutional hindrances (i.e. land tenure) that have prevented the invention or adoption of new agricultural techniques (i.e. lack of contact with modern agriculture). From the situation on the southern flanks it seems permissible to hypothesize that, once a population becomes settled in any given area and subsequently increases in numbers, it tries to work the land as intensively as possible thereby enabling it to remain in the same locality. The alternative of migration is only resorted to after intensification has taken place.

In the light of this hypothesis it seems useful to analyse the impact of population pressure upon both the pattern of migration and on land tenure in Central Sikka. Since neither official nor unofficial figures regarding demographic mobility are known for Sikka, I made an effort to collect data in each desa. Two forms of migration have been distinguished: seasonal and permanent. Circular migration as is known between rural and urban regions of Java is not known for Sikka.

Seasonal migration

Collecting data on seasonal migration (*hokot tulung hebo dalang*(S)) proved to be very tedious since name lists of farmers owning one or more fields in a certain desa had to be copied by hand in the tax office (Inspektorat Keuangan). These lists which included the names of an estimated 90 to 95 per cent of all 'land-owners' of a desa were subsequently checked with the help of village

[3]Evidence from Central Sikka also seems to run counter to Boserup's thesis inasmuch as the labour intensification of Sikka's agriculture did not stimulate any fundamental improvements in the bush fallow technique of maintaining soil fertility. On the contrary, traditional agricultural regulations - e.g. compulsory planting of fallow vegetation (*luma* and *lago*) - are hardly observed today. The planting of *lamtoro* hedges has to be attributed to the initiative from outside (i.e. the mission). Hence Boserup's concept of labour intensification correlated with increasingly complex tools (for which again no proof is found in Central Sikka) is essentially applicable to premodern societies in which economic incentives have not short-circuited the population-intensification process (Knight 1974:199).

elders and village heads with regard to the desa of residence of the landowners. Figure 41 shows the percentage of farmers who are in possession of land outside their desa of residence in relation to the total number of farmers of their desa (see Table 53).[4] Figure 41 demonstrates that desa having an elevated percentage of farmers with fields outside their home desa are concentrated on the saddles of Nita and Baomekot. These are desa in which perennial cash crops play a significant role. This is not accidental, since as a rule the farmers of these saddles are reluctant to live far away from their tree crops for fear of theft and damage. Thus while they preferred to live next to their fruit trees they had to look for land suitable for growing subsistence crops. Such sparsely populated areas they found in desa around Mt Kimang-Buleng (Ds. Nitakloang, Ds. Wolomarang) and Mt Tarat-Egong (Ds. Pogon, Ds. Aibura, Ds. Waibleler). Here they purchased land on which they now practise traditional labour intensive *ladang* cultivation (see Fig. 42). This development has been facilitated by the comparative affluence generated by a high degree of commercialization in the desa of these two saddles. Thus the farmers had the means to buy land outside their home desa.[5] On the other hand cash crop production - particularly copra - has contributed to a greater degree of inflexibility of the population with respect to permanent migration.

A lack of unoccupied cultivable land nearby has led to a different development on the saddle of Blatatating. In search of a source of cash farmers have not run the risk of converting their fields into groves with tree crops and thereby jeopardizing their food production. Instead they accept work as sharecroppers (*maa ihing*) on the northern coastal plain between Maumere and Geliting. Here autochthonous groups from southern Sulawesi (Buginese, Makassarese, Saleijerese, Boneratese, etc.) had bought land from the *zelfbestuurer* - i.e. the *raja* who had declared himself owner of all unoccupied land in the early 1930s. In 1931, these coastal dwellers had to pay f 30 per *bahu* (= 0.7 ha) for fertile agricultural land, and f 20 for land of poorer quality (Brill 1931). As they are unable to work the land themselves they offer comparatively favourable conditions to interested farmers from the mountains. The latter readily accept as they are eager to earn cash which they obtain through the sale of their agricultural products and with which they can buy some imported commodities. The lack of

[4] In this table the comparison of the figures of the number of farmers with those of the persons in possession of land reveals that frequently the latter are higher. There may be several reasons: non-farmers may be in possession of land, or people alien to the desa own some land. This group may include people who have emigrated but who have retained their old 'property' rights to the land. Some of the surmised reasons have been listed in the footnotes to Table 53.

[5] As agricultural land has become scarce: for instance Rp. 75,000/ha was not an exceptional price in Ds. Bloro in 1976.

Table 53

Number of farmers and persons possessing land in Central Sikka, 1976

Kecamatan	Desa	Number of farmers with or without land	Persons in possession of land (according to tax census)	Kecamatan	Desa	Number of farmers with or without land	Persons in possession of land (according to tax census)
Koordinatorschap	Beru	227[a]			Rubit	246	244
Pemerintahan	Kabor	117[a]			Sapankopong	268	273
Maumere	Kota Uneng	55[a]	no data		Namangkewa	530	438
	Wuring	387			Watumilok	290	407[f]
	Wolomarang	325			Kokowahor	413	467[e]
	Koting A	352	315		Tekaiku	318	273
	Koting B I+II	275	278		Wolomapa	345	371[e]
	Koting C	267	253	Kewapante	Kajowair	451	432
	Koting D	359	237		Blatatating	281	361[i]
Maumere	Nele Barat	485	429		Langir	462	607[g]
	Nele Wutung	324	172		Watuliwung	458	609[h]
	Nele Lorang	234	190		Seusina	565	643[h]
	Nele Urung	230	178		Iantena	258	445[e]
	Watugong	319	278		Mekendetung	321	390[i]
	Lela	463	429		Hokor	279	238
	Sikka	372	456[c]		Wolonwalu	433	484[i]
Lela	Iligai	309	376[d]		Wolokoli	387	348
	Hepang	377	469[e]		Bola	253	321[j]
	Korowuwu	347	531[e]	Bola	Umauta	324	306
	Nita	575	562		Ipir	366	340
	Tebuk	280	357[k]		Wolomotong	270	409[e]
	Nitakloang	628	779[e]		Kloangpopot	456	531[e]
Nita	Bloro	510	497		Waihawa	207	216
	Riit	295	482[e]	Perwakilan Kec.	Waibleler	507	649[e]
	Tilang	306	586[e]	Talibura	Pogon	418	269
				(Wairgete)	Aibura	326	379[e]
				Perwakilan Kec. Paga (Lekebai)	Dobo	318	no data

a Calculated at roughly 20 per cent of total number of families (see Departemen Dalam Negri 1976:3).
b These figures include any persons in possession of land irrespective of desa of domicile and profession (farmer, civil servant, merchant, etc.).
c Elevated number of non-farmers; civil servants, teachers, etc.
d Former residents of Ds. Iligai now living in Ds. Korowuwu, Ds. Dobo, Ds. Tilang, etc. but still holding land in their former home desa.
e Farmers from other desa owning land.
f Substantial number of non-farmers (above all merchants, fishermen) owning land.
g Substantial number of non-farmers, mostly civil servants and merchants of Maumere.
h Many non-farmers.
i Former residents emigrated to Wairgete (Ahuwair, etc.) but still holding land in their former home desa.
j Non-farmers - chiefly civil servants - holding land.
k Former residents emigrated to northwest coast (Ds. Magepanda) but still holding land in their former home desa, also some landowners from other desa.

Note: The number of farmers is usually higher than that of households (see Table 13) which is explained by the fact that several male adults declare themselves as farmers while living under one roof.

Source: Kantor Sensus dan Statistik Kabupaten Sikka.

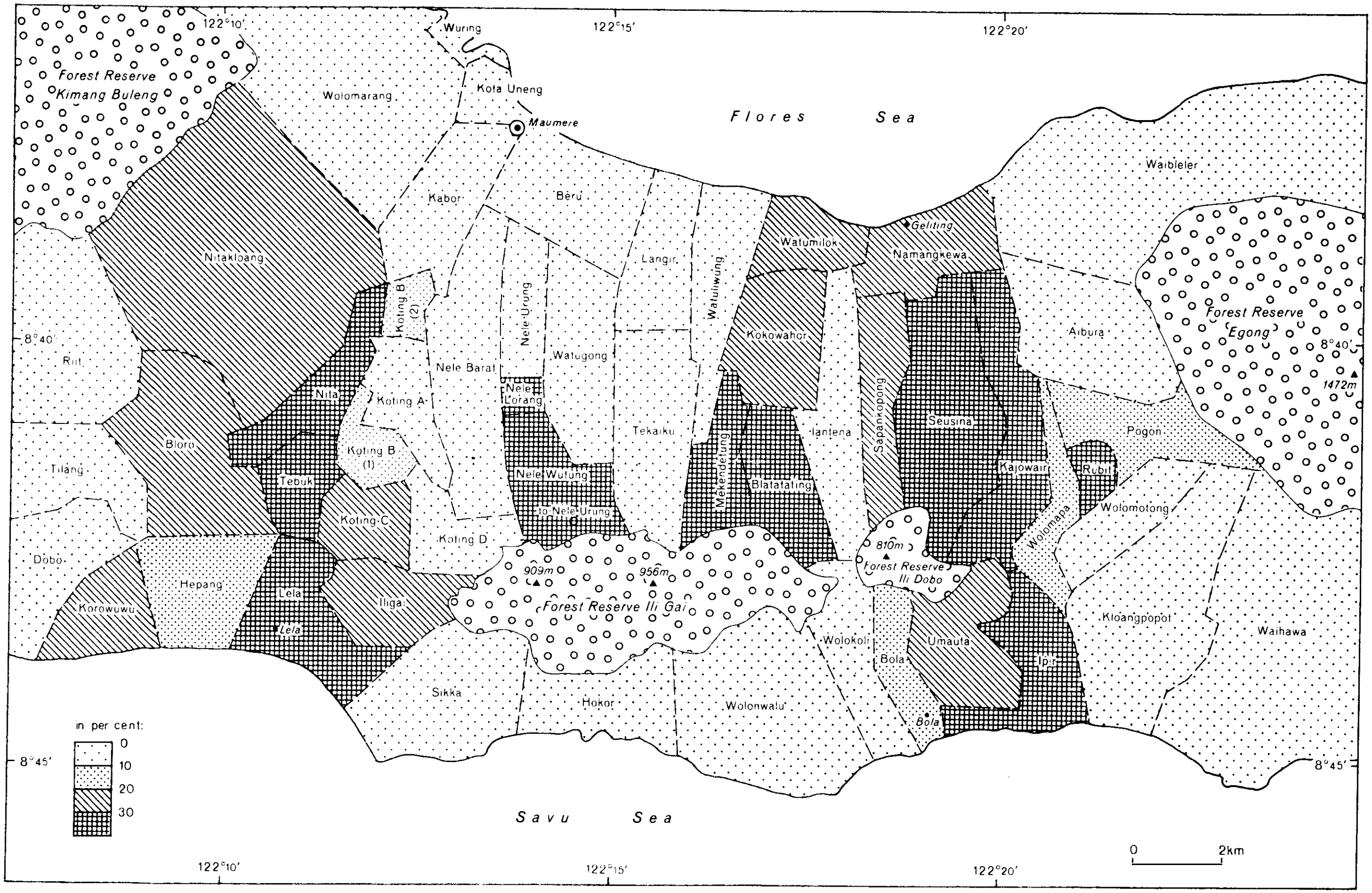


Fig.41 Central Sikka: farmers in possession of land outside their desa of residence in per cent of total number of farmers of home desa

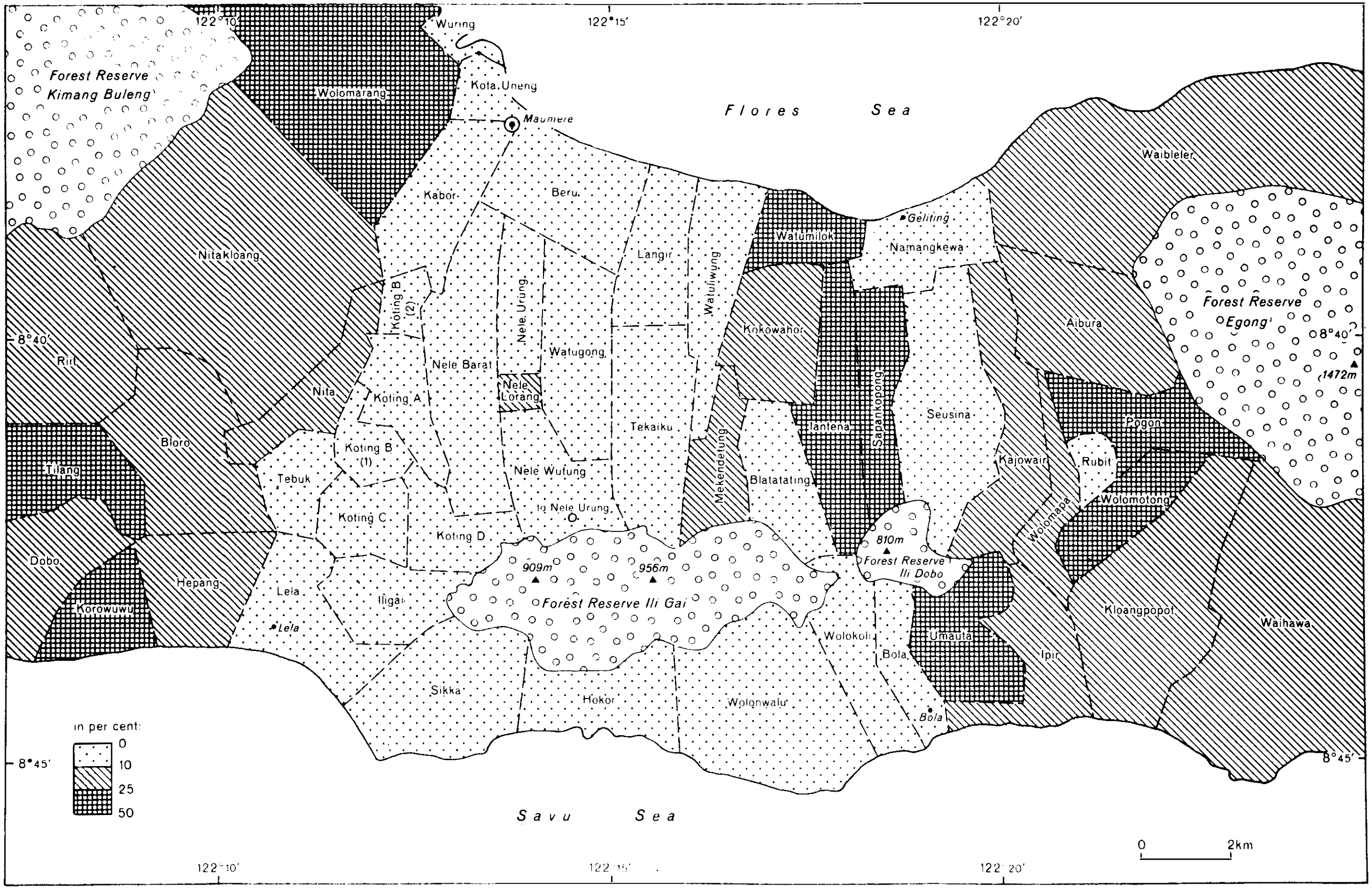


Fig.42 Central Sikka: farmers in possession of land and having their residence outside the desa in per cent of total number of farmers

commercial crops at the saddle of Blatatating had thus to be attributed largely to the absence of nearby sparsely populated areas for the cultivation of subsistence crops. The cash accrued through sharecropping has already enabled a comparatively high percentage of farmers to buy fields outside their desa of residence (particularly in Ds. Iantena, see Fig. 42) on the saddle of Blatatating, which points to the relative population pressure (Fig. 41). Seasonal migrants who do not cultivate their own piece of land outside their home desa are not included on this map. Had such data been available and incorporated the desa of the saddle of Blatatating would have shown far higher percentages of seasonal migrants.

From the foregoing analysis it follows that the pattern of seasonal migration shows no perceptible response to population pressure in Central Sikka.[6] This is reflected, for instance, in the low percentage of farmers of the densely populated south coast desa who cultivate fields outside their desa of residence. On the other hand a closer correlation seems to exist between the degree of commercialization and seasonal or even permanent migration, as will be shown below.

Permanent migration

About the end of the 1950s local government and private organizations supported by the mission encouraged the population to open up wet rice fields and permanently cultivated dry fields in the fertile alluvial plains along Sikka's north coast.[7] In the absence of official or unofficial data on demographic mobility migration figures had to be arrived at indirectly. On the premise that there were no regional differences of birthrate and mortality rate, the migration figures of each village were calculated as the change in population figures for that administrative unit in relation to the average population growth of Kabupaten Sikka (19.5 per cent for the period 1961 to 1975).

[6]Somewhat similar observations were made for the New Hebrides by Bonnemaison (1977) where migration was neither triggered off by urban attraction nor by the absolute pressure of population on the resource base but by the growing integration of the subsistence-oriented farmers into the market economy. Land which had formerly been intensively used by the community as a whole came to be of value through the alienation of common land into private plantations. Land thus became 'scarce' and a number of farmers were forced to emigrate. Bonnemaison's observation does not however apply in Central Sikka with respect to permanent migration, as will be shown.

[7]A regulation concerning internal migration in Sikka was, however, passed no earlier than 1964 (Peraturan Daerah tentang transmigrasi sedaerah, dalam Daerah Tingkat II Sikka No.3 tahun 1964).

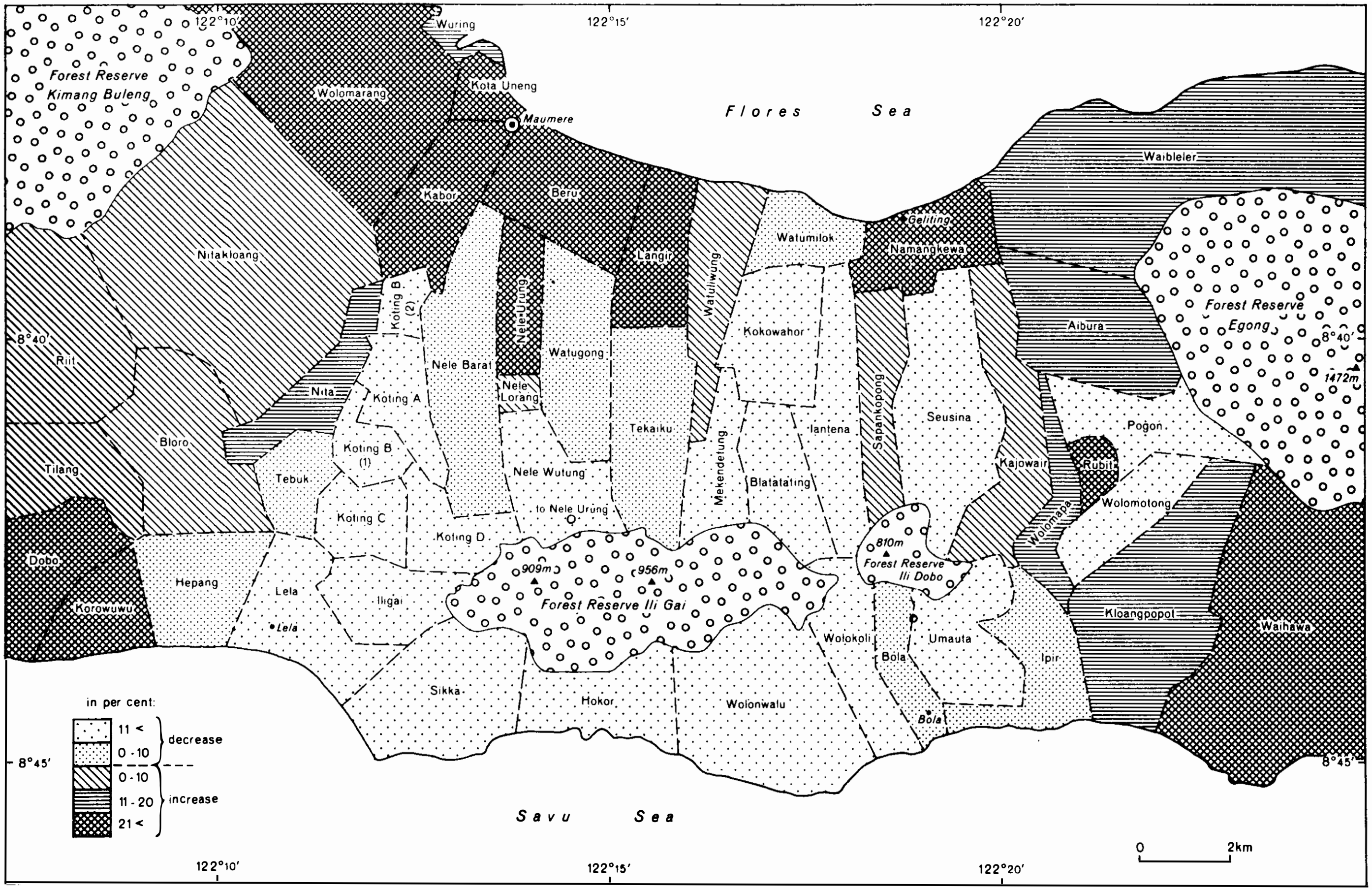


Fig.43 Central Sikka: population change in relation to average growth (19.5 per cent) of Kabupaten Kabupaten Sikka, 1961-75)

The result of this calculation is presented in Fig. 43. It demonstrates a core region of Central Sikka having an underproportional increase of population figures - that is an area of net emigration. It comprises most desa of the saddle of Nita, all desa along the south coast from Hepang to Ipir as well as a number of desa in the upper reaches of the northern flanks - for example Ds. Nele Wutung, Ds. Tekaiku, Ds. Watugong, Ds. Mekendetung, Ds. Blatatating, Ds. Kokowahor, Ds. Iantena, Ds. Seusina. Finally also Ds. Pogon and Ds. Wolomotong fall into this group. On the other hand, desa with population growth above average on account of immigration are found chiefly along the northern littoral plain (Ds. Wolomarang, Ds. Nele Urung, Ds. Langir, town of Maumere, Ds. Watuliwung, Ds. Namangkewa, Ds. Waibleler) as well as in Central Sikka's eastern and western slopes of Mt Tarat-Egong. A high degree of immigration can also be registered for the peripheral desa of Dobo, Korowuwu as well as Kloangpopot and Waihawa located south of the watershed. Outside the section represented on Fig.43 are also two desa on Sikka's north coast which have become major centres of migration - i.e. Ds. Magepanda and Ds. Egong. Table 54 summarizes the three groups of desa.

Chief centres of immigration (Fig.44)

North coast (eastern portion)

1. Wairgete (Ds. Egong)(see Fig.45). Immigration of farmers from desa Koting A, B and D and from Tebuk was made possible when the 'lord of the earth' of the *tanapuangschap* Egong ceded 250 ha (later reduced to 157 ha) to the government of Sikka in 1959 (Mekeng 1973:26, 40). In 1960 fifty-two families were encouraged by the government and the mission (Biro Sosial) to move to Wairgete where they were each given 0.5 ha of *sawah* and in 1965 0.5 ha of dry land also as well as a place to build their homes (25 x 40 m). They maintained the right of possession with respect to their coconut trees in the Koting region. The trees were usually pledged (*sadang*) to others, Twenty-five families from the hinterland of Wairgete (Ds. Egong) joined the immigrants and in 1968 twenty additional families from Ds. Koting B migrated to Wairgete. In 1964 about sixty families from Ds. Seusina (saddle of Baomekot) made an attempt at settling near the river Napung Tarung (west of Wairgete). Because of poor harvests and relative isolation they gave up soon and returned to their desa of origin.

About 68 ha are still reserved in the project for people of Blidit, the only village of Ds. Egong whose inhabitants have adamantly resisted resettlement along the coastal road mainly because their fruit trees are located in the mountains. The village of Blidit, about 4 km inland from the coastal road, happens to be located within the forest reserve (*kawasan hutan*) of Egong. The boundary of this forest has been extended north four times and is found today at no more than 0.5 km from the main road at Waiterang.

Table 54

Population change by desa

I. Desa with an absolute population decrease:			
Southern flanks:	Lela	±	0.0%
	Sikka	-	12.6%
	Iligai	-	20.1%
	Hokor	-	4.6%
	Wolonwalu	-	8.0%
	Wolokoli	-	0.1%
	Umauta	-	5.0%
Northern flanks	Blatatating	-	5.1%
Saddle of Nita:	Koting C	±	0.0%
	Nele Wutung	±	0.0%
	Koting B	±	0.0%
II. Desa with an underproportional increase of population:			
Southern flanks:	Bola	+	19.2%
	Ipir	+	19.5%
	Hepang	+	12.9%
	Wolomotong	+	3.5%
Northern flanks:	Seusina	+	1.5%
	Pogon	+	7.9%
	Iantena	+	6.6%
	Tekaiku	+	12.5%
	Watumilok	+	12.3%
	Kokowahor	+	3.6%
	Mekendetung	+	4.7%
Saddle of Nita:	Nele Barat	+	17.9%
	Koting D	+	6.6%
	Koting A	+	1.5%
	Tebuk	+	11.5%
III. Desa with an overproportional increase of population:			
Southern flanks:	Korowuwu	+	111.0%
	Kloangpopot	+	34.0%
	Waihawa	+	52.8%
Northern flanks and northern littoral zone:			
	Aibura	+	34.9%
	Waibleler	+	35.7%
	Egong	+	36.9%
	Kajowair	+	23.2%
	Namangkewa	+	46.2%
	Wolomapa	+	34.8%
	Sapankopong	+	27.1%
	Rubit	+	44.4%
	Langir	+	43.1%
	Watuliwung	+	29.3%
	Wuring	+	33.4%
	Wolomarang	+	60.0%
Maumere:	(Ds Kabor, Beru, Kota Uneng):		112.0%
	Nele Urung	+	48.2%
	Magepanda	+	41.1%
Saddle of Nita:	Nele Lorang		21.2%
	Nita	+	33.6%
	Nitakloang	+	21.1%
	Bloro	+	25.4%

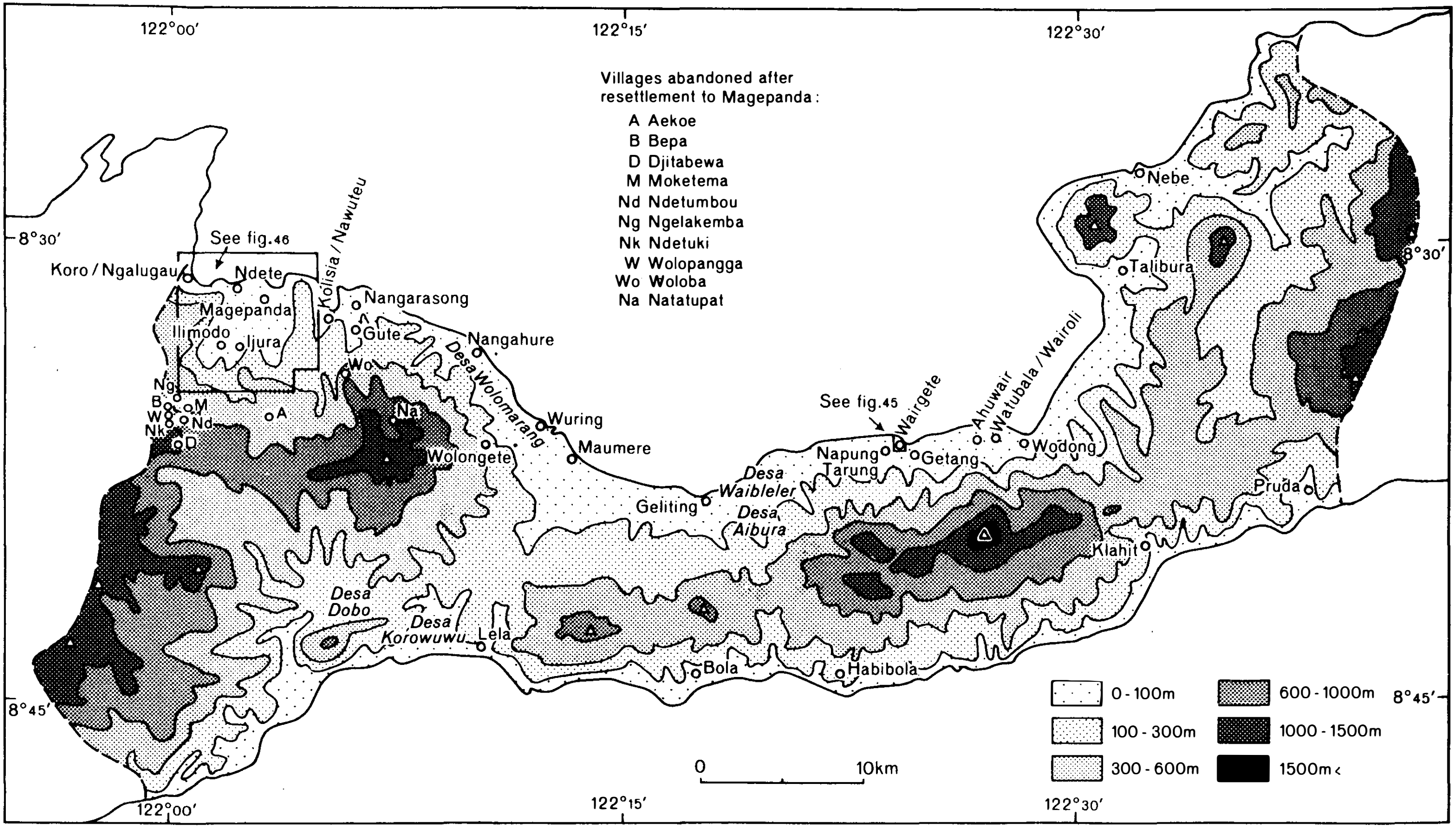


Fig.44 Sikka: chief centres of immigration

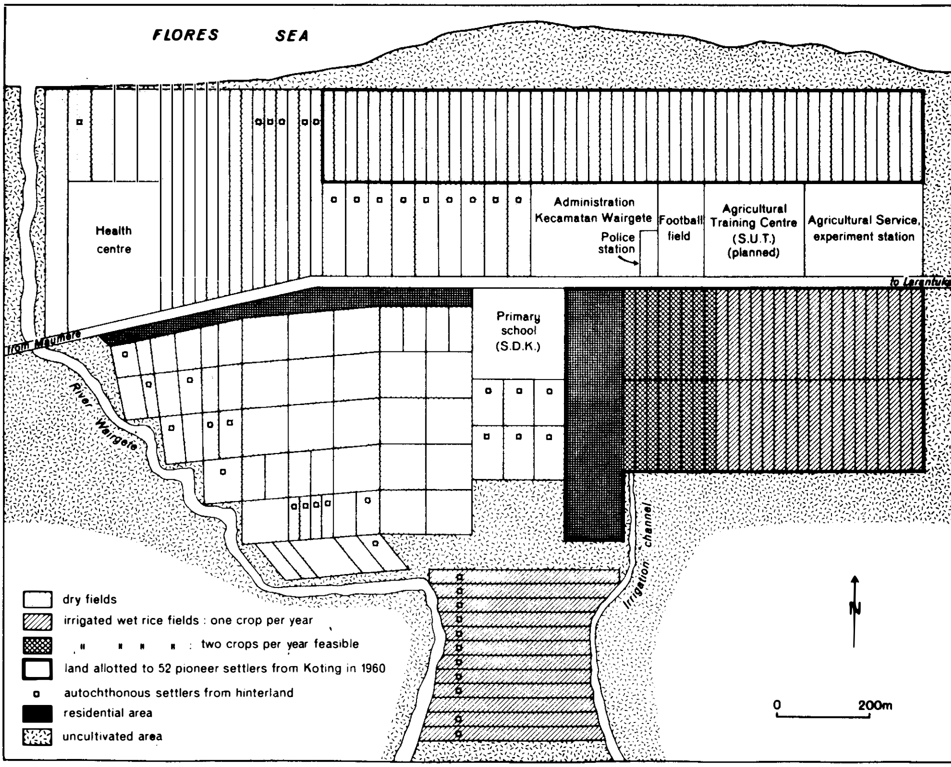


Fig.45 Wairgete: resettlement project

Of 601 landowners of Desa Egong (1974: 3406 inhabitants) only 32 seasonal migrants, chiefly from Kecamatan Kewapante (Ds. Kokowahor, Ds. Namangkewa, Ds. Blatatating) and the saddle of Nita (Ds. Nele Lorang, Ds. Koting C and B, Ds. Watugong), were reported.

Two major problems have prevented the government from encouraging further immigration: first, the unsatisfactory relation between the autochthonous population and the immigrants; and second, the water shortage. A water co-operative (called Subak Pertama = Subak Persatuan Tani Makmur) ceased to exist in 1967 (Mekeng 1973: 41).

2. Ahuwair (Ds. Egong). Immigration of sixty-one families from Hamente Ili-Wetakara (old administrative unit - see Fig. 44) - i.e. from desa Kokowahor, Blatatating, Mekendetung in 1957. Although some thirty farmers returned to their village of origin in 1958, more farmers from Ds. Wolokoli, Ds. Bola, Ds. Wolonwalu, Ds. Kokowahor and Ds. Blatatating settled at Ahuwair after 1963-64. Today all agriculturally usable land has been occupied. Government aid was provided in the form of cement for the construction of a

small dam, as well as hoes and mosquito nets. At Kokowair about 50 small rice fields, each 50 m^2, were opened. At present about 50 ha of dryfields and 42 ha of *sawah* are to be found at Ahuwair.

3. Watubala/Wairoli (Ds. Egong). Since 1963-64 this plain of about 100 ha has been settled spontaneously by about fifty farmers from Ds. Bola, Ds. Wolokoli, Ds. Umauta, Ds. Blatatating and Ds. Kokowahor. Agricultural land was provided by the government.

4. Getang (Ds. Egong). This plain, near Nangatobong, has been occupied by people from Ds. Kokowahor.

5. Wodong (Ds. Egong). Small plain of only about 10 ha occupied by people from Ds. Sikka.

6. Nebe. Occupied by immigrants from Ds. Sikka (mainly from the villages of Du and Wukur), Ds. Wolokoli, Ds. Hokor, Ds. Bola, Ds. Blatatating (from village of Nara) and Ds. Mekendetung (from village of Wololuma) since the end of the 1950s.

7. Talibura. Immigrants chiefly from Ds. Sikka ordered by the *raja* of Sikka to settle permanently in this region before World War II. In particularly dry years farmers from Sikka proper were forced by the *raja* to go to Talibura and to Wodong to grow maize and tubers (Rusconi 1940a:56). After the war settlers from Ds. Hokor also arrived. After 1960 300 spontaneous settlers from Kecamatan Kewapante arrived, each one being given 1 ha of land (Say 1968:13).

8. Ds. Waibleler. Earliest immigration of farmers from Ds. Iantena, who settled at the village of Kloangdualiat, took place at the beginning of the 1950s. After 1960 large-scale immigration ensued: about 400 persons from Ds. Watumilok and Ds. Kokowahor (from the village of Getang) to the village of Wolomapa; people from Ds. Seusina, Ds. Sapankopong and Ds. Pogon to Habijanang. In 1957-58 it was planned to settle farmers from Ds. Nele Wutung, Ds. Nele Lorang, Ds. Nele Barat and Ds. Watugong at Wairita (near the coast. The farmers concerned refused, however, on the grounds of the malaria hazard.

9. Ds. Aibura. Immigration by farmers from Ds. Seusina and Ds. Kajowair since 1946.

South coast (eastern portion)

10. Ds. Pruda. First immigration of about twenty families from Ds. Sikka is reported to have taken place at the beginning of the 1950s. Further immigration occurred from Ds. Bola and Kecamatan Kewapante at the beginning of the 1960s. Coconut palms had been planted by the settlers several years before permanent immigration. In addition seasonal migration from Ds. Sikka is common at present.

11. Habibola (Ds. Waihawa). Large-scale immigration by farmers from Ds. Bola, Ds. Ipir, Ds. Umauta, Ds. Hokor and Ds. Seusina has taken place since 1964-65.

North coast (western portion)

North Lio, as it is also called, was part of Mego/Nualolo until 1912 when for reasons of accessibility it was brought under the administrative control of Nita. It roughly comprises the region north of the watershed from Koro to Nangarasong. The people in the area still speak predominantly Lio.

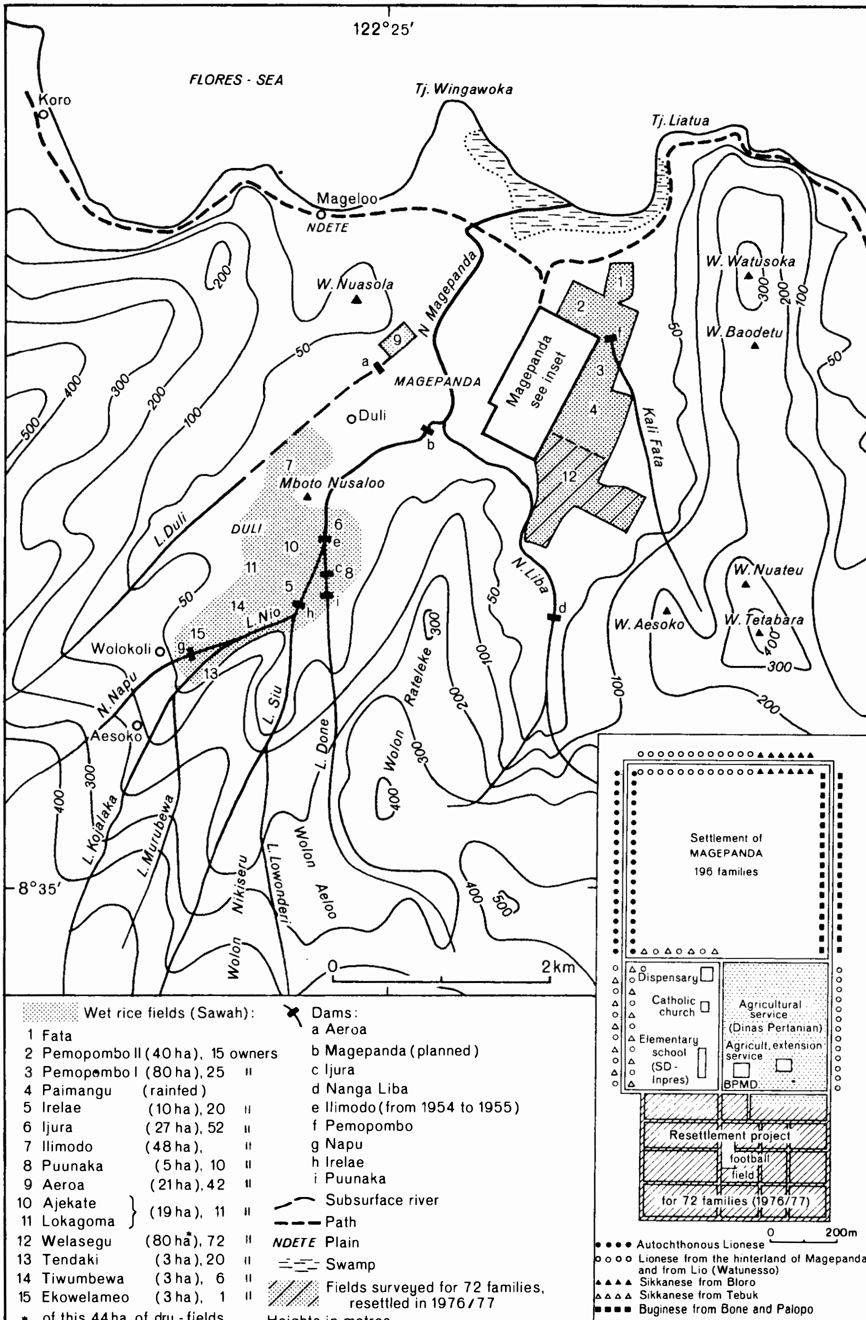
12. Koro/Ngalugau (Ds. Magepanda). Coastal plain of 250 ha of which 50 ha are cultivated as wet rice fields. Immigration commenced in 1950 when thirteen families from Ds. Nita and Ds. Nitakloang opened wet rice fields. Subsequently farmers from Aesoko, Wolokoli and Ngelakemba of the hinterland of Koro moved to the plain. Today fifty-five farmers live at Koro. Rapid occupation of the plain by farmers from outside Koro was impeded by claims of landownership by *riabewa*(L) Kangalande of Lio/Ende (Djangoen 1968). In addition about fifty seasonal farmers from Ds. Bloro (villages of Wukak and Natarwulu), Ds. Nita and Ds. Nitakloang work as sharecroppers.

13. Plain of Magepanda (Ds. Magepanda). One of the largest coastal plains in northern Sikka, 1750 ha, it is composed of several smaller plains (Fig. 46 and Plate 46).

(a) Plain of Ijura (75 ha) (Plate 47). Part of it cultivated as *sawah* for the first time in 1953 by 211 farmers from Ds. Nita (6 farmers), Ds. Bloro (30), Ds. Tebuk (94) (from the villages of Rane and Solot) and Ds. Nitakloang (81) upon initiative of the farmers' co-operative Ikatan Petani Bhakti Pancasila of Tebuk (da Cunha 1974:41). A dam erected by the farmers to make irrigation possible was destroyed by floods one year after its construction in 1955. These floods were the result of increased slash and burn agriculture in the mountains which border the plain to the south. These difficulties as well as problems with the local 'lord of the earth' and health problems (malaria and elephantiasis) caused most of the farmers to return to the saddle of Nita. Only fifty-four families remained in Magepanda. The dam was destroyed and rebuilt various times - e.g. in 1960.

(b) Plain of Ilimodo (74 ha). Part of it cultivated as *sawah* by 140 settlers from Ds. Nitakloang and Ds. Bloro (from villages of Wukak and Keit) since 1954. However in 1957, when floods destroyed the dam built by the settlers, the project was abandoned and with the exception of forty-five persons the farmers returned to their desa of origin.

(c) Plain of Pemopombo (120 ha). This part of the plain was first brought under cultivation by about twenty Buginese families from Bone and Palopo, South Sulawesi (Celebes), in 1963.



Sources: a) Subdir. Tata Guna Tanah, Dir. Agraria Prop. N.T.T., b) Subdir. P.M.D. Kab. Sikka, c) Top. map SC 51-52, U.S.-Army (1963), 1:250000, d) based on field work by the author

Fig.46 Magepanda: resettlement projects

They were given the right to cultivate this land as *sawah* by the 'original owners' of the plain of Magepanda (said to be three families only) in return for their services in catching buffaloes that had run wild. Their first contact with the plain dates back to 1954. With the knowledge of *sawah* cultivation which is common in South Sulawesi they soon succeeded in Magepanda. This community of twenty-six families (264 persons) has to be considered as the most prosperous farmers of the plain. The size of their *sawah* (2-3 ha/family) has been far above the average holding of other farmers (0.5 ha/family). Their economic strength is based not only on their skill but also on the fact that almost all buffaloes of that area are in their possession while other immigrants have to hoe their *sawah*. By the latter method 1/3 ha can be tilled at most by each family (da Cunha 1974:41). This situation has only slightly been changed by the introduction of tractors of Sikka's agricultural service (Dinas Pertanian). Technical difficulties have hitherto prevented the full use of these tractors. Moreover, the rental (Rp. 15,000/ha for ploughing and Rp. 7500/ha for harrowing) is considered too high for many farmers. The farmers of the plain were constantly threatened by floods caused by *ladang* farmers in the nearby mountains. In recognition of this causal sequence, the district government in 1967-68 ordered sixty-seven families from the nearby mountains to move to the plain of Duli (Magepanda) (see Fig. 44):

From	Families
Ngelakemba	10
Moketema	14
Mbou Bepa	17
Ndetuki	3
Wolopangga	3
Aesoko	10
Aekoe	3
Djitabewa	7

No aid was provided by the government. An increasing number of spontaneous immigrants from south Lio, Central Sikka and the district of Ende (west of Kabupaten Sikka) only arrived after the construction of a school, a dispensary and several dams in 1973. The remaining seventy-two families who lived in the mountains around Magepanda (villages of Lelebata and Woloara) were finally moved to the plain of Magepanda in 1975-76. As this project at Welasegu of 161.5 ha (see Fig. 46) was completely organized by the government and financed by the province (costs per family Rp. 250,000 to Rp. 300,000) each family was given a piece of land (30 x 40 m) and a house, a dry field (0.5 ha), and an irrigated rice field (0.5 ha) (for this the government built a dam at Liba) in addition to money for moving their belongings to the plain and a certificate for the surveyed and officially registered land.

But even after complete dislocation of the families from the mountains, Magepanda did not come to rest, for *ladang* farmers from Lekebai - south of the watershed - moved into the region just vacated by hill farmers and continued practising bush fallowing. As a result of indiscriminate deforestation floods continued to occur in the plain of Magepanda, thereby causing a number of dams to break (e.g. Aeroa) .or at least rendering irrigation facilities useless because of silt and rubble brought from the mountains (see Metzner 1978a). The economic position of most of the farmers in the plain has thus to be considered critical (see also Abell and Asten 1976:68).

14. Nangarasong (Ds. Magepanda). About 50 ha of irrigated rice fields and dry fields have been cultivated by fifty-six immigrants from Ds. Koting B, Ds. Koting C (villages of Diler and Gehak), Koting D (village of Gehak) and Ds. Nitakloang since 1963-64. In 1965 about sixty families from the hinterland (villages of Kojabewa and Keuladu) were forced by the government to move to the plain. Their candlenut trees (*Aleurites moluccana*) (*kemiri*(I)) are still in the mountains. In 1970 twenty more families came from Gute. About thirty seasonal migrants from Nita are reported to have been working fields as sharecroppers since 1971.

15. Nawuteu/Kolisia (Ds. Magepanda). Eighty-six farmers, most of them immigrants from Ds. Nitakloang, cultivate 40 ha irrigated ricefields and 20 ha rainfed ricefields. In addition seasonal migration of twenty farmers from Ds. Nita, Ds. Koting B, Ds. Koting D (village of Wutik) and Nele.

16. Nangahure (Ds. Wolomarang). Immigration of farmers from Ds. Nele Wutung, Ds. Nele Barat and Ds. Nele Lorang was envisaged in 1957-58 but failed because of fear of malaria and elephantiasis.

17. Gute/Kolisia (Ds. Magepanda). About 60 ha of irrigated rice fields cultivated by farmers from the surrounding mountains, from Woloba (40 families) and Natatupat (30 families) who had settled in the plain in 1970.

18. Wolongete (Ds. Wolomarang). Exclusively seasonal migration since 1973 by farmers from Ds. Bloro (100 farmers from village of Keit; 25 farmers from village of Bloro; 150 farmers from Ds. Nitakloang). They were each given a plot of 1 ha by the government. Since 1974 all agricultural land has been distributed. Costs of surveying and official registration had to be borne by the farmers. Since 1974, a sort of land use zonation according to which horses are not permitted to enter, or they may be killed, has been in effect. Since that agreement was reached, a large number of farmers cultivate their fields here.

South coast (western portion)

19. Dobo (Ds. Dobo). Immigration of farmers from Ds. Sikka (about 200 persons to Kampung Baru), Ds. Hokor, some also to Ds. Bera, Ds. Blatatating, Ds. Sapankopong (from area around Napung Gete), Ds. Hepang and Ds. Iligai (to Nangablo). In addition seasonal migration to Dobo occurs.

20. Korowuwu (Ds. Korowuwu). Large-scale immigration of farmers from Ds. Iligai, Ds. Sikka, Ds. Lela, Ds. Hepang since the 1950s. Seasonal migration to the plain of Korowuwu is common.

From this list of settlement areas it becomes evident that the northeast coast has become the preferred destination of permanent migration for farmers of the northern and southern flanks of Central Sikka and to some extent also for those from the saddle of Nita. The south coast and southwest coast have been settled exclusively by farmers from the southern flanks of Central Sikka. For the latter the northwest coast (north Lio) has not been attractive enough.

No information was available on the magnitude of emigration of Sikkanese to Java (mainly Jakarta - e.g. over 100 persons from Ds. Seusina) to the Moluccas and to Kalimantan where they work as lumber men. As a rule these emigrants return to Sikka after a number of years.

Population and land tenure

Population pressure can be assumed to have accelerated the process of individualization of land tenure in Central Sikka. The present pattern of land tenure is characterized by the juxtaposition of various forms of land tenure reflecting the stages of individualization mentioned on p.118. Communal land tenure has almost wholly disappeared. Remnants of this type were only found at two places in Central Sikka, above Nilo (Ds. Nitakloang) and at Delang/Mudung (Ds. Aibura) in the form of *medang* (see Fig. 47). This type of land possessed by several lineages is worked communally by 15 to 20 persons as *ladang* for one or two years.[8]

A more advanced stage of individualization is the system of hereditary family land (*tana gung*) still frequently found south of the central divide of Central Sikka (see Table 56). Since these plots are used by different members of a family alternatively, soil improving measures - e.g. planting of anti-erosion hedges,

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[8]Djafar (1972:2) mentioned *medang* for seven locations: Wololora, Doreng, Wisa, Ilikotit south of the central divide and Delang, Ilikoli, Rotat north of the divide. I could not locate Wisa (see Fig. 47). These *medang* were reported to have existed until the 1920s.

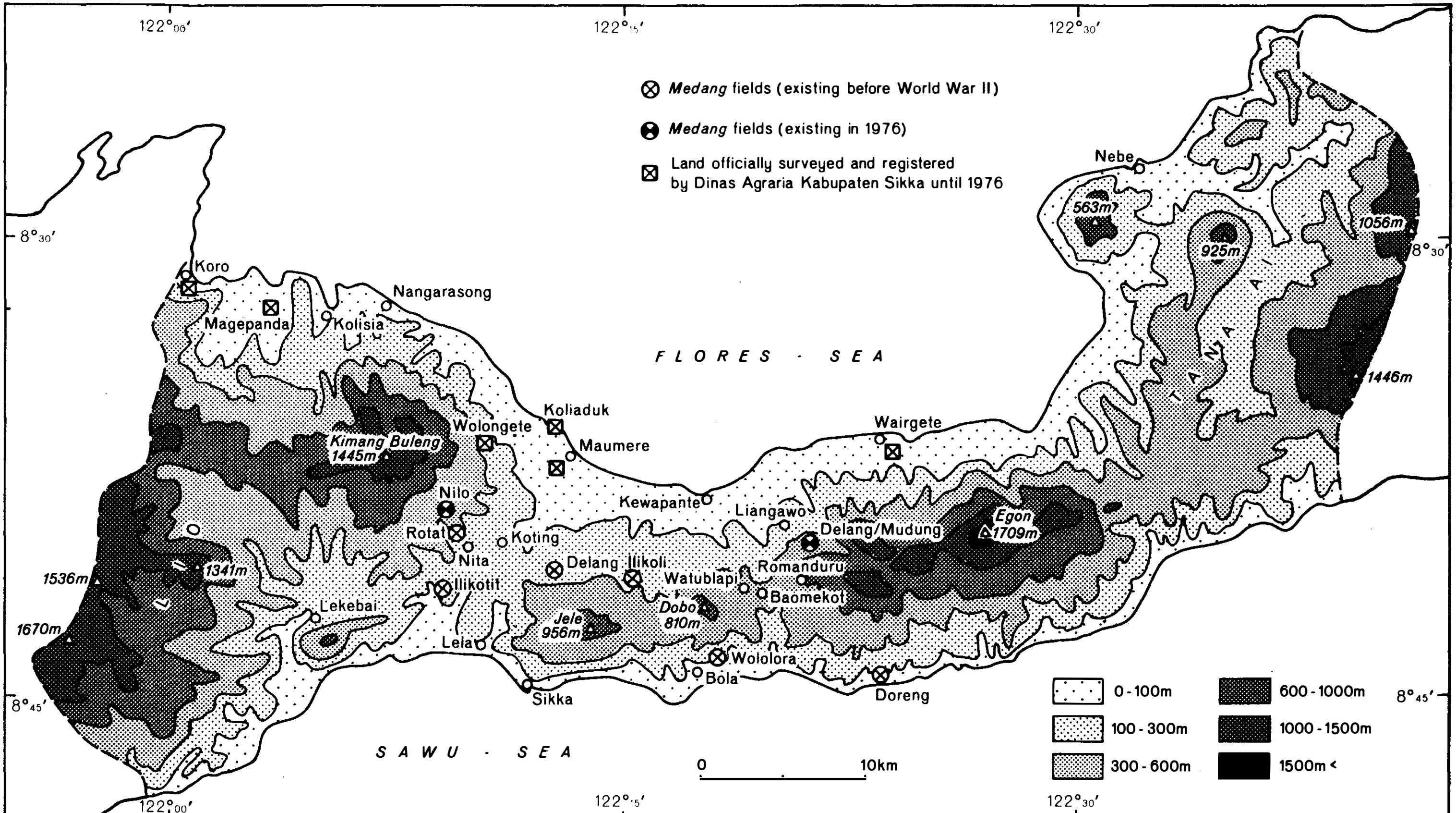


Fig.47 Sikka (without islands): communally held land (*medang*) and land surveyed by Dinas Agraria (as of Jan. 1976)

etc. - as well as perennial crops are absent.[9] If at all, the latter are found along the margins of the fields as boundary marks.

In Central Sikka land 'owned' by individuals (*tana buku batu*) which can be sold, leased and pledged is predominantly found. This category of land is usually bequeathed to the eldest son who has to make sure that his younger brothers are given either a portion of the land or an equivalent. The farmer feels more closely bound to this type of land, a fact which is reflected in a greater care for the soil, the construction of terraces and the planting of *lamtoro* hedgerows.

Established titles on land as such recognized by the government based on the Indonesian Agrarian Law of 1960 are still the exception in Sikka. This law, or rather package of laws (Undang-Undang No.5, tahun 1960 tentang peraturan dasar pokok-pokok agraria), which is said to be based on general *adat* concepts, may be considered as providing the frame for a basic change of Indonesian agrarian law. Yet the implementation of these laws on Flores is still in its infancy as respective regulations are hitherto absent. Local *adat* thus remains effective unless it obviously contradicts the spirit of the new law. In Sikka the new agrarian law cannot be implemented because of the virtual absence of surveyed and officially registered land as is typical for economically more advanced Java, Bali and Lombok, South Sulawesi and West Sumbawa. Surveying did not commence in Sikka before 1964. According to J. Ben Sareng, head of the Dinas Agraria, Kabupaten Sikka (pers. comm., 15 March 1976) surveys carried out before the *coup d'etat* in 1965 were not precise enough. For fear of a possible land tax and of a partial confiscation the actual size of plots was not disclosed by the owners.

Far more reliable figures were obtained after 1974 when surveying was resumed on those plots whose owners specially requested such a survey. Between 1974 and January 1976 only sixteen persons having a total of 18,920 m^2 were holders of officially registered titles (*surat keputusan pemerintah*). Until that moment, however, only 743 ha (i.e. less than 0.5 per cent of the district area of Sikka) had been surveyed. As most of these claims on land were still challenged by former users, official titles had hardly been issued. The surveyed areas were as follows:

Wolongete (west of Maumere)	*ca* 495.0 ha
Koro	57.2 ha
Magepanda (of which 33.8 ha *sawah*)	47.8 ha
Desa Kabor (part of Maumere)	87.9 ha
Waigete	55.0 ha

[9]Lack of soil-improving devices was observed on *tana gung* also by ten Dam (1950b:51) in 1950 on the eastern slope of Mt Kimang-Buleng between the villages of Guru (Ds. Nita) and Nilo (Ds. Nitakloang).

The land reform which was one of the major aims of the aforementioned Indonesian law of 1960 has therefore not even vaguely been implemented. A new regulation for Flores issued in 1974 and based on the national amendment Peraturan Pengganti Undang Undang No.56/1960 tgl. 29. Des. 1960 reduced the maximum size of a *ladang* a family of seven persons might hold from 20 ha to 12 ha, and to a maximum of 15 ha for families with more than seven members. The implementation of such a regulation must remain unattainable as long as actual land property remains unknown.

As a rule the Sikkanese prefer to buy land on the basis of *adat* rules, which means on the basis of oral contracts. These are preferred to titles formally entered in a land register as the former do not involve costs for surveying and for official registration which in 1976 varied according to size of the site to be surveyed between Rp. 2500 and Rp. 12,500. On the other hand, the lack of an official title somewhat impedes programs of agricultural intensification - for example the Bimas Program - because of a shortage of guarantees required for obtaining credit.

Concomitantly with the indicated process of individualization the fixed lease in kind (*kewe*), which was still common before World War II for farm land and for coconut trees, became obsolete.[10] Ten Dam (1950a:53) reports that the local court of Sikka moreover prohibited this type of lease for coconut trees, probably before the war. *Kewe*, with which a different form of lease is meant today, was gradually replaced by share cropping (*maa ihing*) in the northern littoral plain of Central Sikka after the war. These grasslands formerly used for hunting, as we have seen, lend themselves readily to permanent dry-land farming because of the regular supply of fertile minerals from the volcanic ridges south of the plain. The cultivation of the plain was initiated by the *raja* of Sikka in the late 1920s who in consultation with the *tana puăng* concerned agreed that land-hungry farmers be given the opportunity to plant perennial crops in the grasslands (*urung rii rotang*) of the northern littoral plain. The size of the fields was contingent upon what the farmer himself was able to cultivate. As the farmer was not allowed to use fire for this operation he was forced continually to work his field (*rewuk* or *tana magat*) lest noxious grasses invade it. Only the planting of perennial crops (*ru supung* or *supung sulang*) established rights of possession, i.e. permanent usufruct rights.

[10] In Ds. Nitakloang the old form of *kewe* ceased to exist in 1925. For the use of a fertile piece of land of 2.5 ha (= 10 *blek*) for the duration of three years the farmer had to pay in kind: one horse, one small elephant tusk (worth Rp.5000), rice, a woman's sarung, a man's sarung, and a big pig. In 1973 a form of *kewe* was still practised in Ds. Nitakloang at Wolon Keling. For the use of a piece of land of 11 *blek* (=2.75 ha) covered with secondary forest and to be used for three years the farmer in question paid Rp. 10,500 and placed his horse at the disposal of the owner of the land for one year.

As was indicated earlier, the cultivation of the plain was initiated chiefly by Buginese and people from the islands of Saleijer and Bonerate who had bought substantial portions of the coastal plain on the basis of *adat* rules. Since they were neither interested in working their fields themselves nor able to do so because of the size of their holdings they recruited labour from the mountains nearby. The hill farmers being themselves usually all in possession of agricultural land in the mountains had to be won for this extra work by particularly attractive conditions. This seemed to be the case with sharecropping whereby the owner of the field and the sharecropper divide the yield equally or, occasionally, with Moslem owners even at a rate of 1:2. The agricultural products, green gram and maize, were normally sold for cash with which the hill farmers purchase imported goods.

While, generally speaking, population pressure has led to an increasing grip on the land, it was impossible to find any clear correlation between population density and the degree of individualization. Neither did the percentage distribution of land holdings - i.e. only for *tana buku batu* and *tana gung* - of farmers by size yield any correlation with population pressure (Table 55). Desa with a comparatively high percentage of land-owning farmers with holdings of more than 1 ha (= 4 *blek*) were found in Kajowair (60 per cent), Rubit (50 per cent), and Iligai (40 per cent), whereas the percentage of households without land was highest in Ds. Namangkewa (32 per cent), Ds. Aibura (20 per cent), Ds. Nele Wutung (18 per cent), Ds. Koting B (14 per cent), Ds. Iligai (12 per cent), Ds. Nele Lorang (10 per cent), Ds. Kokowahor (10 per cent) and Ds. Nele Lorang (10 per cent).

Table 56 reflects the results of the intensive agricultural survey carried out in 1976, and the types of land tenure indicated by fifty farmers of each of the nineteen desa where interviews were held are shown. A few salient points emerge from this:

1. Share cropping (*maa ihing*) is usually limited to a few coastal desa (Namangkewa, Watumilok). Where sharecropping fields are declared by farmers of mountain desa (Nele Wutung, Nele Lorang, Koting B, Kokowahor) such fields are located outside these desa. Most often farmers of the mountain desa work as sharecroppers; in a few instances they may also own the fields to be worked by others on a sharecropping basis.

2. *Ua tepo* is hardly practised.

3. Family land (*tana gung*) is conspicuous in desa of the southern flanks (Umauta, Bola, Ipir, Wolokoli, Wolonwalu, Hokor). To a far less degree it is also found in Ds. Mekendetung, Ds. Wolomotong and Ds. Watuliwung.

The data of the percentage of families by size of holding are

Table 55

Percentage distribution of farmers interviewed holding land (*tana buku batu* or *tana gung*) according to size of holding (in *blek*), or without land

Desa	Population density per sq. km	Without land	1 *blek*	1.1-2 *blek*	2.1-3 *blek*	3.1-4 *blek*	4.1-5 *blek*	5.1-6 *blek*	6.1-7 *blek*	7.1 *blek*
Hokor	266	6	10	18	8	16	16	4	12	10
Wolonwalu	211	6	16	30	18	10	8	10	0	2
Wolokoli[a]	481	10	40	25	15	5	0	0	0	5
Bola	592	0	22	22	22	20	6	6	2	0
Ipir	417	6	18	10	22	12	12	4	2	7
Umauta	383	4	10	20	16	14	10	0	4	22
Wolomotong	422	6	6	24	12	12	8	4	6	22
Rubit	1266	8	12	12	4	14	6	2	6	36
Kajowair	366	4	4	8	6	18	12	4	8	36
Aibura	206	20	8	8	16	10	10	6	6	16
Kokowahor	357	10	12	12	22	8	6	8	8	14
Mekendetung	471	8	6	18	18	12	12	12	8	6
Nele Wutung	334	18	22	28	16	6	2	0	4	4
Nele Lorang	1990	10	20	22	12	12	12	4	2	6
Koting B	395	14	30	16	12	10	4	2	4	4
Iligai	373	12	18	6	12	12	8	0	2	30
Watumilok	517	8	22	26	18	10	2	4	2	8
Watuliwung	518	0	12	36	16	6	2	8	4	16
Namangkewa	602	32	12	18	2	4	2	4	6	20

a Only 21 farmers interviewed instead of 50 farmers.

Source: My own survey carried out in 1976.

Table 56

Types of land tenure in Central Sikka irrespective of location of fields

Type of land tenure	Watumilok	Kokowahor	Mekendetung	Iligai	Umauta	Ipir	Aibura	Nele Wutung	Wolokoli	Bola	Wolonwalu	Hokor	Koting B	Nele Lorang	Namangkewa	Watuliwung	Rubit	Wolomotong	Kajowair
1.Total land owned by 50 farmers interviewed: [a]																			
total number of fields	90	154	172	185	161	153	118	145	60	130	129	167	113	171	116	103	157	161	85
size (*blek*)	182.25	278.5	232.5	429.75	276.75	241	306	207.25	48.75	155.3	164.25	245.25	165.25	228.25	261.75	211.75	421.0	406.25	384.25
2.*Tana gung*:																			
number	-	-	52	-	43	58	-	-	24	68	61	76	-	-	-	14	-	14	-
size (*blek*)	-	-	109.0	-	127.75	108.75	-	-	21.0	96.0	83.75	121.0	-	-	-	32.25	-	33.0	-
3.*Tana buku batu*:																			
number	75(3) [c]	122(25)	78(32)	135(12)	41(26)	77(5)	74	79(17)	17	55(17)	50	62(5)	86(19)	116(85)	88(47)	82(2)	127(59)	101(9)	136(60)
size (*blek*)	149.5	221.0	89.0	313.75	108.0	102.0	206.0	111.0	14.5	38.3	51.0	85.25	126.75	151.0	218.0	166.0	362.5	272.5	359.0
4.Fields pledged to someone else:																			
number	8(1)	20(7)	5	8	11(3)	16	5.5	-	6	3	6	-	9(1)	5(2)	16(7)	5	11(2)	19	1
size (*blek*)	12.25	29.0	7.0	6.5	19.5	17.75	18.0	-	4.25	2.5	12.0	-	7.0	3.5	32.0	6.75	24.0	47.5	3.0
5.Fields pledged by someone else:																			
number	4(1)	12(4)	26(11)	17(10)	11(3)	8	26(1)	4(2)	4(3)	9(3)	7	1(1)	4(1)	6(5)	7(5)	3	17(8)	21(2)	31(16)
size (*blek*)	9.0	25.0	33.5	38.5	15.5	9.5	44.5	2.0	7.5	13.5	9.0	3.0	5.5	6.5	15.0	5.0	22.5	47.5	80.5
6.Sharecropping (*maa ihing*) fields:																			
(a) owned by the farmers interviewed number	12(4)	6	-	1	-	-	-	4(2)	-	-	-	-	8(5)	5(4)	1(1)	-	1	-	-
size (*blek*)	23.0	3.0	-	2.0	-	-	-	8.0	-	-	-	-	14.5	11.0	2.0	-	4.0	-	-
(b) owned by someone else - number	8(2)	12(4)	4(1)	4(2)	-	-	-	32(24)	-	-	-	-	13(4)	48(34)	14(4)	-	-	-	-
size (*blek*)	19.75	33.5	8.5	5	-	-	-	44.5	-	-	-	-	18.5	73.25	19.25	-	-	-	-
7.Fields borrowed from relatives without payment (*neni plaa*).																			
number	1	6(2)	5	2(2)	14(6)	10(1)	9(2)	-	5	7(3)	11	13	6(2)	1(1)	6(2)	1	6(1)	7(2)	15(6)
size (*blek*)	4.0	8.5	10.75	21.5	24.5	21.25	16.0	-	5.25	4.5	12.5	17.0	7.0	0.5	7.5	4.0	9.0	6.5	26.75
8.Parts of field given to helpers by the owner (*ua tepo*):																			
number	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-
size (*blek*)	-	-	0.25	-	-	-	-	-	-	-	-	-	-	-	12.0	-	-	2.5	-
9.Two persons who divide the yield equally:																			
number	-	2	-	27(13)	-	-	9(1)	15(7)	1	1(1)	4	15	2	-	1	2	6(3)	17	4(2)
size (*blek*)	-	3.75	-	53.0	-	-	37.5	28.50	1.0	3.0	7.0	20.0	3.0	-	2.0	4.5	23.0	42.75	16.5

a Total land 'owned' is not identical with the sum of types of land tenure 2-9, since for instance land pledged to someone else (No.4) or leased out for sharecropping (No.6) is usually also listed under No.3.

b Only 21 farmers interviewed.

c Number in brackets indicates fields located outside the desa but included in figure to the left of it.

Source: Survey carried out by the author in 1976.

by themselves of limited value only in an assessment of population pressure. The fact that a farmer does not hold land, or has only a small field, does not mean that he does not have access to land for subsistence production. The borrowing of land (*neni plaa, ua tepo, sadang* and *uma leleng*) from relatives, friends, and villagers is common throughout those parts of Sikka settled by the autochthonous population. Its base is the customary, though weakened social obligations that exist between kinsmen, friends and villagers. Yet the right of access to land usually does not imply that the borrower may plant perennial cash crops. Thus as long as land was abundant no value was attached to the possession of land. People planted whatever they deemed necessary. It was only when land became scarcer that inequalities of landholdings led to economic differentiation of the population. Thus the planting of fruit trees, like coconuts, cacao, cloves, etc. is only permitted on one's own land.[11] Such planting is frequently performed in order to demarcate a claim. Consequently coconut groves have boundaries that are well defined. The social system and its customary obligations were only partly able to even out the inequalities of landholdings. Hence increasing land shortage is as much the result of population increase as of growing commercialization.

Resource-based perspective

As we have seen there is no clear relationship between population density and intensity of agricultural use. Whereas permanent cultivation as the most intensive form of agriculture is found along the northern littoral zone and in a few isolated spots on the saddle of Nita, these areas by no means coincide with those of highest population density. High population density figures are, for instance, encountered in Ds. Bola, Ds. Lewa and Ds. Korowuwu along the south coast where bush fallowing - hence less intensive agriculture - is common. Despite this non-concurrence the population increase particularly since the 1950s has - on the whole- caused fallow periods to become significantly shorter. While eight to ten years of fallow were typical for most of Central Sikka before

[11]As a result of compulsory planting of coconuts before World War II (see p.143) coconut trees were frequently planted on land not belonging to the planter's clan. While the trees belonged to one person or clan, the land belonged to somebody else. These mixed holdings (*puung gaer*) have meanwhile given rise to ardent conflicts which keep the court of Maumere still busy today. The following cases were brought to court between 1975 and 1977:

	1975	1976	1977
Hereditary land	5	12	6
Private ownership	3	2	3
Village land	1	2	-

Source: V. Parera, pers. comm., July 1978.

World War II, no more than two to three years are common today. While the length of the fallow has been shortened the cropping period has, generally speaking, not been modified; two to three years under cultivation, as were typical in the 1930s, are still common except where permanent cultivation is practised. Yet although intensity of cultivation has more than doubled over the last fifty years there has been no change in the bush fallow technique of maintaining soil fertility. On the contrary, formerly practised techniques of induced fallows with *Sesbania grandiflora* and *Hibiscus tiliaceus* (*tana luma lago*) have been discontinued. One might therefore expect to find symptoms of ecological stress within the system.

Although land completely denuded and hence lost for agricultural purposes, so typical of Timor and Sumba (see Metzner 1977a and 1976a; Ormeling 1955), is not encountered in Central Sikka, large-scale erosion and a deterioration in the fallow vegetation from *belukar* to grassland is encountered in the densely populated desa in the mountains. As a result of man's activity surface run-off has been accelerated and rivers and creeks have cut deeply into the loose tuffaceous material. The water regime has become more seasonal. No river in Central Sikka can be called perennial. Instead, flooding has become a menace for the people in the lowlands. Since the 1950s when forests were no longer effectively protected and farmers opened new fields in the woods; the town of Maumere (Fig. 16) and the market centre of Kewa/Geliting have been struck by disastrous floods, as we saw earlier.

A convincing example of the results of indiscriminate bush fallowing is the destruction of fishponds at Koliaduk, one kilometre west of Maumere. This spot, which was considered *taboo* by the local population, had its sanctity removed by the fisheries department of Sikka with the opening of thirty fishponds in 1959. The yields were, however, discouraging as water from the sea could not be controlled owing to the lack of a water-gate. Only two years later the fishponds became victim of floods caused by *ladang* cultivation in the upper reaches of the river Wairklau which flows through the project area (Plate 29).

A new effort at reviving the fishponds scheme was made in 1967 when government funds were allocated for the construction of a main gate. Private parties - merchants, policemen and the mission - acquired the usufruct right for one or more of the fifty-five fishponds with altogether 67.7 ha, each pond being equipped with a water-gate. The first two years of operation, 1968 and 1969, were quite successful (e.g. in 1968, 1655 kg of fish were caught on 33.5 ha - Bella 1972:71). In contrast to the practice in Java where young milk fish (*Chanos Chanos Forskal* of the family *Chanidae*), called *ikan benteng*, are raised in the running water of creeks and rivers, at Koliaduk young milk fish (about 25 cm long, weighing about 600 g) enter the fishponds at high tide or are caught near the beach in July. Twice a month (at new moon and full moon) the gates are opened to let sea water enter the fishponds.

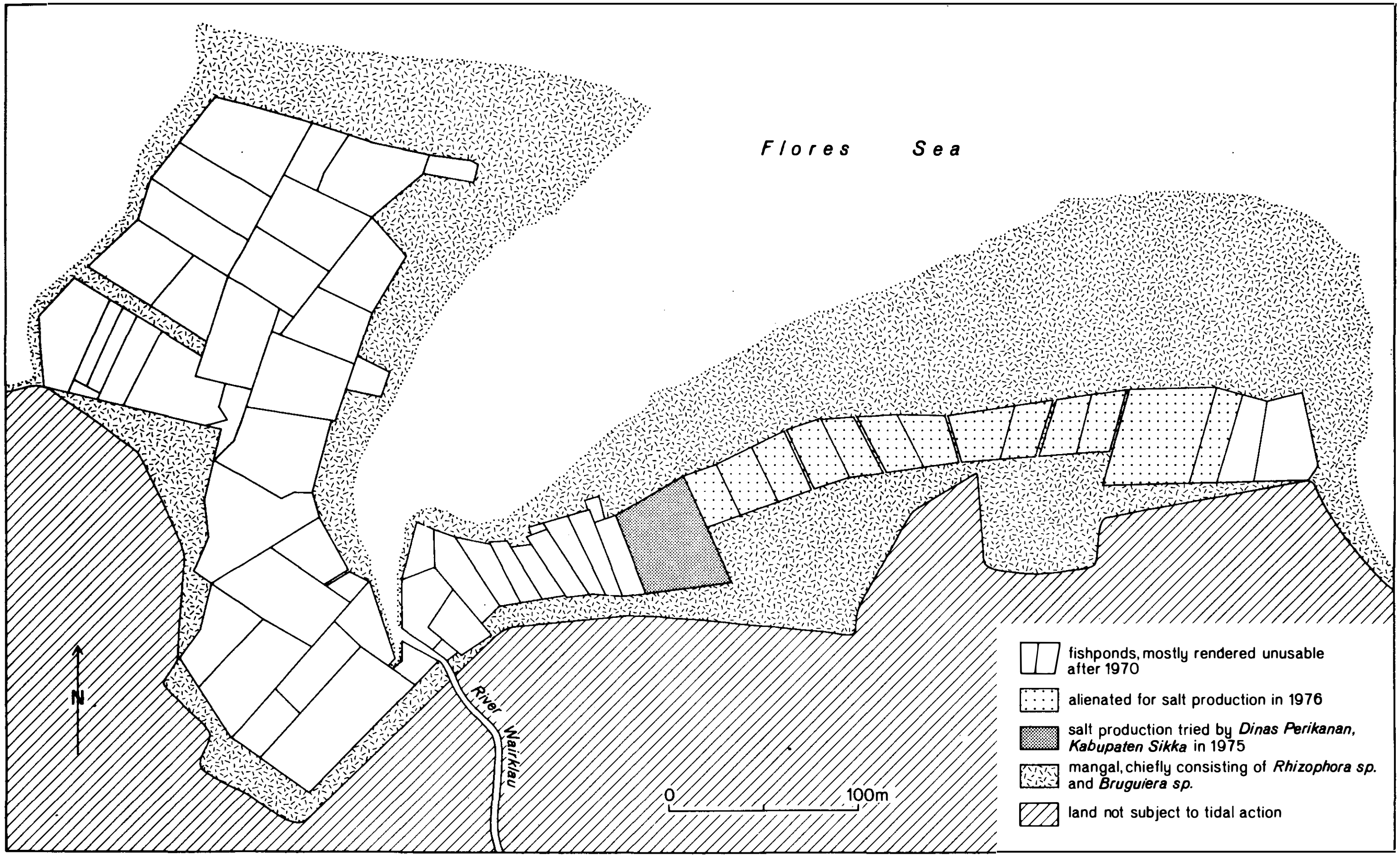
In January 1970 the river Wairklau flooded, again destroying a substantial section of the fishponds. The gradual destruction of the remaining ponds could not be prevented even by a hastily erected dam. When in March 1973 a tidal wave caused further damage, the project was discontinued. In 1976, thirteen of the ponds (Fig. 48) were alienated for salt production. So far only a few persons have availed themselves of this free offer from the fisheries department, despite encouraging trials in 1975 which yielded 3.5 tonnes of salt in a pond indicated on Fig. 48. This step by the department seems to be no less short-sighted than the previous one and gives proof of the absolute lack of understanding of geoecological relationships. Since the production of salt requires tremendous amounts of firewood because of pan-evaporation, the little forest that is found in the hinterland of Koliaduk is at stake.[12] This again is likely to engender further erosion.

Symptomatic of the overutilization of natural resources has been the change of fallow vegetation. The increase in the proportion of grassland in the mountains - e.g. at Mt Iligai, Mt Ilinewa, Mt Tolawair and on the eastern slopes of Mt Kimang-Buleng in Ds. Nitakloang - has been conspicuous. The deforestation of the latter area has given rise to the floods experienced at Koliaduk.[13] The disappearance of *belukar* vegetation and the ensuing decline in agricultural yields have caused farmers of Koting, Nita and Nitakloang who used to cultivate fields on these slopes to abandon their plots and to look for alternative land, chiefly for the growing of subsistence crops, in Ds. Wolomarang and elsewhere (see p.210). Information provided by village elders at Nita suggests that dry-land cultivation was once far more intensive. As grasslands (*Imperata cylindrica*) require a far greater labour input to render them useful for agriculture and since yields are considerably lower, the farmers readily abandoned their plots.

If we try to relate the degree of ecological deterioration to the agricultural systems distinguished in Central Sikka, agricultural systems VII and VIII of the southern flanks as well as that practised on the western slopes of Mt Tarat-Egong above 500 m

[12] Salt is produced from tidal salt-impregnated soil which is placed in a wooden frame. Water is poured over the soil. The salt solution collected in containers underneath is then poured into shallow pans. A steady fire beneath the plans speeds evaporation. About one cubic metre of wood is required as fuel for about 120 to 150 kg of salt.

[13] For instance the slopes around the rivers Wairpelit and Wairlebeng were reportedly still under forest in the second or third decade of this century (ten Dam 1950b:23).



Source: 1:2000 map produced by R. Reo, *Dinas Perikanan, Kabupaten Sikka*.

Fig.48 Koliaduk: fishponds

(agricultural system VI) seem to be in a particularly exposed position. It is here that ecologically unstable systems exist. Terracing, either direct or indirect, increased growing of tree crops, rotation of crops, planting of induced fallow vegetation, etc. - techniques which are urgently required to render agriculture more stable on these steepest of Central Sikka's flanks - are not found in these zones, or else are insufficiently found.

On the other hand, a number of attempts by the indigenous population towards ecologically oriented land utilization are conspicuous for most parts of Central Sikka in which agricultural systems I-V are practised. Examples of such attempts are:

1. *Ajar waang lelē*; i.e. mulching using maize stalks.
2. *Hera blepeng*; i.e. construction of anti-erosion devices whereby bamboo poles are fastened along contour lines. These *blepeng* are, however, of limited use as they are easily destroyed by surface run-off.
3. *Tokang ai waing*; i.e. planting shrubs at *blepeng* for stabilization of the latter.
4. *Reping*; i.e. placing grass and brushwood at *bleping* to increase efficiency of *blepeng* as erosion controller.
5. *Sako magang*; i.e. hoeing of the soil restricted to the spots where maize or rice seed is inserted. By this technique which is only practised on fertile *tana mita* on the saddle of Nita the hazard of erosion is reduced.
6. On tobacco fields of agricultural system I, weeded grass is not burnt as is usually done but spread on the field, thus serving as mulch. At times additional grass is also cut at distant spots and brought to the fields.
7. Since 1964, small livestock (goats and pigs) have had to be penned or tied by common consent of all farmers on the saddle of Baomekot - above all around Watublapi. As a positive result, young perennial plants like cloves and cacao planted to form *ongeng* are no longer damaged by livestock. A similar agreement was reached with respect to horses by the farmers of Ds. Watuliwung. Here - at the low-lying portions of the desa - horses were left free to graze until 1965. They have to be tethered now.

While erosion, a shortening of the fallow period, and a change in the fallow vegetation have occurred throughout Central Sikka the difficulties do not seem to have reached such dimensions as to make a breakdown of the ecosystem likely to occur in the near future. The agricultural environment in Sikka seems to be much more suitable for intensive cropping than what Geertz assumed to be typical for Southeast Asia. Sikka's soils, derived from recent volcanic material, are of high inherent fertility. Owing to comparatively low rainfall they are not subject to heavy leaching.

As a consequence the decline in yields is nowhere near the 80 per cent drop reported by Geertz (1963:23). It rather seems that Geertz, who based his characterization of the *ladang* system largely on Schrieke's (1955) case study of the Minangkabau of West Sumatra, overestimated the fragility of the shifting cultivation system and the narrowness of the demographic limits within which it is a stable system.

Economic perspective

A discussion of the issue of stability of agricultural systems under economic aspects presupposes a definition of the term intensification. In agriculture intensification of production describes the addition of inputs chiefly of capital and labour against constant land. The purpose of intensification is to gain more production from a given area. Although labour intensification has been primarily dealt with in the literature, skills are in many ways more important, particularly if these are employed in the creation of permanent improvement to the land. Such improvements - like *lamtoro* hedges, fences, terraces, etc. - may be regarded as capital for the farmer. Another important aspect of agricultural intensification is the organization of the farm itself and the method used to allocate land. From this discussion it becomes evident that if we rank agricultural systems according to their degree of intensity, the terms 'extensive' and 'intensive' systems only inadequately describe the wide range of possible variations.

Existing theory concerning the causal processes of agricultural intensification is essentially population-based. Yet from the previous chapters we have seen that neither Boserup's thesis of a close relationship between population density and intensity of agricultural production, nor Geertz's thesis of an alleged narrowness of the demographic limits within which a *ladang* system is considered stable, could be credibly sustained in the Sikka context. While the former seemed to disregard the impact of different environments on the process of agricultural intensification, the latter appeared to underestimate the stability of *ladang* systems under rising population density. Agricultural involution - that is the constant absorption of additional labour into an agricultural system without upsetting it, claimed to be the rule for *sawah* systems, does not in the eyes of Geertz apply to the comparatively fragile ecology of *ladang* systems. The notion of involution which Geertz introduces is nothing else but a refined version of the Malthus theorem. He and Malthus consider environmental constraints the independent, and population the dependent variable.

All three theories - Boserup, Geertz and Malthus - are, however, quite closely related if we take account of the variables each disregards (Brookfield 1972:34). The environmental constraint, which Boserup fails to include in her scheme, is significant in so far as it determines the basic input of labour needed to make a living. Thus it can be assumed that any given area with a given resource endowment can be made use of by a hierarchy of feasible agricultural systems. The lower the environmental constraints the more agricultural systems seem to be feasible. The hierarchy is determined by the complex of skills and technology involved. Assuming that the labour input per head of population is fixed, each system has a range of population capacities. From Fig. 49 we see that the minimum capacity is determined by the population which is capable of sustaining the system, while the maximum capacity is defined by the population at which the marginal per capita product reaches zero. Theoretically the optimum population capacity of a given system is located between the minimum and the maximum capacity at I_{opt} where the average labour productivity curve reaches its maximum.

The slope of the curves and the distance between the three critical points will vary from system to system. The range of population capacities of different systems will most likely overlap. Under a given agricultural system increasing population beyond I_{opt} will lead to decreasing labour productivity and hence to 'agricultural involution' (from I_{opt} to I_{max}) according to Geertz. When the marginal product reaches zero there will either be an enforced shift to a higher level system or a Malthusian limit. The shift to a higher level system which theoretically should occur at I_{opt} may be delayed because of social, psychological and institutional hindrances (Brookfield 1972:34-5).

If these theoretical proportions are to be useful they must relate empirically and help explain at least part of the phenomena of agricultural intensification and hence also the factors conditioning the stability of agricultural systems in Central Sikka. What we shall attempt to demonstrate is essentially how farmers of the three major ecological zones (northern littoral zone, southern flanks, central mountains including saddles) have responded in terms of farm management to increasing population pressure. Thus we shall be concerned with labour as the chief factor of production, while the influence of capital is, in my view, as yet negligible. The provision of simple agricultural tools - like digging sticks, dibbles, hoes - is still fairly uniform throughout the area. More sophisticated implements including motor ploughs or tractors are still unknown. Likewise land improving devices - e.g. terraces, *lamtoro* hedges, *blepeng*, etc., most of them of recent origin - are only just beginning to bear fruit. Thus capital as a differentiating factor influencing the yield performance can safely be disregarded. This will probably change rapidly once the Bimas program with its massive capital-intensive inputs of mineral fertilizer, herbicides and pesticides has caught on with Central Sikka's farmers. For this reason, farmers participating in the Bimas program have not been interviewed.

There is certainly no uniformity in the economic behaviour nor in the farming abilities of individual families. Considerable differences in skills are conspicuous as revealed by the analysis of our detailed questionnaire presented to 950 farmers.[14] The analysis for instance clearly demonstrated the effect of the time of sowing and the amount of weeding on yields of both maize and hill rice. It substantiated the opinion generally held by Sikka's farmers that early sowing coupled with frequent weeding (twice or three times during the growth of the crop) gives higher yields. It also showed that the period between sowing and weeding significantly affects yields. If weeding is not performed four to six weeks at most after sowing, agricultural production may be jeopardized. From these examples the significance of proper timing of agricultural tasks and thus also of the availability of labour at specific moments during the agricultural year can be gauged. It is the availability of labour that has to be considered the paramount factor in farm management upon which hinges success or failure of agricultural production.

Skills are also applied to the creation of real capital in the sense of permanent improvements to land. Evidence for this are, for instance, *lamtoro* hedges with which indirect terracing is attempted. Such activities are not encountered in all parts of Central Sikka, as we have seen. They are, for instance, largely absent in the desa of the southern flanks. Yet as these land improving activities only bear fruit in the form of higher yields in the long run, they were not considered in the calculation of labour productivity, as presented below.

The foregoing remarks served to qualify the data which we collected through our detailed questionnaire of 950 farmers belonging to 19 desa of Central Sikka. In comparing groups of various desa we assumed that the groups were homogeneous - i.e. that the distribution pattern of skills was similar in all groups. Although this assumption may sound quite rigorous, it largely reflects the impression conveyed from the data.

For the subsequent analysis of labour productivity only maize and hill rice (converted into grain equivalents - Ge), the staple

[14] It is recognized that an even more realistic picture of labour productivity could have been obtained, had labour input figures been recorded for an entire year. Such an approach, however useful it may be, would have been far beyond the scope and capacity of a single researcher. Moreover, a greater degree of statistical reliability might have been provided if techniques of variance analysis had been applied.

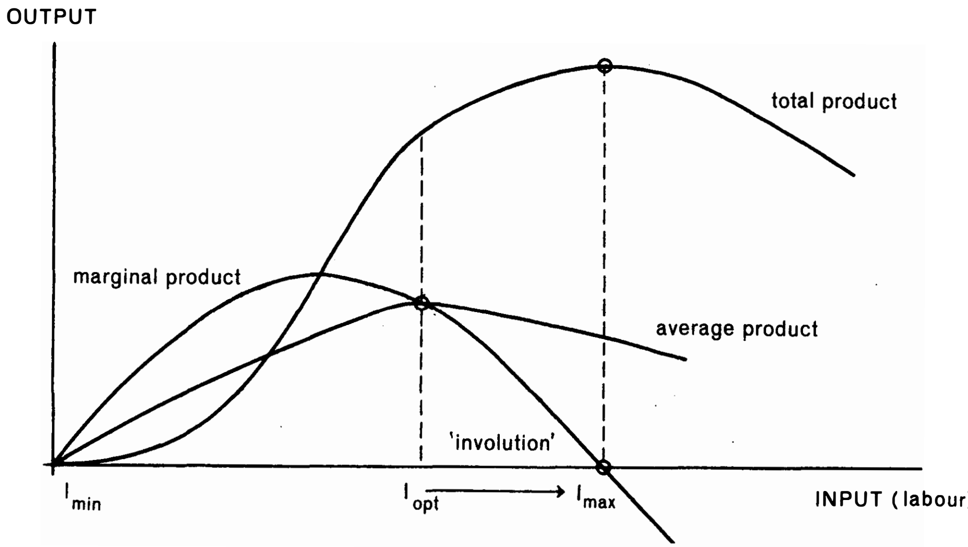


Fig.49 Classical function of production, average and marginal product

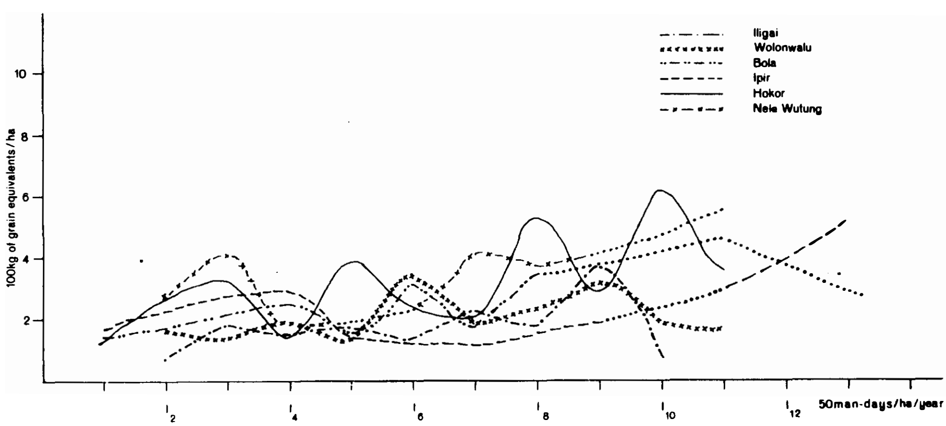


Fig.50 Desa of the southern flanks: gross yield curves

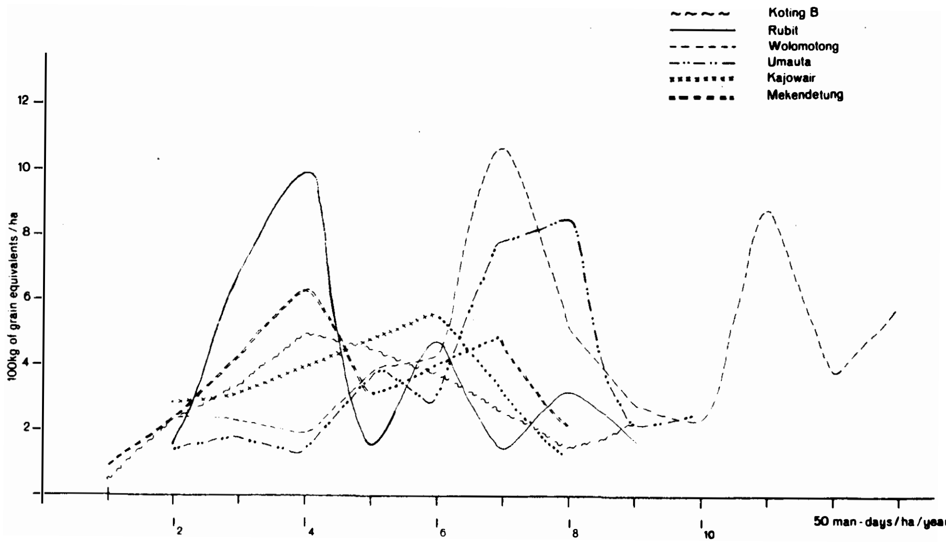


Fig.51 Desa of the saddles: gross yield curves

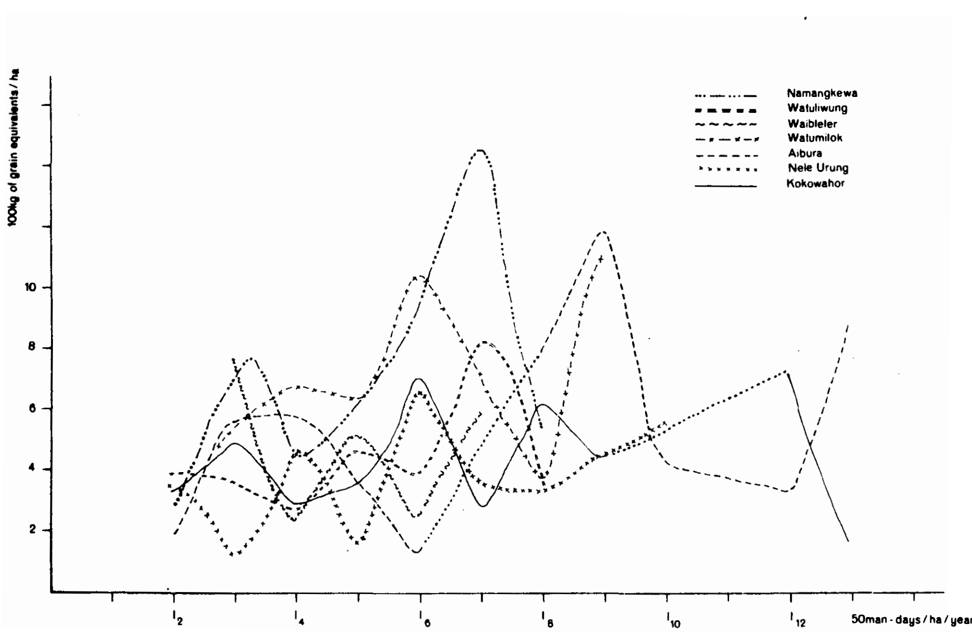


Fig.52 Desa of the northern foothill and littoral zones: gross yield curves

crops of the farmer of Central Sikka, have been included.[15] Moreover, we have deliberately excluded crops of the second season - i.e. the production of green gram - which was found to be of importance in the northern littoral zone, and second-season maize (*lelê daran*) which is not regularly grown and only by those who had a poor harvest of the first season crops. Cash crops (copra, cloves, cocoa) have likewise been excluded. It is maintained that Sikkanese farmers do not grow cash crops in order to be able to purchase some of their daily food. Rather they attempt to grow their daily food crops themselves. Thus only the latter have been included in the survey.

Table 57 summarizes the results of the calculation of labour productivity for 24 desa of Central Sikka. The median values and their range of deviation indicated by quartiles and deciles clearly point to regional differences. Most desa south of the watershed are characterized by very low median values (Iligai 0.80; Hokor 0.90; Wolonwalu 0.64; Ipir 0.82; Bola 0.88). Wolokoli forms an exception (1.83) but since for technical reasons the information from only twenty-one farmers was found useful in that desa the data are not fully comparable. From observation in the field it is safe to say that its labour productivity values can be assumed to be as low as those of Ds. Wolonwalu. Low labour productivity seems to be correlated with the low degree of stability of the agricultural system. The common practice of 3 years under cultivation and 3 years under fallow seems to be too short. As noted above, soil improving devices are largely absent. Tree crops are hardly planted because of hindrances imposed by land tenure.

Low productivity is also recorded for the desa of Wolomotong (1.00) and Rubit (0.96) which is not surprising in view of the intensive cultivation and the lack of measures aimed at restoring soil productivity (agricultural system VI). Because of the extremely high population density in these two desa (Ds. Rubit: 1267 persons/km^2 and Ds. Wolomotong: 422 persons/km^2 - whereby almost half of the peasantry of Ds. Rubit cultivate fields in the neighbouring desa of Wolomotong) permanent dry-land agriculture is practised locally. For reasons of scale this form of cultivation could not be mapped on Fig. 35 (p.156), given the dynamic topographic conditions. Permanent dry-land cultivation does not seem to be stable without direct or indirect terracing with *Leucaena leucocephala*.

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[15]The following conversion rates were used (Klayman 1960):

1 kg rough rice (*padi*) = 0.80 Ge
1 kg hulled rice (*beras*) = 1.19 Ge
1 kg maize = 0.75 Ge

On the basis of these rates 1 *blek* of clean rice (*padi bersih* = 12 kg) equals 9.6 Ge; and 1 *beser* (= 6 kg of maize kernels) equals 4.5 Ge.

Table 57

Labour productivity (medians, quartiles, deciles) for all fields under cultivation irrespective of size[a]

Desa	Lower quartile	Upper quartile	Lower decile	Upper decile	Median
Hokor	0.48	1.50	0.20	2.25	0.90
Wolonwalu	0.38	0.97	0.22	2.07	0.64
Wolokoli[b]	0.79	2.50	0.45	3.44	1.83
Bola	0.46	1.85	0.25	3.49	0.88
Ipir	0.38	1.56	0.23	2.40	0.82
Umauta	0.65	2.27	0.43	2.73	1.20
Iligai	0.47	1.56	0.26	3.05	0.80
Rubit	0.49	1.49	0.28	3.47	0.96
Wolomotong	0.46	1.64	0.25	2.18	1.00
Kajowair	0.97	2.32	0.39	3.66	1.83
Kokowahor	1.01	2.47	0.63	4.54	1.54
Aibura	1.03	4.00	0.58	5.05	1.83
Mekendetung	1.20	3.20	1.60	5.00	2.10
Watuliwung	1.02	3.31	0.43	5.00	2.08
Watumilok	1.57	4.93	0.84	7.50	3.38
Namangkewa	1.60	4.55	1.03	6.88	3.21
Waibleler[b]	1.40	4.47	0.77	7.89	3.15
Koting B	0.65	2.85	0.35	4.65	1.65
Nele Wutung	1.00	2.70	0.60	4.30	1.30
Nele Urung[b]	1.01	2.56	0.42	4.50	1.31
Nele Lorang	0.78	2.85	0.48	3.60	1.29
Dobo[b]	0.69	2.30	0.56	4.50	1.33
Watugong[b]	0.39	0.80	0.30	1.41	0.60
Beru[b]	0.30	1.52	0.20	3.84	0.60

a Labour productivity measured in kg grain equivalents/man-day.

b Data for these desa were obtained indirectly through farmers having their residence in other desa.

By far the lowest median values are found at Ds. Beru (0.60) and Ds. Watugong (0.60) where cultivation is particularly intensive owing to the proximity of Maumere and Nele, two centres of population. In addition, physical conditions in these two desa seem to be less favourable because of outcrops of coral limestone (see Fig. 6, p.24).

The highest productivity values were obtained in the desa of the northern alluvial plain in Ds. Watumilok (3.38), Ds. Namangkewa (3.21) and Ds. Waibleler (3.15). The data for Ds. Watuliwung (2.08) are somewhat lower, which can be explained by the fact that this desa comprises not only one but several physical zones - the lower reaches of the central ridge as well as part of the alluvial plain.[16] The high labour productivity in the northern plain has to be attributed to favourable edaphic conditions as well as to the common practice of crop rotation (maize and green gram).

Most other desa fall into a category showing productivity values of between roughly 1.00 and 2.00. Such is the case with desa of the saddle of Wolomapa and Blatatating as well as the northern flank: Umauta (1.20), Mekendetung (2.1), Kajowair (1.83), Aibura (1.83), Kokowahor (1.54), and desa of the saddle of Nita: Nele Wutung (1.30), Koting B (1.65), Nele Urung (1.31), Nele Lorang (1.29).

While the median values of labour productivity and the range of deviation indicated by lower and upper quartiles and deciles only yielded a very rough idea of regional differences a more differentiated view seems to be called for. For this reason average labour productivity values have been calculated for each group of labour intensity whereby a gradation of 50 man-days (standardized for all fields on a hectare basis) was taken. Such calculations have been attempted - provided that sufficient data were available - for three types of holdings: holdings of no more than one *blek* (= 0.25 ha), one to two *blek* (0.26-0.50 ha) and more than two *blek* (0.51 ha and more).

From Table 58 it becomes evident that in most desa and irrespective of plot size maximum average productivity is found in intensity groups I_2 and I_3 (i.e. 51-150 man-days (MD) per hectare). The distribution of the actual data (Table 59) in a given desa will not only help us to gain an idea of the number of cases used as a basis for calculation but also serves as a yard-stick for

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[16]For practical reasons the productivity values were not grouped according to ecological zones. Such a calculation is feasible as the precise location of the fields is recorded. It will be the subject of a separate treatise.

Table 58

Average returns to labour (grain equivalents/man-day) by labour intensity group and according to size of field (a = >0.25 ha; b = 0.26-0.50 ha; c = 0.51 ha<)

Desa	Labour intensity group												
	I_1	I_2	I_3	I_4	I_5	I_6	I_7	I_8	I_9	I_{10}	I_{11}	I_{12}	I_{13}
	0-50MD	51-100MD	101-150MD	151-200MD	201-250MD	251-300MD	301-350MD	351-400MD	401-450MD	451-500MD	501-550MD	551-600MD	601<MD
Hokor a	2.25	3.95	1.59	0.64	1.76	0.94	0.61	1.49	0.88	1.35	0.70	-	0.87
b	-	0.63	2.45	1.30	0.79	0.50	-	0.62	0.39	-	-	-	-
Koting B a	0.72	2.77	2.44	1.57	1.87	1.21	-	0.37	0.54	-	-	-	-
Watumilok a	-	2.86	4.60	3.92	2.80	3.75	-	1.01	2.72	6.02	-	1.47	0.53
b	6.43	5.68	2.53	0.89	1.97	0.84	-	-	-	0.79	-	-	-
Watuliwung a	-	5.17	2.59	1.52	3.11	1.38	2.55	-	4.66	-	-	-	-
b	7.90	2.92	2.82	1.98	1.21	-	1.40	-	-	-	-	-	-
c	3.91	2.02	2.76	-	-	-	-	-	-	-	-	-	-
Rubit a	-	1.71	5.15	1.34	0.48	1.84	0.38	-	0.75	-	0.28	0.22	1.00
b	-	7.41	1.61	0.62	0.73	0.66	-	-	-	-	-	-	-
Namangkewa a	-	3.63	5.86	2.27	2.67	2.01	3.10	1.15	-	-	1.27	-	0.28
b	10.70	7.77	3.11	1.20	0.54	2.10	4.29	-	-	-	-	-	-
Iligai a	-	0.80	1.33	0.87	0.92	0.44	0.66	0.44	0.90	0.14	-	0.13	-
b	-	0.88	1.67	0.40	-	1.58	-	-	-	-	-	-	-
Nele Urung a	-	4.05	0.79	2.75	0.96	1.58	0.18	0.90	1.07	1.20	-	-	-
Mekendetung a	2.00	3.34	3.70	3.43	1.26	0.60	1.40	-	-	-	-	-	-
b	3.60	2.31	3.40	1.20	2.00	0.50	0.80	-	-	-	-	-	-
Kokowahor a	-	3.92	3.60	1.57	1.51	2.46	0.87	1.68	1.04	-	-	1.29	0.29
b	3.96	2.64	3.07	1.20	1.33	-	0.63	-	-	-	-	-	-
Wolomotong a	-	2.54	2.01	1.97	1.69	1.49	3.40	1.37	0.71	0.47	1.76	0.65	0.53
b	-	3.98	1.85	1.44	4.15	0.92	0.66	1.26	-	-	0.91	-	0.57
c	-	0.46	-	1.04	0.68	0.85	1.57	-	-	-	-	-	-
Bola a	3.49	2.05	1.72	1.43	0.83	1.14	0.56	0.97	-	-	0.96	-	0.41
b	-	2.44	1.40	-	-	0.45	-	-	-	0.61	-	-	-
Wolonwalu a	-	3.63	0.84	1.12	0.46	1.27	0.67	0.47	0.73	0.39	0.34	7.06	0.19
b	-	1.79	1.60	1.12	0.35	0.84	-	-	-	-	0.48	-	-
Kajowair a	-	4.28	2.32	2.33	2.10	1.97	-	0.39	-	-	-	-	1.19
b	8.45	2.31	2.03	1.71	1.30	0.83	1.14	0.53	-	-	0.37	-	-
Aibura a	-	2.25	1.30	3.35	1.52	0.44	-	1.99	2.82	0.87	-	0.58	0.85
b	2.31	5.00	4.02	3.30	1.00	-	1.05	1.74	-	-	-	-	1.12
Umauta a	-	1.49	1.35	0.78	1.90	0.96	2.46	2.18	0.47	0.59	-	-	-
b	5.82	1.84	3.39	1.90	-	-	-	-	-	-	-	-	-
Ipir a	3.48	3.07	2.15	1.61	0.62	0.46	0.34	0.39	0.42	-	-	-	-
Nele Lorang a	-	2.88	2.52	1.42	1.01	0.90	-	0.87	-	-	0.60	-	1.12
Waibleler a	-	3.40	6.40	1.41	1.45	0.85	1.71	-	-	-	-	0.89	-
b	-	7.00	4.35	2.96	9.53	2.62	-	-	-	-	-	-	-
c	-	5.78	2.45	1.82	-	-	-	-	-	-	-	-	-
Nele Wutung a	-	3.07	3.73	1.01	-	0.87	1.30	1.13	-	-	1.10	-	-
b	2.30	2.03	1.97	0.75	0.60	-	0.60	-	-	-	-	-	-
c	3.70	1.90	1.35	2.05	2.25	-	-	-	-	-	-	-	-
Wolokoli a	-	2.85	3.26	2.28	0.44	1.86	-	0.44	-	-	-	-	-
Beru a	-	1.63	0.40	0.25	0.51	0.37	-	1.50	-	-	-	-	-
b	-	3.84	1.55	-	-	-	-	-	-	-	-	-	-

MD = Man/day

Table 59

Number of fields per labour intensity group for which labour productivity could be calculated according to size of field (a = >0.25 ha; b = 0.26-0.50 ha; c = 0.51 ha<)

Desa	Total number of fields	Labour intensity groups (same as Table 58)												
		I_1	I_2	I_3	I_4	I_5	I_6	I_7	I_8	I_9	I_{10}	I_{11}	I_{12}	I_{13}
Hokor a	31	1	2	3	2	6	2	3	1	5	2	1	-	4
b	16	-	1	2	5	2	1	-	3	2	-	-	-	-
Koting B a	32	1	8	8	5	3	4	-	2	1	-	-	-	-
Watumilok a	33	-	3	6	7	5	5	-	1	1	1	-	2	2
b	26	2	11	9	1	1	1	-	-	-	1	-	-	-
Watuliwung a	31	-	4	7	6	5	6	1	1	-	1	-	-	-
b	32	1	6	11	6	7	-	1	-	-	-	-	-	-
c	19	5	13	1	-	-	-	-	-	-	-	-	-	-
Rubit a	17	-	3	2	4	2	1	1	-	1	-	1	1	1
b	10	-	1	2	2	3	2	-	-	-	-	-	-	-
Namangkewa a	24	-	5	5	3	2	1	2	4	-	-	1	-	1
b	10	1	2	3	1	1	1	1	-	-	-	-	-	-
Iligai a	17	-	1	2	1	4	3	1	2	1	1	-	1	-
b	13	-	4	6	2	-	1	-	-	-	-	-	-	-
Nele Urung a	42	-	7	8	12	7	4	1	1	1	1	-	-	-
Mekendetung a	21	5	1	3	3	5	1	3	-	-	-	-	-	-
b	14	1	6	2	1	2	1	1	-	-	-	-	-	-
Kokowahor a	36	-	2	10	7	3	4	3	3	2	-	-	1	1
b	20	1	7	6	4	1	-	1	-	-	-	-	-	-
Wolomotong a	34	-	1	1	1	5	7	3	2	5	1	1	1	6
b	20	-	2	4	2	1	2	3	1	-	-	1	-	4
c	11	-	1	-	5	2	1	1	-	-	1	-	-	-
Bola a	37	1	8	6	2	3	2	5	3	-	-	2	-	5
b	9	-	4	3	-	-	1	-	-	-	1	-	-	-
Wolonwalu a	40	-	3	8	2	1	5	3	5	2	3	1	1	6
b	11	-	4	2	2	1	1	-	-	-	-	1	-	-
Kajowair a	12	-	3	2	2	1	1	-	1	-	-	-	-	2
b	15	1	1	3	2	2	3	1	1	-	-	1	-	-
Aibura a	25	-	1	3	6	3	2	-	2	1	3	-	1	3
b	16	1	1	5	2	3	-	2	1	-	-	-	-	1
Umauta a	27	-	3	6	3	3	3	1	4	2	2	-	-	-
b	17	1	6	7	3	-	-	-	-	-	-	-	-	-
Ipir a	43	1	6	5	8	3	6	3	6	1	-	-	3	1
Nele Lorang a	27	-	4	5	7	3	2	-	1	-	-	1	-	4
Waibleler a	10	-	1	1	2	2	1	2	-	-	-	-	1	-
b	10	-	2	2	3	2	1	-	-	-	-	-	-	-
c	8	-	4	2	2	-	-	-	-	-	-	-	-	-
Nele Wutung a	23	-	3	7	5	-	2	3	2	-	-	1	-	-
b	19	2	8	4	3	1	-	1	-	-	-	-	-	-
c	11	3	3	2	2	1	-	-	-	-	-	-	-	-
Wolokoli a	24	-	6	4	7	1	4	-	2	-	-	-	-	-
Beru a	23	-	5	7	2	5	3	-	1	-	-	-	-	-
b	5	1	1	3	-	-	-	-	-	-	-	-	-	-

Note: Although 50 farmers per desa had been interviewed, labour productivity values were calculated for an irregular number of fields for the following reasons: either too few values were available for a certain size and category or else many fields were located outside the desa of residence.

measuring the degree of 'economic-mindedness'[17] of the farmers of the desa.

In Ds. Hokor, for instance, the majority of the thirty-one fields in the group of up to 0.25 ha is found in labour intensity categories I_6 to I_{13}. Hence if these samples are representative of actual conditions for the desa as a whole, farmers in Ds. Hokor invest far more labour in the cultivation of their fields than seems economically necessary. A contrasting picture is conveyed by figures for Ds. Koting B. Most of the 32 values (for plot sizes not exceeding 0.25 ha) are found in labour intensity groups I_1 to I_4 and hence grouped around the optimum. This fact is all the more remarkable as Ds. Koting B is characterized by a far higher population density than Ds. Hokor.

In our economic analysis, however, simplification would have been carried too far had total gross yields not been included. The shape of the gross yield curve is essential on the following grounds:

- It indicates I_{max} (where the marginal product is zero). It thus enables us to specify the degree of non-market orientation; e.g. of farmers hence exceeded I_{max}.
- It indicates the absolute level of production.

Gross yields (expressed in kg grain equivalents per hectare) were therefore calculated as an average for each category of labour intensity (expressed in grades of 50 man-days/ha).[18] The result of this calculation has been illustrated in Figs. 50-52 for holdings no larger than 0.25 ha. Three major regional patterns of gross yields emerged.

I. Desa of the south coast (Ds. Bola, Ds. Wolonwalu, Ds. Iligai, Ds. Hokor, Ds. Ipir) and Ds. Nele Wutung. The yield curves of this group of desa increase very slowly with increasing labour input (per hectare). Yet average yield (or average productivity of labour), as we know, falls beyond its maximum at I_2/I_3. What is significant is the slowly increasing upward slope of the gross yield curve. Had running averages been calculated the oscillations around the trend path, however slight they may be, would have been smaller.

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[17] The term 'economic-mindedness' is used here in the sense of profit-maximization. Sikka's farmers do, however, behave economically in their own way according to their own system of values even though they may reject the opportunity to increase their income.

[18] A more differentiated idea of the shape of gross yield and average yield curves could have been obtained, had units of labour intensity of less than 50 man-days - e.g. 25 man-days/ha - been used. Moreover, a calculation of sliding averages would have somewhat smoothed the oscillations in the curves. The conclusions drawn from the following analysis would, however, not be affected in essence.

Although only insufficient data in the higher categories of labour intensity (I_{10} and over) can be provided to substantiate my impression quantitatively, there is ample evidence from observation in the field to suggest that gross yields have reached their maximum at I_{10} to I_{12}. As environmental conditions rapidly deteriorate, given the prevailing high degree of labour intensity (whereby soil improving measures are largely unknown) (Plate 27), the point where gross yields begin to fall will recede from I_{10}/I_{12} to lower intensities.

II. <u>Desa of the saddles</u> (Ds. Rubit, Ds. Kajowair, Ds. Mekendetung, Ds. Koting B). The graphs display far higher maximum values which three of these four desa reach at I_4, and Ds. Kajowair at I_6. Beyond these points the gross yields fall rapidly. In addition, oscillations are far more pronounced than in desa of the southern flanks. Hence the results of increasing inputs of labour are more clearly felt. The degree of 'economic-mindedness' is indicated by the fact that most farmers of these four desa operate within the respective spheres of agricultural intensity - Rubit (70 per cent of the farmers interviewed), Mekendetung (57 per cent), Kajowair (75 per cent), Koting B (68 per cent). Ds. Wolomotong and Ds. Umauta have been included in this group because the slope of their curves displays similar features - that is a general downward trend. Their maximum values, however, are attained at far higher categories of labour intensity. The particular shape of the curves of the latter two desa may be explained in part by the fact that several crops per year are quite frequent in Ds. Wolomotong (up to three crops of maize per year) and Ds. Umauta (up to two crops of maize per year) where perennial tree crops in the form of *ongeng* or *uma kabor gong* are hardly found. Hence overcropping occurs.

III. <u>Desa of the northern littoral zone</u> (Ds. Waibleler, Ds. Namangkewa, Ds. Watumilok, Ds. Kokowahor, Ds. Watuliwung, Ds. Nele Urung and Ds. Aibura). The yield curves of these desa display a bimodal course, usually reaching a first peak at I_3 and a second at I_6/I_7. These marked oscillations are of importance to farmers as they seem to influence their degree of labour input, in contrast to the south coast where such characteristic thresholds are not as clearly felt by the farmers. Ds. Aibura has been included in this group of desa although the second peak seems to be attained only at I_9. However, the bimodal upward trend justifies its inclusion in this group.

The shapes of the gross yield curves, the maximum intensity beyond which the marginal product becomes negative, and the location of the optimum agricultural intensity (I_{opt}) enable us now to obtain a more differentiated idea of the degree of 'economic-mindedness' of the farmers of a desa. Respective data have been calculated for two sizes of cultivated fields:

<u>Cultivated fields under 0.25 ha</u>. The least economic desa seem to be Ds. Rubit and Ds. Wolomotong (each having 47 per cent of 'uneconomic' farmers), Ds. Mekendetung (43 per cent) while Ds.

Umauta (15 per cent) and most desa along the northern littoral are the most economic: Ds. Watuliwung (6 per cent), Ds. Watumilok (21 per cent), Ds. Nele Urung (10 per cent). In desa of the south coast gross yields do not fall with increasing labour input, at least not until I_{10} (see Fig. 50) for which sufficient data are available. The high degree of farmers (between 82 and 92 per cent) working fields beyond the optimum level of labour input gives us, however, sufficient evidence of a low degree of 'economic-mindedness' (Table 60).

Cultivated fields between 0.26 and 0.50 ha in size. In this category of field size gross yield curves, even those of the desa along the south coast, display distinct maxima (I_{max}) as indicated on Table 61. The highest percentage of fields worked beyond I_{max} is found in Ds. Hokor (81 per cent), Ds. Rubit (90 per cent), Ds. Wolomotong (70 per cent), while the lowest percentages are encountered in Ds. Watumilok (8 per cent) and Ds. Namangkewa (20 per cent).

Somewhat surprising are the low values for Ds. Iligai (8 per cent), Ds. Umauta (18 per cent) and Ds. Bola (22 per cent). Although located south of the watershed these three desa are characterized by a more intensive exposure to foreign ideas. Ds. Iligai is located next to the saddle of Nita; hence farmers of this desa who cultivate fields of 1 to 2 *blek* in size (0.26-0.50 ha) are evidently more willing to accept risk and to work their fields to (or near to) I_{max} than farmers who work lower-sized plots. Also Ds. Bola and to some extent also Ds. Umauta adjacent to saddles of Blatatating and Baomekot are more exposed to foreign influences - that is they have a higher degree of 'economic-mindedness' due to Bola's status of administrative centre of Kecamatan Bola. The different results of our analysis of these desa - from Tables 60 and 61 - may be explained as follows: while a relatively high degree of 'economic-mindedness' is observed with farmers working larger fields (0.26-0.50 ha), small-scale farmers (fields under 0.26 ha) are still more closely bound to tradition.

A comparison of Ds. Iligai with Ds. Hokor, with similarly unfavourable physical conditions, makes evident also that the relationship of population to physical environment is of minor importance in determining the level of agricultural intensity. Far more important seem to be the degree of expectations and the size of the field which a farmer is able to cultivate. Hence ultimately motives have to be considered crucial in all decisions. These can only be explained from a farmer's particular socio-cultural background.

The discussion of this example shows us that a carefully differentiated analysis along these lines may serve as a basis for agricultural planning. It may help the planner to decide which group of farmers (those with small plots or those with large plots) should be given assistance in what form (e.g. agricultural extension

Table 60

Fields no larger than 0.25 ha in size cultivated beyond I_{opt} and I_{max} per desa

Desa	I_{opt}	I_{max}	Total number of fields	Fields worked more intensively than I_{max}		Fields worked more intensively than I_{opt}	
				Number	In % of total fields	Number	In % of total fields
Rubit	I_3	I_4	17	8	47	12	71
Mekendetung	I_3	I_4	21	9	43	12	57
Kajowair	I_2	I_6	12	3	25	9	75
Koting B	I_2	I_4	32	10	31	23	72
Wolomotong	I_2	I_7	34	16	47	33	97
Umauta	I_2	I_{7-8}	27	4	15	24	89
Namangkewa	I_3	I_7	24	6	25	14	58
Watumilok	I_3	I_9	33	5	15	24	73
Watuliwung	I_2	I_7	31	2	06	27	87
Kokowahor	I_2	I_6	36	10	28	34	94
Aibura	I_2	I_9	25	7	28	24	96
Nele Urung	I_2	I_6	42	4	10	35	83
Hokor	I_2	-	31	-	-	28	90
Iligai	I_3	-	17	-	-	14	82
Bola	I_2	-	37	-	-	28	78
Wolonwalu	I_2	-	40	-	-	37	92
Ipir	I_2	-	43	-	-	36	84

Table 61

Fields between 0.26 and 0.50 ha in size cultivated beyond I_{opt} and I_{max} per desa

Desa	I_{opt}	I_{max}	Total number of fields	Fields worked more intensively than I_{max}		Fields worked more intensively than I_{opt}	
				Number	In % of total fields	Number	In % of total fields
Hokor	I_2	I_3	16	13	81	15	94
Watumilok	I_3	I_5	26	2	8	4	15
Watuliwung	I_2	I_3	32	14	44	25	78
Rubit	I_2	I_2	10	9	90	9	90
Namangkewa	I_3	I_5	10	2	20	4	40
Iligai	I_3	I_4	13	1	8	3	23
Mekendetung	I_3	I_3	14	5	36	5	36
Kokowahor	I_3	I_3	20	6	30	6	30
Wolomotong	I_2	I_2	20	14	70	14	70
Bola	I_2	I_3	9	2	22	5	56
Wolonwalu	I_2	I_3	11	5	45	7	64
Kajowair	I_2	I_5	15	8	53	13	87
Aibura	I_2	I_4	16	7	44	14	88
Umauta	I_3	I_3	17	3	18	3	18

in situ or resettlement). Yet the evaluation of economic parameters alone does not seem to suffice. A more comprehensive approach is needed which draws upon several factors simultaneously. Such a geoecological interpretation is attempted in the following paragraph.

Geoecological interpretation

After having analysed the impact of a number of factors and processes on the stability of agricultural systems it will now be useful to merge these perspectives. The result of such a geoecological analysis will enable us to place Central Sikka within some more generally applicable approaches to the study of agricultural stability.

Desa of the southern flanks

As we have seen the desa south of the watershed are poorly endowed with natural resources suitable for intensive agriculture. Neither topographic nor edaphic conditions lend themselves readily to farming or livestock keeping. This is reflected in the gross yield curves (Fig.50). Despite a more even distribution of rainfall the top yields attained are significantly below the levels of production found on the saddles and north of the watershed. Moreover, physical conditions seem to be the chief reason for the fact that yields do not increase proportionally to additional labour input. What seems to be particularly important is that owing to the lack of marked thresholds in the yield curves farmers less readily perceive the impact of additional labour invested in the cultivation of their fields. Although they know that total yields keep increasing, they are not prompted by marked thresholds to limit their labour input to the most economic portion of the labour intensity scale.

Far more labour than is economically necessary is also invested in the cultivation of fields for other reasons. For one thing the lack of nearby vacant land to which the farmers of the south coast could move temporarily to open new fields has furthered the increasingly uneconomic intensification locally. In contrast to farmers who live on the saddles or north of the central divide, people of the south coast are comparatively isolated. Since all of the land adjacent to their homeland is already being used for agricultural purposes by their neighbours - only more distant places could offer true alternatives for these farmers - opportunity costs are comparatively low and do not induce farmers to abandon their plots readily once the economic optimum has been reached.

Of similar effect has been the lack of motivation. Because of the mountain barrier of the Tolowair ridge to the north and a rough sea to the south this part of Central Sikka has always been isolated. It is for this reason that it served the original *krowe* population from Natargahar (near Sikka-Natar) as a refuge when, according to oral tradition, the invading Sikkanese-proper expelled them. This lack of accessibility has also impeded the penetration by new ideas. Only comparatively lately - in the third decade of this century - did evangelization and hence education gain a footing in this region (Timmers 1896; Sevink 1914). Cash crop production - mainly coconuts - plays a comparatively minor role. Except for a road from Ili to Bola, which is frequently and for long periods rendered impassable because of heavy rains, no communication exists with the market centres other than difficult footpaths. Modern ideas of commercialization through Buginese, Chinese or Europeans were only reluctantly accepted by the local population.

As *adat* rules are still strongly adhered to, the individualization of land ownership is less advanced than on the north coast. As can be seen in Table 56 unalienable family land (*tana gung*) still appears to be quite common. On such land, as we have seen, land improving measures - e.g. terraces, *lamtoro* hedges, planting of fallow vegetation - are usually not applied. Because of the highly dynamic topography anti-erosion measures would be particularly necessary here. Increasing population density causes the farmers to invest more labour in the same fields. Although available figures are not suited to substantiate it, from observation in the field it can be concluded that most farmers have reached a point where total yields can be expected to drop if additional labour is invested on the same field. Agricultural systems VII and VIII have to be considered highly unstable as the environmental base is being rapidly destroyed by erosion caused by overworking of the soil and lack of perennial tree crops.

The 'threshold of perception' at which farmers are prompted to migrate seasonally, or rather to emigrate, is particularly high and far removed from the economic and ecological optimum. The strong influence of local *adat* and the lack of nearby land suitable for cultivation by seasonal migrants cause people of the south coast to take the decision to emigrate definitely only when living conditions - and thus local ecological conditions - have become dismal. The south coast may be likened to Geertz's case of 'agricultural involution' which he found to be typical for the manipulated ecosystem of wet rice cultivation. It can be concluded from the foregoing analysis that 'agricultural involution' is not characteristic of *sawah* cultivation only but may also occur with *ladang* cultivation.[19] As we have seen, the majority of farmers

[19]Polak (1972-73), who examined Geertz's thesis in northern Lombok, believes that whether an involutionary or evolutionary path is taken by the farmers of a specific region and a specific socio-cultural framework is largely contingent upon the production level of a farm which has to be adequate to avoid comparatively high production costs. He argues that for various reasons peasants with small holdings must give away a comparatively larger portion

(continued p.253)

operate far beyond the optimum level of labour input, which was found to be between I_2 and I_3. Such involution is only feasible in a *ladang* ecosystem up to a certain degree of labour intensity without causing fundamental deterioration of the environment. Yet in a number of *ladang* systems this limit seems to be reached at far higher population densities than has been assumed by Geertz.

Still the following general conclusions may be drawn from this example: given a low level of motivation, socio-economic conditions tend to break down under population pressure. This challenge is usually met through a lowering of the living standard. There is a growing inefficiency in the use of resources as the deterioration of the environment calls for a greater input of labour.

In an effort to provide an additional explanation of why the labour input of so many farmers greatly exceeds the optimum input, particularly on Sikka's south coast, the thesis advanced by Tschajanow (1923) was checked. His thesis, although originally devised on the basis of a study in Czarist Russia, was repeatedly applied with success in economically less advanced societies (e.g. McKinnon 1976; Sahlins 1971). Essentially he demonstrated that the labour invested in agriculture by a family was positively correlated with the quotient C/W (C = consumers, W = workers) in a family. In the case of Sikka, children under 15 years of age were thereby rated 0.6 consumers (C) while they as well as old persons beyond the age of 60 were not counted as workers (W).

The calculation did not, however, yield a conclusive enough correlation between either size of field under cultivation or amount of labour invested in the cultivation of a field to the quotient C/W. The lack of correlation is, however, not surprising. Since motives and expectations have been singled out as the crucial factor determining the stability of agricultural systems, it is obvious that people of different social status and age (married/

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[19] (continued)
of their yield to members of other households than peasants with extensive holdings. While in Lombok the former have to borrow money and rice at high interest rate 'to dine and wine' kith and kin who helped them, the latter are often able to have their fields cultivated by low-paid labourers (Polak 1972-73:37ff.). Hence Polak believes a process of involution to be likely to occur with farmers whose production level is low. Whether or not the resources at a peasant's disposal are adequate to fend off an involutionary process seems to him determining. I cannot agree with such a monocausal explanation, however. Besides the resource base and the population pressure the farmer's expectations ought to be considered. These seem to be of particular importance - at least in the case of Central Sikka. Such a view is also shared by van den Muijzenberg (1971) on the ground of fieldwork from central Luzon.

unmarried, old or young) behave differently. This was shown in a study of the Solomon Islands by McKinnon (1976). Unfortunately, however, such detailed information on social status was not collected in the course of our survey. Such an analysis might have substantiated the general results arrived at above. A hypothesis would be: the less affected an area is by foreign ideas (i.e. the less market-oriented farmers are) the more people could be expected to behave according to Tschajanow.

Table 62 shows the lack of conclusive evidence for ten desa.[20]

Table 62

Correlation between labour input, size of fields under cultivation and C/W for selected desa of Central Sikka

Desa	Coefficient of correlation between C/W and labour input	Coefficient of correlation between C/W and size of field under cultivation
Wolokoli	- .12	- .15
Wolonwalu	+ .02	+ .24
Wolomotong	+ .04	+ .62
Hokor	+ .15	+ .34
Rubit	+ .18	+ .07
Bola	- .29	- .10
Ipir	+ .04	- .08
Kajowair	+ .32	+ .05
Aibura	- .07	- .21
Umauta	- .17	+ .07

Desa of the saddles (Fig. 51)

A contrasting situation has developed on the saddles which have traditionally been centres of population chiefly for historical and, with respect to the saddle of Nita, also physical reasons. Here people felt more secure from raiding Buginese as well as from malaria, which was rampant along the northern littoral zone. Here Sikka's highest population densities are found, yet labour intensity is considerably lower than on the south coast. Instead of investing more labour on the same field most farmers tend to open new fields. Such behaviour is not accidental. It is conditioned in the first

[20]Group labour has not been considered in the calculation. As an elevated percentage of fields was worked by labour groups (*hokot seng*, etc.) in the remaining nine desa of our survey, a regional analysis was not carried out.

place by particular ecological conditions which are reflected in the shape of the yield curves. These reach their maximum rather rapidly, mostly at I_4 (= labour input of about 200 man-days per hectare), after which gross yields drop with additional labour input. What is significant is a marked threshold which helps the farmer to perceive the impact of additional labour input more clearly. The 'threshold of perception' is thus more pronounced on the saddles than along the south coast. Moreover, the absolute maximum of yields is markedly higher in the former than in the latter region.

Once I_4-I_6 (in Ds. Kajowair), I_7 (in Ds. Wolomotong) and I_8 (in Ds. Umauta) have been reached, yields begin to drop rapidly. Instead of devising or introducing more efficient techniques with which commercial and subsistence crops could be grown together, farmers looked rather for new fields. Such fields were found in the vicinity of the saddle of Nita on the eastern slopes of Mt Kimang-Buleng, as well as on the western slopes of Mt Tarat-Egong east of the saddle of Baomekot. The proximity of these only thinly populated areas caused the farmers of these two saddles to migrate seasonally to these areas where they opened new fields. As a rule, settlements were not removed as farmers preferred to live next to the cash crops for fear of theft or fire.

Permanent migration to these areas as well as to areas along the north coast (Ds. Wolomarang, Ds. Magepanda, Ds. Waibleler, Ds. Egong, Ds. Talibura) and to the south coast (Ds. Korowuwu, Ds. Dobo, Ds. Waihawa) started only at the end of the 1950s when communication and health services were improved in these thinly populated areas. Thus population growth and commercialization due to which the land available for subsistence crops was reduced have worked together to accelerate migration. Intensification of the cultivation of subsistence crops (i.e. in economic terms: adoption of higher production function) on the saddles commenced only fairly recently during the late 1950s and 1960s in the form of terraces, fallow vegetation (*Mimosa invisa*) underneath coconut trees to accelerate the restoration of soil fertility (on saddle of Nita), and *lamtoro* hedges (*Leucaena leucocephala*) along contour lines or at the rim of terraces in order to combat erosion as well as loss of soil productivity.

The farmers of the saddle of Blatatating had no land in their vicinity which they could cultivate. Opportunity costs were thus considerably lower for them than for farmers of the saddles of Nita and Baomekot. Instead the farmers of the saddle of Blatatating chose to earn some extra money as sharecroppers on fields along the northern littoral zone. As a result of this voluntary limitation of labour input on their fields, the agricultural systems in the saddles seem to be far more stable than those along the south coast.

The high degree of stability is to no small degree also conditioned by high expectations. This applies particularly to the saddle of Nita which has been subject to foreign influence and new ideas for a longer period than any other portion of Sikka. It is here that the Sikkanese proper live, and they for centuries had commercial contacts with Buginese tradesmen on the north coast. The overriding significance of the saddle of Nita was further enhanced by the fact that it was the first portion of Sikka subjected to evangelization. Hence it became a centre of education. Evangelization began only in the second decade of this century in other parts of Sikka. As we have seen it was not before the third decade that the first mission schools were opened in areas outside that of the Sikkanese proper. If nevertheless a high level of expectations can be reported for the population of the saddles of Blatatating and Baomekot it is because of the impact of foreign traders. Hence market-orientation was traditionally strong on these saddles. The port of Geliting would not have been as important had it not been for the populated and productive saddle of Baomekot. The same applies to the ports of Bolong-Bolong and Waipare with the nearby saddle of Blatatating. On these two saddles, however, commercialization did not reach the same dimensions as at Nita until quite recently. The high level of expectations at the latter is thus not only attributable to a high educational level but also to far more developed communications with the administrative centre and chief port of Maumere.

Since the beginning of this century the Dutch encouraged the local population to plant coconuts the population pressure upon the land noticeably increased as the land left for subsistence crops became scarcer. The population attempted to plant these food crops underneath the coconut trees. Results were, however, unsatisfactory. Because the palms were planted too densely shade seriously inhibited the growth of the food crops (maize and hill rice) underneath. The low yields per harvest were, however, countered by more frequent cultivation of the same plot. At present many fields are even worked permanently.

The high degree of expectations encountered on all three saddles inhibited a process of involution à la Geertz. Most farmers interviewed operate around the optimum level of labour intensity. The population surplus was siphoned off by migration and, more recently, by employment as teachers and government civil servants. The individualization of land ownership is far more advanced than along the south coast. On the saddle of Nita in particular, traditional *tana pušng* territories held by the 'lord of the earth' are no longer known. In the absence of institutional impediments soil improving devices have been applied most readily, particularly terracing and the planting of fallow vegetation (*Mimosa invisa*) beneath coconut trees. Yet commercial crops have nowhere completely replaced food cropping for subsistence. As a rule, the farmer adopts a prudent attitude. In an effort to minimize risk he keeps growing his subsistence crops. The cash from the sale of commercial crops is seldom used to buy daily subsistence food, but rather for imported luxury commodities.

Northern foothill and littoral zone

Of all agricultural systems in Central Sikka the system observed in the northern littoral plain zone is beyond doubt ecologically the most stable. This is due to the level terrain and fertile alluvial soils on one hand, and to the care farmers devote to maintaining soil fertility on the other. The latter is achieved by crop rotation of maize and green gram. Yields react positively upon additional input of labour, as reflected in the yield curves (Fig. 52). Bimodal yield curves are conspicuous with a first peak at I_3-I_4 and a second peak at I_6-I_7. The oscillations are strongly pronounced. Thresholds are therefore more likely to be 'felt' by farmers. Most farmers operate around the economic optimum. This applies particularly to farmers with land holdings exceeding one *blek*. Under this agricultural system far higher population densities are possible than under any other within the area for two reasons: first, the second peak of the yield curves is further removed from zero intensity than on the saddles, and, second, this is the only system with permanent cultivation. Attempts at permanent cultivation under coconut trees (agricultural system II) and above 500 m (agricultural system VI) are too recent to allow any statement as to their ecological viability.

As we have seen in Table 58 labour productivity along the northern littoral zone is by far the highest of Central Sikka. Hence people did not feel compelled to switch to more intensive agricultural systems. The high level of labour productivity with annual crops has to be taken as the chief reason why farmers were reluctant to plant perennial crops - e.g. coconut trees - as had been done on the saddles and along the northern flanks of Central Sikka. The present system of crop rotation has proved quite satisfactory.

The alternative of migration has been resorted to only recently. Some farmers of densely populated Ds. Watumilok and Ds. Namangkewa seasonally migrate to thinly populated Ds. Waibleler where they cultivate additional fields. Permanent migration from this region is hardly known. On the contrary, the littoral zone has absorbed population from the mountainous hinterland.

The high degree of 'economic-mindedness' is explained by the fact that a large portion of the land is in the hands of foreign ethnic groups - mostly traders from South Sulawesi. High expectations can thus be assumed. As this zone began to be cultivated only very gradually in the late 1920s, compulsory planting of coconut trees as was customary in the densely populated mountainous hinterland hardly occurred. Even today coconut plantings are found only around the few coastal settlements (Geliting, Kewa, Kewapante, Waipare). Instead of perennial fruit trees local farmers found crop rotation with green gram to be both ecologically suitable and economically profitable, for green gram is partly sold on the market. In good years it is even exported. The attractiveness of this system of crop rotation may be gauged by the high number of sharecroppers mostly coming from the mountainous hinterland. These farmers are usually all in possession of a piece of land of their own and avail themselves of the opportunity of working an additional piece of land as sharecroppers to earn some extra cash.

Conclusion

The aim of the present study has been to analyse the main factors determining the stability of agricultural systems in Central Sikka on the isle of Flores. From this analysis it emerged that the ecological stability of the area's agricultural systems is a complex phenomenon which could not be adequately explained by the simple relationship of population density to physical resources under a given form of agriculture.

The large number of people living in this portion of Flores was found to be attributable both to physical and historical reasons. In contrast to east and west Sikka where the volcanic material is less weathered and locally interspersed with surfacing sedimentaries Central Sikka enjoys comparatively fertile soils (andosols and alluvial soils). Although these soils are low in nitrogen, they are rich in minerals. Central Sikka's topography is also believed to have favoured human occupation. The saddles between the volcanoes offered particular advantages. Here the people enjoyed both a cooler and healthier climate (less affected by malaria) and a greater degree of security from slave raiders from southern Sulawesi. The short distance from coast to coast was an additional attraction in case of attack. The sharp volcanic ridges provided ideal locations for settlement for the local population. Until the beginning of this century and locally even later people used to live in small territorial units headed by a 'lord of the earth' (*tana puăng*). These groups were frequently bitterly fighting each other, so strategic considerations played a major part in decisions about settlement.

Despite these advantages physical conditions are not all that favourable, as strong contrasts between wet and dry seasons, a pronounced variability of the rainfall regime and highly erodible topography constitute serious drawbacks. These weigh heavily in a society like that of the Sikkanese whose level of agricultural technology is but little developed. The erratic character of the rainfall regime and a rugged topography - particularly in the southern half of Central Sikka - adversely affect agricultural activity in the area.

Eight agricultural systems were distinguished in Central Sikka. These display various degrees of adaptation to local environmental conditions. Evidence of land degradation, erosion, etc. observed in the field pointed to various degrees of stability which, however, could not be conclusively correlated with population pressure. It was even found that up to a certain point Central Sikka's agricultural systems were quite adaptive to increasing numbers of population. Hence the degree of ecological stability of the systems was determined to a minor extent only by population figures. Of greater significance seem to be:

1. Opportunity costs - i.e. the existence of nearby vacant land to which farmers of densely populated areas may resort for the cultivation of food crops. The existence of such alternatives is particularly necessary when perennial cash crops reduce the land left for subsistence production.

2. Shape of curve of gross yields and the existence of 'thresholds of perception'.

3. Absolute level of production.

4. Level of 'social and economic expectations' which the people hope to derive from their resources. These are largely determined by the impact of foreign ideas introduced by foreign traders, missionaries, colonial powers and the Indonesian government - e.g. through agricultural extension, taxation and forest regulations. In an archipelago expectations are frequently created only locally, because of the insularity and isolation.

The level of 'expectations' which may be considered the crucial factor determining the stability of agricultural systems led us to the issue of motives and motivation. The significance of motives in the development process has been underscored in studies by several authors, among them Rühl (1922) who coined the term *Wirtschaftsgesinnung* (economic attitude), Tschajanow (1923) and more recently by Tenbruck (1968). The lack of correlation between density of population and degree of agricultural intensity, as found in our study area, has to be attributed to the impact of expectations. This becomes clearer if we disaggregate production into production for physical subsistence, commercial production and production for ritual and social purposes. A close correlation may only be postulated between the subsistence needs of an area and its population density provided that consumption patterns are essentially egalitarian. Social production, however, is subject to a different set of conditions. These will vary between groups according to the desire for status and prestige. Thus social production and trade production, as indistinguishable from it in many societies, may not necessarily correspond to population numbers or density.[1]

[1]Although social production is still important in Sikka, it is rapidly losing ground. An increasing individualization of the cultivator can be observed. The loss of social obligations may be hazardous in Sikka's system of cultivation where natural disasters constitute a permanent threat for the population. The traditional system of mutual assistance served to reduce dangers.

As production is pursued for various purposes it follows that farmers are unlikely to attempt to maximize labour productivity (point I_{opt} in Fig. 49, p.239). Instead inputs are dispersed over the three types of production, each pursued at relatively low intensity according to the principle of least effort. Thereby farmers attempt to keep risks as low as possible.[2] The point of labour intensity thereby attained may lie below as well as above I_{opt}. Risks are minimized in several ways - for example by a farmer's desire to have fields in various ecological zones in the mountains (*uma reta iling*) as well as in the lowlands (*uma lau detung*). Risks are also reduced by selecting drought resistant varieties of maize and hill rice. Such motives are also to be observed if farmers do not completely change over to cash crop cultivation. Maximizing security also accounts for the reliance upon the extended family and upon the village. It is under this aspect that we have to see the seemingly 'uneconomic' behaviour of recruiting group labour (*hokot seng*, *letā*, etc.) for agricultural tasks. Although communal work can be very expensive and 'uneconomic' it fulfills an important social function. It ties the farmer to the community which he may fall back upon should need arise.

The risk issue also helps us to understand why Central Sikka's farmers, even those of the saddles and the north coast who have become increasingly enmeshed in a market economy, are still bound to traditional values, for example the bridewealth. It has to be admitted though that through their participation in the world market for copra and more recently also for other agricultural products (cacao, cloves) a great number of Sikkanese has increasingly withdrawn from a subsistence-oriented system responsive to local control in favour of a system quite beyond their control. But bearing in mind risk minimization they have never completely changed to cash crop production. The bridewealth and other traditional values to which the Sikkanese adhere may even have spurred their participation in a market-oriented system in some places, while it may have inhibited agricultural intensification at others.[3]

It is for these reasons that the study of agricultural development should encompass the study of human behaviour. What

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[2] The relationships between risk and resistance to change in subsistence farming have been analysed by Wharton (1971).

[3] Of similar effect may be the following custom: As gift-giving adds to social prestige in Sikkanese culture and as the extended family participates freely in the economic success of any of its members, it is unlikely that individuals work hard to acquire a particularly desirable item if they may eventually have to share it or give it away. Hence economic limits are given by the traditional pattern of distribution of produce. This aspect, however, requires more detailed investigation.

seems to be needed is a theory of production which includes agricultural production for non-farm consumption - i.e. for social and ritual purposes (see also Brookfield 1972:46). To this end Arndt (1970) made an attempt at outlining the rudiments of an economic model which gives attention to 'status' and 'prestige'. These values contrast with the assumption of Economic Man of traditional economic theory.

It follows from the foregoing remarks that it seems of doubtful value to try to increase the stability of agricultural systems by indiscriminately promoting higher levels of expectations through imported technology frequently maladapted to the new environment.[4] Chemical fertilizer and pesticides are already in wide use, and these are needed for the growing of high yielding varieties of rice and maize. The increased reliance on fossil fuel inputs, for instance, which is likely to prove costly in environmental terms, is a case in point. The results of such undifferentiated adoption of imported ideas and methods of production are evidenced by the long history of failures of agricultural projects in eastern Nusatenggara (see Ormeling 1955; Metzner 1978b) and in Southeast Asia in general (see Feith 1974). Although the Sikkanese do not yet have to pay heavily - either in ecological, economic or social terms - for the presumed benefits realized from the indiscriminate adoption of new technology, it may well be that the stability of their agricultural systems may eventually be jeopardized by these 'technological gifts'.

A more promising approach seems to be to increase the capacity to innovate effectively on the basis of indigenous resources.[5] Central Sikka's need in the future will be for ecologically-based improvements along the lines of mulching, crop rotation, growing of legumes, etc. As such recommendations would not basically alter the farmers' concepts of risk minimization, they stand a good chance

[4]This was the conclusion drawn by Mabogunje (1970) in a study of West Africa.

[5]An increasing appreciation of the merits of traditional agriculture led to a conference held in Honiara, Solomon Islands in November 1977 entitled 'The adaptation of traditional systems of agricultural production to serve the needs of a developing market economy' (see Fisk 1978). In a paper presented to this conference (Clarke 1978) the emphasis was laid upon the futility of trying to replace energy-efficient, less industrialized systems with transferred systems based on high-energy technology' (p.155). Following this line of thinking Clarke (p.156) proposes a new vision 'toward something near sustainable self-sufficiency for most of the community and optimal rather than maximal productivity within a healthy ecosystem'. I had already arrived at very similar conclusions about East Timor (Metzner 1977a).

of being adopted. To this end, traditional social institutions, for example the former land council in Sikka, should be used as far as possible to help implement these ideas (Metzner 1977b; 1978b).

Appendix I: Questionnaire

My questionnaire was carried out in Central Sikka in 19 desa with 950 farmers. It was held in Indonesian and Sikkanese. Since my knowledge of Sikkanese was limited to agricultural terms, I drew upon the help of village headmen when necessary. In order to obtain data that were as reliable as possible the farmers' names were omitted and only those farmers were asked who felt free to co-operate. Women frequently proved to be better informed than men as the former were often in charge of gardening. In many desa co-operation of women in the interview was secured through the help of my wife. The following information was asked for:

1. Number of dry fields:

    (a) owned by the farmer (*tana buku batu*),

    (b) owned by the clan (*tana gung*),

    (c) pledged by someone else to the farmer,

    (d) pledged to someone else,

    (e) worked by sharecroppers
        (i) owned by the farmer,
        (ii) owned by someone else;

    (f) borrowed from relatives without payment (*neni plaa*),

    (g) parts of fields given to helpers by the owner in lieu of payment in return for services rendered (*ua tepo*),

    (h) worked together by two persons who divide the yield equally (*uma leleng*).

2. For each field mentioned under 1, the following information was collected:

    (a) name of location,

    (b) desa in which it is located,

    (c) topographic conditions (steep, slightly inclined, level),

    (d) coverage with *lamtoro (Leucaena leucocephala)*,

    (e) status mentioned under 1(a) to 1(h),

    (f) size, measured in number of *blek* rice seed (*padi*) needed if the entire field would be planted (1 *blek padi* = 13.5 kg uncleaned hill rice which equals 12 kg cleaned rice (*padi bersih*), which again equals 8 kg of hulled rice (*beras*).

(g) extent to which perennial crops were planted (*uma kabor gong, uma ongeng, ongeng*).

3. For each field currently (1975-76) under cultivation the following detailed information was asked:

(a) name of field,

(b) number of years during which the field had been cropped (*uma weru, amak weru, amak*) or cropped permanently (*hokot nane*),

(c) size of cultivated area (in *blek*),

(d) type of *padi* seed used,

(e) yields of hill rice (in *blek*) (*padi bersih* - i.e. without stalks etc.)

(f) yields of maize (on the cob) measured in *subur* (= 40 maize cobs) or *beser* (= 100 maize cobs ≈ 6 kg of maize kernels),

(g) labour involved in the preparation of the field (including planting), measured in man-days (one man-day equals 6 hours of work)
(i) rendered by members of the farmer's family,
(ii) rendered by specific labour groups (*hokot seng, letah, woter*),

(h) date of planting
(i) hill rice,
(ii) maize,

(i) date of weeding and how often,

(j) labour involved in weeding (man-days)
(i) rendered by members of the farmer's family,
(ii) rendered by specific labour groups (*hokot seng, letah, woter*),

(k) expenses incurred by group labour,

(l) number of persons (adults, children) of the farmer's family who depend on the agricultural production,

(m) length of cultivation period, length of fallow period.

The time needed for harvesting has been omitted in the calculation since it is comparatively fixed for the crops under discussion (hill rice: 40 man-days/ha; maize: 20 man-days/ha). Hence no regional differences can be expected. The values of labour productivity calculated in the present study are therefore absolutely too high and only convey a relative idea of regional differences.

Appendix II: Description of soil profiles

Profile 13: Soil type: Immaturely developed Andosol (Ranker stage)

Locality: Watuklong, east of Koker, 600 m

Topography: rolling, 45% slope gradient

Vegetation: abandoned *ladang*

Parent material: andesites and tuffs

Drainage: internal and external - good

Date of sampling: 24 Jan. 1976. Lab. No. 179535-36

Profile morphology:

Horizon	Depth
A_h	0-15 cm: black with roots, loaminess increasing with depth
C	15-200 cm<: yellowish tuff

Mechanical and chemical analysis: see Table 1.

Chief characteristics: very light textured soil, loam in upper horizon overlying sandy loam. Very high permeability; neutral to slightly acid in reaction. Acidity increasing with depth; low in organic matter and nitrogen, fairly good C/N ratio; low cation exchange capacity (C.E.C.); medium in Ca, Mg, high in K, low in Na and carbonates; low in phosphorus.

Profile 14: Soil type: Fully developed andosol (Lessivé stage)

Locality: Watupogot, 650 m, within forest reserve (*kawasan hutan*), former *ladang* until 1964/65. Since then fallow.

Topography: slightly undulating, 15% slope gradient

Vegetation: ?

Parent material: andesites and tuffs

Drainage: good

Date of sampling: 24 Jan. 1976. Lab. No. 179537-39

Profile morphology:

Horizon	Depth
A_h	0-20 cm: dark, lightly textured
B_v	20-40 cm: brown, clayey
C	40 cm<

Mechanical and chemical analysis: see Table 1

Chief characteristics: very light texture, loamy, thus high permeability; slightly acid in reaction; low in organic matter and nitrogen, good C/N ratio; very low phosphorus content; low C.E.C.; medium in Ca, Mg and K; very low in Na and carbonates.

Profile 15: Soil type: Fully developed andosol (Lessivé stage)

Locality: Waibehar, 450 m, 1 km south of Kloangrotat in direction of Ohe

Topography: slightly undulating, 15% slope gradient, at foot of *wolon*

Vegetation: under coconut trees, fallowed garden for two years

Parent material: Andesites and tuffs

Drainage: excessive

Date of sampling: 24 Jan. 1976, Lab. No. 179540-42

Profile morphology:

Horizon	Depth
A_h	0-10 cm: dark brown with roots
B_v	10-25 cm: brown, loamy
C	25 cm<: brown

Mechanical and chemical analysis: see Table 1

Chief characteristics: very light texture, loamy, thus high permeability, neutral to slightly acid in reaction; low in organic matter and nitrogen; good C/N ratio; low C.E.C.; medium in Ca, Mg; high in K but low in Na and carbonates

Profile 16: Soil type: Juvenile Andosol

Locality: Batubong (Desa Kajowair); north of Botang, near road Kewapante-Watublapi, 250 m.

Topography: hilly, 60% slope gradient

Vegetation: fallow vegetation (second year) under coconut trees

Parent material: tuffs

Drainage: excessive

Date of sampling: 25 Jan. 1976. Lab. No. 179543-44

Profile morphology:

Horizon	Depth
A	0-30/40 cm: dark, humic horizon, loamy, roots
C_v	30/40-120 cm: light brown/yellowish, stony, loamy
C	below 120 cm: bedrocks (*napan*)

Mechanical and chemical analysis: see Table 1

Chief characteristics: very light textured soil, sandy clay loam to sandy loam; neutral to slightly acid, very low in organic matter and nitrogen; good C/N ratio in upper horizon; very low phosphorus content; low C.E.C.; medium Ca, Mg and K; low in Na and carbonates.

Profile 17: Soil type: Immaturely developed andosol (Ranker stage)

Locality: Tanalet; 180 m (Desa Kajowair) east of road Kewapante-Watublapi

Topography: rolling, 45% slope gradient, crest of *wolon*

Vegetation: tussocky grass (*tebe*) only

Parent material: tuffs

Drainage: excessive

Date of sampling: 25 Jan. 1976. Lab. No. 179545-46

Profile morphology:

Horizon	Depth
A_h	0-5/10 cm: dark, sandy, roots
C	5/10 cm<: tuffs

Mechanical and chemical analysis: see Table 1

Chief characteristics: Sandy loam; neutral to slightly acid; low in organic matter and nitrogen; good C/N ratio; phosphorus low in upper horizon, medium in C horizon; medium C.E.C. in top horizon; high in Ca; medium in Mg and K, low in Na and carbonates.

Profile 18: Soil type: Fully developed andosol (Lessivé stage)

Locality: Natarwegok (Desa Seusina), 75 m, west of road Kewapante Watublapi

Topography: slightly undulating, 15% slope gradient

Vegetation: *ladang* field, second year under cultivation

Parent material: tuffs

Drainage: excessive

Date of sampling: 25 Jan. 1976. Lab. No. 179547-49

Profile morphology:

Horizon	Depth
A_h	0-20 cm: dark humus
B_v	20-40 cm: yellowish, crumbly, sandy, some tuffaceous stones *(wura gete)*
C_v	40-200 cm: reddish brown, loamy, clay stone (*napan*); tuffaceous stones (*wura gete)*

Mechanical and chemical analysis: see Table 1

Chief characteristics: Loam to sandy loam; neutral to slightly acid in reaction; good C/N ratio in top horizon; low in organic matter and nitrogen; low to medium in phosphorus; high in C.E.C. of top horizon, medium C.E.C. in lower horizons; very slightly in Ca in A_h- and C-horizons; medium in Mg, high in K - particularly in the B-horizon; Na low in upper horizon and fairly high in lower horizons; low in carbonates. Note: The value of 8 mg P_2O_5 in C_v-horizon has to be considered an error.

Profile 19: Soil type: alluvial soil

Locality: Napungseda (Desa Namangkewa), 50 m, 50 m north of bridge crossing the river Seda on Kewapante-Watublapi road

Topography: near level; irregularly inundated by river Seda (e.g. 1976)

Vegetation: edge of garden, permanently used

Parent material: -

Drainage: excessive

Date of sampling: 25 Jan. 1976. Lab. No. 179550-52

Profile morphology:

Horizon	Depth
A_h	0-20 cm: dark, sandy loam
C_{al_2}	20-50 cm: grey, sandy (mottled)
C_{al_1}	50 cm<: small stones and gravel, yellowish

Mechanical and chemical analysis: see Table 1

Chief characteristics: sandy loam; neutral in reaction; good C/N ratio; low in organic matter and nitrogen; medium content of phosphorus; medium C.E.C.; medium in Ca and Mg; high in K; low in Na and carbonates. Owing to regular flooding a number of horizons can be distinguished which did not develop in *situ*.

Profile 20: Soil type: lithosol

Locality: Wairita, 150 m, on site belonging to the veterinary service of Sikka

Topography: slightly undulating, 15% slope gradient

Vegetation: short grass savanna with *tebe* grass (*Heteropogon contortus*(?), some *Calotropis gigantea* and scattered *koli* palms (*Borassus flabellifer*)

Parent material: tuffs and andesitic conglomerates

Drainage: good

Date of sampling: 3 Feb. 1976

Profile morphology:

Horizon	Depth
(A)	0-10 cm: dark, roots
C_v	10-100 cm: reddish brown, crumbly, roots, containing conglomerates (*napan*)
C	100 cm<: bedrock

Mechanical and chemical analysis: see Table 1

Chief characteristics: clay loam to loam; neutral to slightly acid in reaction; good C/N ratio; low in organic matter and nitrogen; medium C.E.C.; low in carbonates

Profile 21: Soil type: immaturely developed andosol (Ranker stage)

Locality: Bola, 200 m north of church, west of road to Watublapi

Topography: gently rolling, 30% slope gradient

Vegetation: *ladang*, third year under cultivation

Parent material: tuffs underlain by coral limestone and marl

Drainage: excellent

Date of sampling: 4 May 1976

Profile morphology:

Horizon	Depth
A_h	0-15/20 cm: dark, roots
C	bedrock

Mechanical and chemical analysis: see Table 1

Chief characteristics: Sandy clay loam; neutral to slightly acid in reaction; good C/N ratio; low in organic matter and nitrogen; low C.E.C.; low in carbonates

Profile 22: Soil type: degraded andosol (Ranker stage)

Locality: Puho, new Kantor Desa (Desa Iligai), 180 m

Topography: slightly undulating, 15% slope gradient

Vegetation: fallowed field, mainly *Imperata* grass

Parent material: tuff

Drainage: excessive

Date of sampling: 21 May 1976

Profile morphology:

Horizon	Depth
A	0-15/20 cm: yellowish sand
C	20 cm<: brown pumice with intrusions

Mechanical and chemical analysis: see Table 1

Chief characteristics: sandy loam; neutral to slightly acid in reaction; good C/N ratio; low in organic matter and nitrogen; low C.E.C.; low in carbonates

Profile 23: Soil type: fully developed andosol (Lessivé stage)

Locality: south of road between Magegera (Desa Koting B) and Tebuk (Desa Tebuk)

Topography: slightly rolling

Vegetation: coconut garden

Parent material: tuffs and andesites

Drainage: good

Date of sampling: 26 May 1976

Profile morphology:

Horizon	Depth
A_h	0-15 cm: dark, roots
B_v	15-50 cm: tuffaceous hard layer (*watu wura*)
C	50 cm<: sandy, reddish (*tana mera*) roots

Mechanical and chemical analysis: see Table 1

Chief characteristics: sandy loam, sand, loam in lower horizon; neutral to slightly acid in reaction; C/N ratio good; low in organic matter and nitrogen; low C.E.C.; low in carbonates.

Profile 24: Soil type: fully developed andosol (Lessivé stage) (underlain by fossil soil)

Locality: Nele Lorang, 240 m

Topography: slightly rolling

Vegetation: coconut garden

Parent material: tuffs and andesites

Drainage: good

Date of sampling: Feb. 1975 by Faculty of Agriculture of Institut Pertanian Bogor (IPB)

Profile morphology:

Horizon	Depth	
A	0-36 cm:	dark reddish brown (5YR 2.5/2); sandy loam, gravel; fine crumbly structure; pH 6.5; clear transition
B_{el}	36-75 cm:	dark reddish brown (5YR 3/2); loamy, fine crumbly structure; pH 6.8 = neutral in reaction; clear transition
B_{al}	75-99 cm:	brown to dark brown (7.5YR 4/4); loamy sand; loose structure; pH 6.0; clear transition.
C	99-117 cm:	pumice
A_f	117-133 cm:	brown to dark brown (7.5YR 4/4); sand and gravel; mixed with organic matter; pH 5.4; clear transition
B_{vf}	133-150 cm:	reddish dark brown (5YR 3/2) loam and gravel; fine crumbly structure; pH 5.5

Mechanical and chemical analysis: see Table 1

Chief characteristics: light texture; neutral in reaction; unfavourable C/N ratio; very low in organic matter and nitrogen; medium C.E.C.; medium Ca (upper 75 cm), Mg and K; fairly high Na, high in soluble phosphorus in the top horizon, below which it decreases rapidly until 99 cm from where it increases again.

Profile 25: Soil type: fully developed andosol (Lessivé stage)

Locality: Desa Koting B, 230 m

Topography: slightly undulating

Vegetation: coconut

Parent material: tuff

Drainage: good

Date of sampling: Feb. 1975 by Faculty of Agriculture of IPB.

Profile morphology:

Horizon	Depth	
A_h	0-24 cm:	dark reddish brown (5YR 2.5/2); loamy sand mixed with gravel, crumbly structure, pH 6.6; clear transition
B_{el}	24-42 cm:	dark reddish brown (5YR 2.5/2); sand mixed with gravel; loose fine structure; pH 7.1, clear transition
B_{al}	42-111 cm:	dark reddish brown (5YR 3/2); sand mixed with gravel; loose fine structure; pH 8.1
C	111-150 cm:	rocks and pumice

Mechanical and chemical analysis: see Table 1

Chief characteristics: light texture; neutral in reaction; unfavourable C/N ratio; low in organic matter and nitrogen; medium C.E.C.; medium Ca in top horizon only; high in Mg in top horizon; high in K in upper 42 cm; low in Na; extremely high in soluble phosphorus in top layer from where it decreases before its content increases again below 42 cm.

Profile 26: Soil type: fully developed andosol (Lessivé stage)

Locality: Desa Koting C, 240 m

Topography: level to slightly undulating

Vegetation: coconut

Parent material: tuff and andesites

Drainage: good

Date of sampling: Feb. 1975 by Faculty of Agriculture of IPB

Profile morphology:

Horizon	Depth	
Ah	0-28 cm:	dark reddish brown (5YR 2.5/2); sandy loam; fine crumbly structure; pH 7.3, clear transition
B	28-97 cm:	dark brown (7.5YR 3/2); sand; loose structure pH 9.1; clear transition
C	97-150 cm:	pumice

Mechanical and chemical analysis: see Table 1

Chief characteristics: light texture; neutral in reaction; favourable C/N ratio; low in organic matter and nitrogen; medium C.E.C.; medium in Ca; medium in Mg in top horizon only; very high in K; low in Na; very high in soluble phosphorus.

Profile 27: Soil type: juvenile andosol

Locality: Rotat, 400 m

Topography: no data

Vegetation: *ladang* field

Parent material: no data

Drainage: no data

Date of sampling: Feb. 1970 by Direktorat Jenderal Kehutanan Lab. No. 151447

Profile morphology: top layer only; loamy sand

Mechanical and chemical analysis: see Table 1

Chief characteristics: slightly alkaline in reaction; very low in organic matter and nitrogen; low in P_2O_5 and very low in K_2O.

Profile 28: Soil type: alluvial soil

Locality: Maumere, sea level

Topography: level

Vegetation: no data

Parent material: no data

Drainage: no data

Date of sampling: Feb. 1970 by Direktorat Jenderal Kehutanan Lab. No. 151448

Profile morphology: top layer only; sandy loam

Mechanical and chemical analysis: see Table 1

Chief characteristics: neutral in reaction; very low in organic matter and nitrogen; good C/N ratio; medium in P_2O_5; very low in K_2O.

Profile 29: Soil type: immaturely developed andosol (Ranker stage)

Locality: Ladogahar (Desa Nitakloang), east slope Mt Kimang-Buleng, 700 m

Topography: no data

Vegetation: grass savanna (*Imperata cylindrica*)

Parent material: tuff and andesites

Drainage: no data

Date of sampling: Feb. 1970 by Direktorat Jenderal Kehutanan Lab. No. 151449

Profile morphology: top layer only; silt loam

Mechanical and chemical analysis: see Table 1

Chief characteristics: slightly acid in reaction; low in organic matter and nitrogen; favourable C/N ratio; very low P_2O_5 and K_2O.

Profile 30: Soil type: Immaturely developed andosol (Ranker stage)

Locality: Ladogahar (Desa Nitakloang), east slope Mt Kimang-Buleng, 800 m

Topography: no data

Vegetation: grass savanna (*Imperata cylindrica*)

Parent material: tuff and andesites

Drainage: no data

Date of sampling: Feb. 1970 by Direktorat Jenderal Kehutanan Lab. No. 151450

Profile morphology: top layer only; silt loam

Mechanical and chemical analysis: see Table 1

Chief characteristics: slightly acid; low to moderate in organic matter and nitrogen; favourable C/N ratio; very low in P_2O_5 and K_2O.

Profile 31: Soil type: Lithosol

Locality: Wolonkolit (Desa Nele Wutung), north slope of Mt Ilinggai, 600 m

Topography: no data

Vegetation: no data

Parent material: no data

Drainage: no data

Date of sampling: Feb. 1970 by Direktorat Jenderal Kehutanan Lab. No. 151451

Profile morphology: top layer only; sandy loam

Mechanical and chemical analysis: see Table 1

Chief characteristics: neutral in reaction; low in organic matter and nitrogen; favourable C/N ratio; very low P_2O_5 and K_2O.

Profile 32: Soil type: immaturely developed andosol (Ranker stage)

Locality: Wolonkolit (Desa Nele Wutung), north slope of Mt Ilinggai, 700 m

Topography: no data

Vegetation: grass savanna (*Imperata cylindrica*)

Parent material: no data

Drainage: no data

Date of sampling: Feb. 1970 by Direktorat Jenderal Kehutanan Lab. No. 151452

Profile morphology: top layer only; silt loam

Mechanical and chemical analysis: see Table 1

Chief characteristics: neutral in reaction; low in organic matter and nitrogen; favourable C/N ratio; very low P_2O_5 and K_2O.

Profile 33: Soil type: Lithosol

Locality: 16 km east of Maumere (approx. in grass savanna north of Tarat-Egong complex, elevation 25 m, 400 m inland)

Topography: gently rolling, 15-20% slope; several stones

Vegetation: rainfed maize and rough pasture, some tree crops

Parent material: volcanic debris

Drainage: external good; internal good to excessive

Date of sampling: 28 April 1975 by Canadian International Development Agency, East Indonesia, Reg. Development Study, Lab. No. 178239-40; profile No. EI-12.

Profile morphology:

Horizon	Depth	
A	0-12 cm:	granular structure; loose consistency; few small roots; no clay films; many coarse fragments; field pH 7.0
C_v	12-30 cm:	structureless; fragmented consistency; few small roots, no clay films; many coarse fragments; field pH 7.0
C	30 cm:	bedrock contact

Mechanical and chemical analysis: see Table 1

Chief characteristics: slightly alkaline; loam upper horizon; heavy clay lower horizon; low in organic matter; no data for nitrogen; high C.E.C.; high to very high in Ca, medium to high in Mg; low in K, Na and carbonates.

Profile 34: Soil type: Regosol

Locality: 16 km east of Maumere, on coast near profile 33

Topography: undulating

Vegetation: no data

Parent material: no data

Drainage: good (external); excessive (internal)

Date of sampling: 28 April 1975 by Canadian International Development Agency, East Indonesia Reg. Development Study. Lab. No. 178239-41, profile No. EI-12

Profile morphology: Surface horizon only; single grain structure; loose consistency; few small roots; no clay films; few coarse fragments; field pH 7.0

Mechanical and chemical analysis: see Table 1

Chief characteristics: silt loam, alkaline in reaction; low in organic matter and P_2O_5, while medium in K_2O; medium C.E.C., Ca, Mg; high in K and low in Na; very low in carbonates.

Appendix III

List of place names in Fig.53, in numerical order

1	Wairita	A7	43	Kloangaur	B6
2	Degit	A6/7	44	Wailong	B5
3	Nangahaledoi	A6	45	Wairotang	B5
4	Habijanang	B7	46	Waipare	B5
5	Magehenit	B7	47	Bolawolong	B5
6	Hoder	B7	48	Benarat	B5
7	Wolomapa (Waibleler)	B7	49	Kloanglagot	B5
8	Wukak	B7	50	Higetegera	B5
9	Kloangdualiat	B7	51	Habilopong	B5
10	Habiheret	B6	52	Kahat	B5
11	Liangawo	B7	53	Kloangbolat	B5
12	Magetuwa	B7	54	Habihogor (Iantena)	B5
13	Pomabolat	B7	55	Magepedar	B5
14	Biket	B7	56	Apinggoot	B5
15	Kubit	B7	57	Habihogor (Kokowahor)	B5
16	Tanabitak	B7	58	Orinmude	B5
17	Mudung	C7	59	Liangtahon	C5
18	Delang	B7	60	Blatat	B5
19	Aibura	B7	61	Tuwat	B5
20	Watuwogat	B7	62	Wolomotong (Watuliwung)	B5
21	Igot	C7	63	Wetakara	B5
22	Wolontibang	B6	64	Watuwutur	B4
23	Kebot	B6	65	Safit	B4
24	Tadat	B7	66	Watuliwung	B4
25	Tadaruhat	B7	67	Habigahar	B4
26	Bulabutu	B6	68	Haniwetak	B4
27	Wolonbue	B6	69	Weko	B4
28	Wairwerut	B6	70	Kamet	B4
29	Watuwekak	B6	71	Lokaria	B4
30	Teguluri	B6	72	Brai	B4
31	Waiara	B6	73	Kabor	A3
32	Krokowolong	B6	74	Iligetang	A3
33	Kewa	B6	75	Nara	B3
34	Kewapante	B6	76	Enak	B3
35	Napungseda	B6	77	Detung	B4
36	Kloangliat	B6	78	Kolibuluk	B3
37	Kloangpidat	B6	79	Nangalimang	B3
38	Nitakloang	B6	80	Hoba	B3
39	Wegoknatar	B6	81	Woloara	B3
40	Sedabaot	B6	82	Ribang	B3
41	Reketlimat	B6	83	Mageteok	B3
42	Baosak	B6	84	Guru	B3

85	Sigawetat	B3
86	Koliaduk	A3
87	Nilo	A1
88	Natargahar	A1
89	Lirikelang	A2
90	Keling	B2
91	Koligahar	B1
92	Dota	B2
93	Natarwulu	B2
94	Rotat	B2/C2
95	Wukak	B2/C2
96	Bloro	C2
97	Watubala	C2
98	Kei	C2
99	Natarweru	C2
100	Nitakloang	C2
101	Nita-Lalat	C2
102	Nita Pleat	C2
103	Ritapiret	B2/C2
104	Weruoret	C2
105	Ledalero	B2
106	Nita Lorat	C2
107	Nita Lawolo	C2
108	Napungblega	C2
109	Rane	C2
110	Tebuk	C2
111	Solot	C2
112	Werut	C2
113	Gere	C2
114	Magegera	C2/C3
115	Kojagete	C2/C3
116	Baot	D1
117	Hepang	D1
118	Napung Liti	D1/D2
119	Bang	D1
120	Lagokagur	D2
121	Mageuta	D2
122	Koliwolong	D2
123	Tadat	D2
124	Rohot	D2
125	Kotit	D2
126	Wolomapa (Hepang)	D2
127	Wololora (Hepang)	D2
128	Medut	D2
129	Umaili	D2
130	Riangsina	D2
131	Lihet	D2
132	Wolowukak	D2
133	Puho	D2/D3
134	Watugete	D3
135	Kolitwuradoi	D3
136	Natarwerut	D3
137	Boralobo	D3
138	Kojapadu	D3
139	Wutik	D3
140	Gehak-Retawolo	C3
141	Gehak-Lau	C3
142	Diler	C3
143	Arat	C3
144	Petuntetok	C3
145	Wolohuler	C3
146	Tomu	C3
147	Muut	C3
148	Paubekor	C3
149	Halat	C3
150	Lepolina	C3
151	Balulele	C3
152	Keduwair	C3
153	Watutena	C3
154	Wodong (Nele Lorang)	C3
155	Nele	C3
156	Kode	C3
157	Tadabliro	C3
158	Delang	C3
159	Padang	C3
160	Kloangbola	C3
161	Tikang	D2
162	Ililewa	D2
163	Napungnao	D2
164	Du	D2
165	Sikka	E3
166	Wukur	E3
167	Wetak	E3
168	Detung	E3
169	Kopor	E3
170	Ragaegong	D3
171	Wolongkepi	D3
172	Tanaling	D3
173	Werapepa	D3
174	Wolonglorang	D3
175	Bidara	D3
176	Wolowukak	D3
177	Petunglanang	D3
178	Terunggawang	D2
179	Hubing	D3
180	Wolonarat	D2
181	Todang	D3
182	Kloang	D3
183	Hokor	D3
184	Bora	D4
185	Lawanguneng	D4
186	Pomat	D4

187 Kopor	D4	238 Wuradohor	D6
188 Pigejawa	D4	239 Golat	D6
189 Hokok	D5	240 Riidetut	D6
190 Ru	D4	241 Watublapi	C6
191 Gade	D4	242 Misi Watublapi	C6
192 Bora Blupur	D5	243 Wegok	C6
193 Klotang Gahar	D5	244 Kojaturak	C6/D6
194 Klotang Detut	D5	245 Wolonmuut	C6
195 Taranggatar	D5	246 Baomekot	C6
196 Sulit	D5	247 Wolonpikang	C7
197 Oringbelang	D5	248 Ohe	C7
198 Leku	E5	249 Romanduru	C7
199 Ili (Wolonwalu)	E5	250 Watuwitir	C7
200 Klakat	E5	251 Kloangrotat	C7
201 Tok	E5	252 Oringkolit	C7
202 Watupogot	C7	253 Koker	C7
203 Tiong	D5	254 Pauhura	C7
204 Klekar	D5	255 Wolonkotit	C7
205 Wur	D5	256 Pogonbola	C7
206 Maget (Wolokoli)	D5	257 Botang	C6
207 Baot	D5	258 Wolonbola	C6
208 Rohot	D5	259 Klibing	C6
209 Diret	D5	260 Woloklereng	C7
210 Tadat (Wolokoli)	D5	261 Wailaba	C7
211 Wuut	D5	262 Kojagelo	C7
212 Natarloar (Wolokoli)	D5	263 Watuklong	C7
213 Gale	D5	264 Kojadulot	C7
214 Gedo	D5	265 Dokak	C7
215 Ian	D5	266 Sinawair	C6
216 Natarkaha	D5	267 Hewotkloang	C6
217 Mapat	D5/E5	268 Kewagunung	C6
218 Piren	D5	269 Heo	C6
219 Rota	E6	270 Wolondalo	C6
220 Natarwatu	E6	271 Potet	C6
221 Baluk	E6	272 Magerobak	C6
222 Detungbatikdetut	E6	273 Magesunga	C6
223 Wologaharpante	E6	274 Natarbola	C6
224 Wologahargunung	D6	275 Kojateda	C6
225 Orindetut	E6	276 Kojablutuk	D4
226 Ipir	E6	277 Kopong	C6
227 Wairgete	E6	278 Gloir	C6
228 Patiorok	D6	279 Magetada	C6
229 Krado	D6	280 Kolibaluk	C6
230 Umauta	D6	281 Moro	C6
231 Detunkolit	D6	282 Watukobu	C6
232 Wojong	D6	283 Piring	C5
233 Dokar	D6	284 Dobo	C5
234 Puho	D6	285 Baobatung	C5
235 Rohe	D6	286 Wolomotong (Kokowahor)	C5
236 Wololora (Umauta)	D6	287 Getang	C5
237 Watudenak	D6	288 Ili	C5

289	Riit	C5	325	Tadat (Wolomapa)	D6
290	Belang	C5	326	Legar	C7
291	Edo	C5	327	Maget (Wolomotong)	C7
292	Deu	C5	328	Kloangpopot	D7
293	Wodong (Blatatating)	C5	329	Wualadu	D7
294	Nara	C5	330	Eha	D7
295	Kloanggelot	D5	331	Wuwur	D7
296	Keit	D5	332	Ewa	D7
297	Tadagahar	C5	333	Kahagoleng	D7
298	Litikloang	C5	334	Edat	D7
299	Bei	C5	335	Daat	E8
300	Detung	C5	336	Habibola	E8
301	Natarloar (Mekendetung)	C5	337	Pelibaler	D7
302	Wololuma	C5	338	Bora	D7
303	Wolooa	C5	339	Kongas	D8
304	Tadat (Mekendetung)	C5	340	Kloangmudet	D8
305	Lawang	C5	341	Wairdahi	D8
306	Padang	C5	342	Sago	C6
307	Paurao	C5	343	Hapengkabor	C6
308	Natarloar (Watuliwung)	C4/C5	344	Bauwunut	C6
309	Habigete	C4/C5	345	Liwubau	C7
310	Nitung	C4	346	Teongbakut	D3
311	Kangae	C4	347	Sikut	D7
312	Orinwolot	C4	348	Maget (Wolomapa)	C6
313	Ohet	C4	349	Wolondoi	C6
314	Hubungnatar	C4	350	Natarwerut	C6
315	Kloa	C4	351	Wolomotong (Wolomotong)	C7
316	Hubingkloang	C4	352	Kojatadat	C6
317	Wolomude	C4	353	Nahaleman	C4
318	Sari	C4	354	Doreng	E8
319	Arat (Tekaiku)	C4	355	Hebar	D8/E8
320	Watutoa	C4	356	Ojang	C5
321	Watubuku	C4	357	Ribang	C1
322	Kedadue	C4	358	Waidoko	A3
323	Teteng	C4	359	Bebeng	A3
324	Kloangkoja	C4	360	Wuring	A3

<u>List of ridges, mountains and hills in Fig.53, in numerical order</u>

(W = Wolong)

1	W. Aibura	B7	11	W. Wegok	C6
2	W. Kolit	B7	12	W. Mapa	D6/C6
3	W. Jat	B7	13	W. Tobong	C6
4	W. Biket	B7	14	W. Kopong Watut	C7
5	W. Glemok	B6	15	W. Gai	C7
6	W. Natarweru	C6	16	W. Meklotong	C7
7	W. Tadat	B6	17	W. Watuklong	C7
8	W. Solit	C6	18	W. Kotit	C7
9	W. Hewerbura	C6	19	W. Takat	D8
10	W. Tuat	D6	20	W. Tedet	C7

21	W. Koker	C7	67	W. Popibaka	D4
22	W. Pogon	C7	68	W. Edoboga	E4
23	W. Wolomotong	C7	69	W. Majatmahet	D4
24	W. Meradue	D7	70	W. Klamang	E4
25	W. Kloangbogit	C8	71	W. Nuper	E4
26	W. Watutenat	C8	72	W. Leat	D4
27	W. Sikut/ W. Kebar	D7	73	W. Tadat	D4/E4
28	W. Jawutu	D7/C7	74	W. Darat	D4
29	W. Paut	D7	75	W. Pigang	D3
30	W. Wuwur Glara	D7	76	W. Kopor	E3
31	W. Liat	D7	77	W. Sikka	D3
32	W. Araobat	D7	78	W. Delang	D3
33	W. Urut	D7	79	W. Wutiknatargut	D3
34	W. Warut	D6	80	W. Wutik	C3
35	W. Ipir	D6	81	W. Bauregang	C3
36	W. Watuwoilaren	D6	82	W. Koligahar	B2
37	W. Pauklotong	D6	83	W. Wauk	B2
38	W. Henit	D6	84	W. Maget	B2
39	W. Herigete	D6	85	W. Lelebura	B2
40	W. Watuwene	D6	86	W. Legulo	B2
41	W. Natarmihe	D6	87	W. Nilogahar	B2
42	W. Watutile	D6	88	W. Wukak Keut	B2
43	W. Tobung	D6	89	W. Deladetun	B2
44	W. Watugung	D6	90	W. Natarloar	A1
45	W. Natawatu Loar	D6	91	W. Egakiok	A2
46	W. Bekor	D6	92	W. Watubuku	C4
47	W. Biro	D6/E6	93	W. Helakabor	C4
48	W. Detunkolit	D6	94	W. Bolat	C4
49	W. Soko	D6	95	W. Bao	C4
50	W. Biroderit	D6	96	W. Doi	C4
51	W. Gele	D5/D6	97	W. Wolomotong	C4
52	W. Baut	D6	98	W. Ritat	C4/D4
53	W. Karambau	D5	99	W. Takahokok	D5
54	W. Ian	D5	100	W. Alonduen	D5
55	W. Betan	D5	101	W. Plaget	D5
56	W. Ogoroang	D5	102	W. Suruk	D5
57	W. Wolokoli	D5	103	W. Lalanklagen	C6
58	W. Baot	E5	104	W. Heo	C6
59	W. Baka	E5	105	W. Gerat	C6
60	W. Betan	D5	106	W. Tegunajar	D6
61	W. Ili Leku	E5	107	W. Bora	D6/C6
62	W. Wolotalo	E5/D5	108	W. Dalo	C6
63	W. Nilo	D5	109	W. Kewagunung	C6
64	W. Pigejawa	D5	110	W. Haruntenat	D6
65	W. Watuhea	D4	111	W. Mudung	B7
66	W. Watuplepa	E4	112	W. Kliling	B4/5

Alphabetical list of place names in Fig.53

Aibura	B7
Apinggoot	B5
Arat	C3
Arat (Tekaiku)	C4
Baluk	E6
Balulele	C3
Bang	D1
Baobatung	C5
Baomekot	C6
Baosak	B6
Baot	D1
Baot	D5
Bauwunut	C6
Bebing	A3
Bei	C5
Belang	C5
Benarat	B5
Bidara	D3
Biket	B7
Blatat	B5
Bloro	C2
Bola	E5
Bolawolong	B5
Bora	D7
Bora	D4
Bora Blupur	D5
Boralobo	D3
Botang	C6
Brai	B4
Bulabutu	B6
Daat	E8
Degit	A6/7
Delang	B7
Delang	C3
Detung	C5
Detung	B4
Detung	E3
Detungbatikdetut	E6
Detunkolit	D6
Detut	E6
Deu	C5
Diler	C3
Diret	D5
Dobo	C5
Dokak	C7
Dokar	D6
Doreng	E8
Dota	B2
Du	D2
Edat	D7
Edo	C5
Eha	D7
Enak	B3
Ewa	D7
Gade	D4
Gale	D5
Gedo	D5
Gehak-Lau	C3
Gehak-Retawolo	C3
Geliting	B6
Gere	C2
Getang	C5
Gloir	C6
Golat	D6
Guun Dogon	B3
Guru	B3
Habibola	E8
Habigahar	B4
Habigete	C4/C5
Habiheret	B6
Habihogor (Iantena)	B5
Habihogor (Kokowahor)	B5
Habijanang	B7
Habilopong	B5
Habiwetak	B4
Halat	C3
Hangak	D6
Hapengkabor	C6
Hebar	D8/E8
Heo	C6
Hepang	D1
Hewotkloang	C6
Higetegera	B5
Hoba	B3
Hoder	B7
Hokok	D5
Hokor	D3
Hubing	D3
Hubingkloang	C4
Hubingnatar	C4
Ian	D5
Igot	C7
Ili (Wolonwalu)	E5
Ili	C5
Ili Bekor	D4
I. Dobo	D6
I. Gai	D3
I. Getang	A4

I. Hawoat (= I. Doi)	D6
I. Jele	D4
I. Ladan	D6
I. Ladawuat	C7
I. Liwundetut	D6
I. Lorat	D4
I. Newa	D3
I. Tarat	C8
I. Tolawair (Raganatar)	D4
I. Tomak	C8
I. Weker	D3
Iligetang	A3
Ililewa	D2
Ipir	E6
Kabor	A3
Kahagoleng	D7
Kahat	B5
Kamet	B4
Kangae	C4
Kebot	B6
Kedadue	C4
Keduwair	C3
Keling	B2
Kei	C2
Keut	D5
Kewa	B6
Kewagunung	C6
Kewapante	B6
Klakat	E5
Klekar	D5
Kloa	C4
Kloang	D3
Kloangaur	B6
Kloangbola	C3
Kloangbolat	B5
Kloangdualiat	B7
Kloanggelot	D5
Kloangkoja	C4
Kloanglagot	B5
Kloangliat	B6
Kloangmudet	D8
Kloangpidat	B6
Kloangpopot	D7
Kloangrotat	C7
Klotong Detut	D5
Klotong Gahar	D5
Kode	C3
Kojablutuk	D4
Kojadulot	C7
Kojagelo	C7
Kojagete	C2/C3
Kojapadu	D3
Kojatadat	C6
Kojateda	C6
Kojaturak	C6/D6
Koker	C7
Koliaduk	A3
Kolibaluk	C6
Kolibubluk	B4
Koligahar	B1
Kolitwuradoi	D3
Koliwolong	D2
Kongas	D8
Kopong	C6
Kopor	E3
Kopor	D4
Koting	C3
Kotit	D2
Krado	D6
Krokowolong	B6
Kubing	C6
Kubit	B7
Langokagur	D2
Lawang	C5
Lawanguneng	D4
Ledalero	B2
Ledar	C7
Leku	E5
Lela	D2
Lepolina	C3
Liangawo	B7
Liagoa	E5
Liangtahon	C5
Lihet	D2
Lirikelang	A2
Litikloang	C5
Liwubau	C7
Lokaria	B4
Mapat	D5/E5
Magegera	C2/C3
Magehenit	B7
Magenidung	D2
Magepedar	B5
Magerobak	C6
Magesunga	C6
Maget (Wolokoli)	D5
Maget (Wolomotong)	C7
Maget (Wolomapa)	C6
Magetada	C6
Mageteok	B3
Magetuwa	B7
Mageuta	D2

Maumere	A3
Medut	D2
Misi Watublapi	C6
Moro	C6
Mudung	C7
Muut	C3
Nahaleman	C4
Nangahaledoi	A6
Nangalimang	B3
Napungnao	D2
Napungblega	C2
Napung Liti	D1/D2
Napungseda	B6
Nara	B3
Nara	C5
Natarbola	C6
Natarkaha	D5
Natarloar (Wolokoli)	D5
Natarloar (Mekendetung)	C5
Natarloar (Watuliwung)	C4/C5
Natarwatu	E6
Natarweru	C2
Natarwerut	C6
Natarwerut	D3
Natarwulu	B2
Nele	C3
Nemita	E7
Nilo	A1
Nita	C2
Nitakloang	C2
Nitakloang	B6
Nita Lalat	C2
Nita Lawolo	C2
Nita Lorat	C2
Nita Pleat	C2
Nitung	C4
Nuba Nanga Habigete	B5
Nuba Nanga Nitung	B5
Nuba Nanga Ili	B5
Ohe	C7
Ohet	C4
Ojang	C5
Orindetut	E6
Oringbelang	D5
Oringkolit	C7
Orinmude	B5
Orinwolot	C4
Padang	C3
Padang	C5
Patiorok	D6
Paubekor	C3
Pauhura	C7
Paurao	C5
Pelibaler	D7
Petunglanang	D3
Petuntetok	C3
Pigejawa	D4
Piren	D5
Piring	C5
Pogonbola	C7
Pomabolat	B7
Pomat	D4
Potet	C6
Puho	D2/D3
Puho	D6
Ragaegong	D3
Rane	C2
Reketlimat	B6
Riangsina	D2
Ribang	B3
Ribang	C1
Riit	C5
Riidetut	D6
Ritapiret	B2/C2
Rohe	D6
Rohot	D2
Rohot	D5
Romanduru	C7
Rota	E6
Rotat	B2/C2
Ru	D4
Safit	B4
Sago	C6
Sari	C4
Sedabaot	B6
Sigawetat	B3
Sikka	E3
Sikut	D7
Sinawair	C6
Solot	C2
Sulit	D5
Tadabliro	C3
Tadagahar	C5
Tadaruhat	B7
Tadat	B7
Tadat (Wolomapa)	D6
Tadat (Wolokoli)	D5
Tadat (Mekendetung)	C5
Tadat	D2
Tanabitak	B7
Tanaling	D3
Taranggatar	D5

Alphabetical list of rivers in Fig.53

(N = Napung)

	Nangablo	C1-D1	N.	Ian	D5
N.	Aibura	B7	N.	Ili	B5
N.	Balaregong	D4-C3	N.	Iligetang	D4-A3
N.	Baluk	E6	N.	Ipir	D6-E6
N.	Basar	C3	N.	Jangregang	C4
	Batikwair	C2	N.	Jojet	D7
N.	Betat	B7/B6	N.	Kabor	B2/B3
N.	Blirat	D6	N.	Kajowair	C6
N.	Blatadenak	C6		Kakiwair (Kloangpopot)	C8-D7
N.	Blinit	D8	N.	Kakiwair (Seusina)	C6
N.	Blot	B7/B6	N.	Kamet	C4-A4
N.	Bola (Nita)	B2	N.	Kapa	B3
N.	Bola (Bola)	E6	N.	Kebot	B7/B6
N.	Bonga	E5	N.	Keit	B1-C2
N.	Bora	D2	N.	Keut	D5
N.	Boralobo	D3	N.	Kewangniur	B2
N.	Bungat	C5-B5	N.	Kibong	B2
N.	Bura	D6-C6	N.	Klegang	D6
N.	Dalodetut	C7	N.	Kleteng	C7-C6
N.	Degit	C7	N.	Klotong	D5
N.	Degit	D4-C4	N.	Kobadua	D6
N.	Diler	C2	N.	Koja	C7
N.	Diret	D5	N.	Kojababung	D6
N.	Do	D5-E5	N.	Kojablutuk	D6
N.	Dobo	D5	N.	Kojadoko	C3
N.	Bowakok	D8-E7	N.	Kojaguni	C6
N.	Duga	E4	N.	Kojaklobit	D7
N.	Gade	D4-D5	N.	Kojaladar	C5-B5
N.	Gajot	D8	N.	Kojalaka	C7
N.	Gawat	C6	N.	Kojalakat	C7
N.	Gedo	D5	N.	Kojalawat	D7
N.	Geho	C3	N.	Kojalebawaat	C6
N.	Gesosogot	C4	N.	Kojamoning	C3
N.	Getang	B5	N.	Kojapadu	D3
N.	Gete (Koting)	C3-B3	N.	Kojaregang	D7
N.	Gete (Nele Barat)	B3	N.	Kojat	C5
N.	Gete (Iantena)	C5-B5	N.	Kojaregot	E5
N.	Gete (Hokor)	D3-E3	N.	Kojawetat	D3
N.	Gusar	C6	N.	Kojawoko	D8
N.	Habigete	C4-C5	N.	Kolit (Hewotkloang)	C6
N.	Habitedang	B3-A3	N.	Kolit (Tekaiku)	C4
N.	Halat	C3	N.	Kopong	C6
N.	Halet	B5	N.	Koting	C3
N.	Hebar	D8-E8	N.	Koting (Watuliwung)	B5
N.	Heit	C7	N.	Laget	E5
N.	Henit	D6		Lakiwair	C6
N.	Higun	D5	N.	Langir	B3-A3
N.	Hoban	D5	N.	Leat	D5

N. Leaunet	D4/E4	N. Puukleman	D4-C4
N. Lawan	D5-C5	N. Rohot	D5
N. Lekut	C7	N. Rohot	D2
N. Lela	D2	N. Roingmeting	C2-D2
N. Lepot	C6	N. Romanduro	C7
N. Letu	D6	N. Rume	C5
N. Liargoar	D4	N. Runut	D6-E6
N. Liat (Umauta)	D6	N. Sago	C6
N. Lihet	E6	N. Sarusogar	C7
N. Liti	C2-D1	N. Sawuwair	D6-E6
N. Litikloang	C5	N. Seda	B6
N. Liwubau	C7	N. Sewa	D5
N. Liwunlagot	D8	N. Sikapleak	C7
N. Liwunmudet	C7	N. Sinawair	C6
N. Loat	D4-C4	N. Tadahelang	D5-C5
N. Logat	C5	N. Tadat	D5
N. Lorat	D7-E7	N. Tawunebon	C3-B3
N. Luber (Umauta)	D6	N. Tedagong	D5
N. Luber (Hewotkloang)	C6	N. Tedet	D6
N. Luber (Bola)	D6	N. Tegunajar	D6-C6
N. Lumajawa	D4-E4	N. Tenat	C6
N. Malor	C7	N. Tibat	C7
N. Manuwain	D5	N. Toa	C6-B5
N. Marawutung	C3-B3	N. Tomu	C3
Masawair	D7	N. Tuangdabit	A2
N. Mudegaru	D3	N. Udek	D4
N. Maget	C7/C6	N. Udur	A1-B2
N. Murunwotok	D7	N. Uruwat	D4-E4
N. Murun	E7	Waiara	B6
N. Murut	C6	Waibleler	B7/A7
N. Murut (Kloangpopot)	C8-D7	Wair	E3
N. Murut (Umauta)	D6	Wairao	C5
N. Nalot	C3	Wairbaba	C6
Nanga Lekon	A3	Wairbala	D6-E6
Nanga Limang	B3-A3	Wairbaluk	E6
Nangatobon	A3	Wairbega	D6
N. Nanu	D6	Wairbei	D6-D7
N. Napanmerat	C7-C6	Wairberung	D3-E3
N. Napat	D7	Wairbura	A2
N. Natardoi	D6-E6	Wairdahi	D6
N. Natarweru	C6	Wairdalo	B7
N. Ngorohong	C5-B5	Wairdao	D5
N. Nitung	C5	Wairdoit	D1
N. Ojat	C6	Waireat	C7-D7
N. Onget	D2	Wairgete (Ipir)	D6-E6
N. Paut	D1	Wairgabo	D3-D2
N. Pedan	C2	Wairhawa	E8-E7
N. Pehang (Kajowair)	C6	Wairheli	D7-E7
N. Pehang (Kloanpopot)	D7	Wairhelir	C7
N. Plare	D6-C6	Wairita	B7/A7
N. Puho	D3-D2	Wairkeang	C1

Wairklau	B3-A3
Wairkoting	B3
Wairlebeng	B3
Wairlekon	B2
Wairlewa	B2
Wairmea	D3-E3
Wairmein	C5
Wairmude	B2-C2
Wairmuut	C7
Wairnapa	A2
Wairresi	B3
Wairpelit	B2
Wairpuang	A1-B2
Wairiat	D5
Wairrabung	E7
Wairrulit	C7-D7
Wairtanat	D8
Wairtone	B2
Wairterang (Nikloang)	A1-B2
Wairterang (Bola)	D5
Wairterang (Ipir)	D6
Wairuri	D4-E4
N. Wat	E5-E6
N. Watubala	D4-C4
N. Watubil	C4
N. Watubo	C6
N. Watudalit	D8
N. Watukotat	C6
N. Watumerak	C4
N. Watuwekak	B6
N. Wegerkojang	C3
N. Weko	C4-A4
N. Wodon	C3
N. Wogat	E5
N. Wolohuler	C3
N. Wolonwauk	B2
N. Wolowukak	C2-D2
N. Wulat	D8-E8
N. Wutik	D3-D2

PLATES

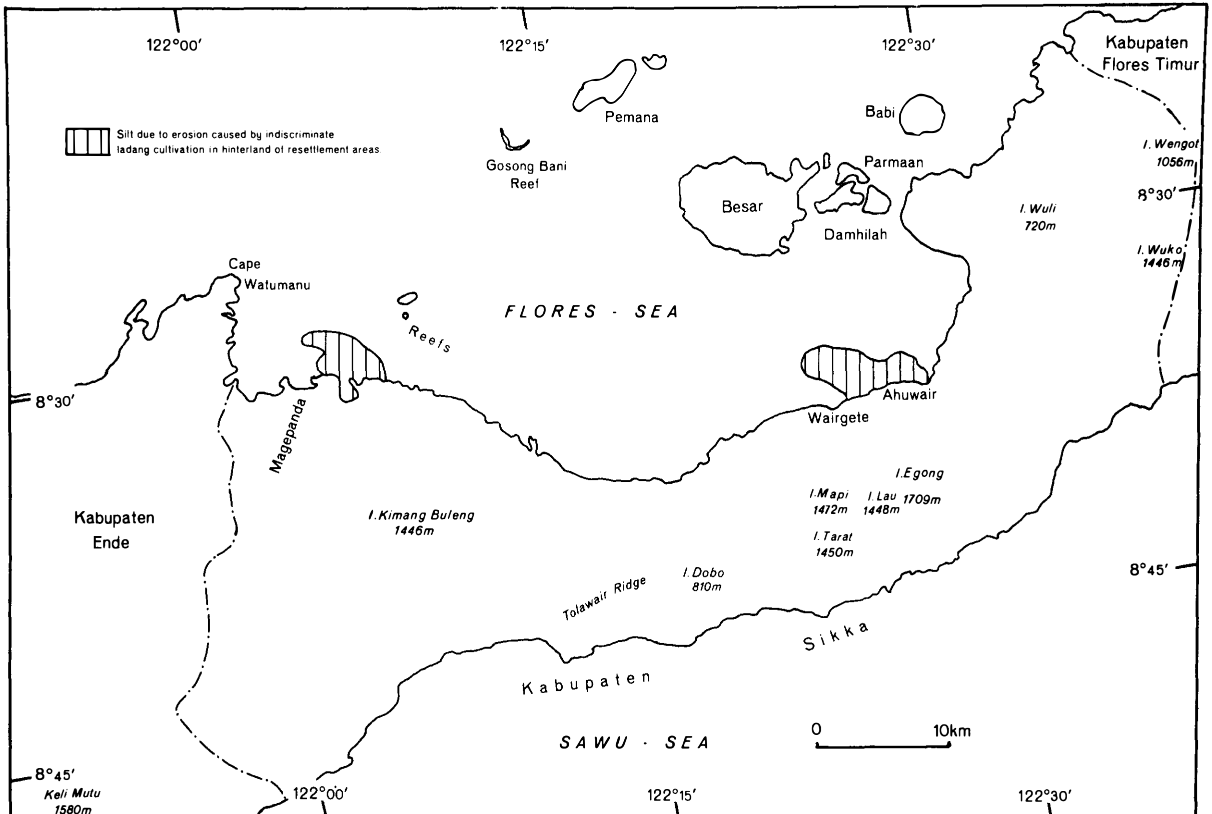
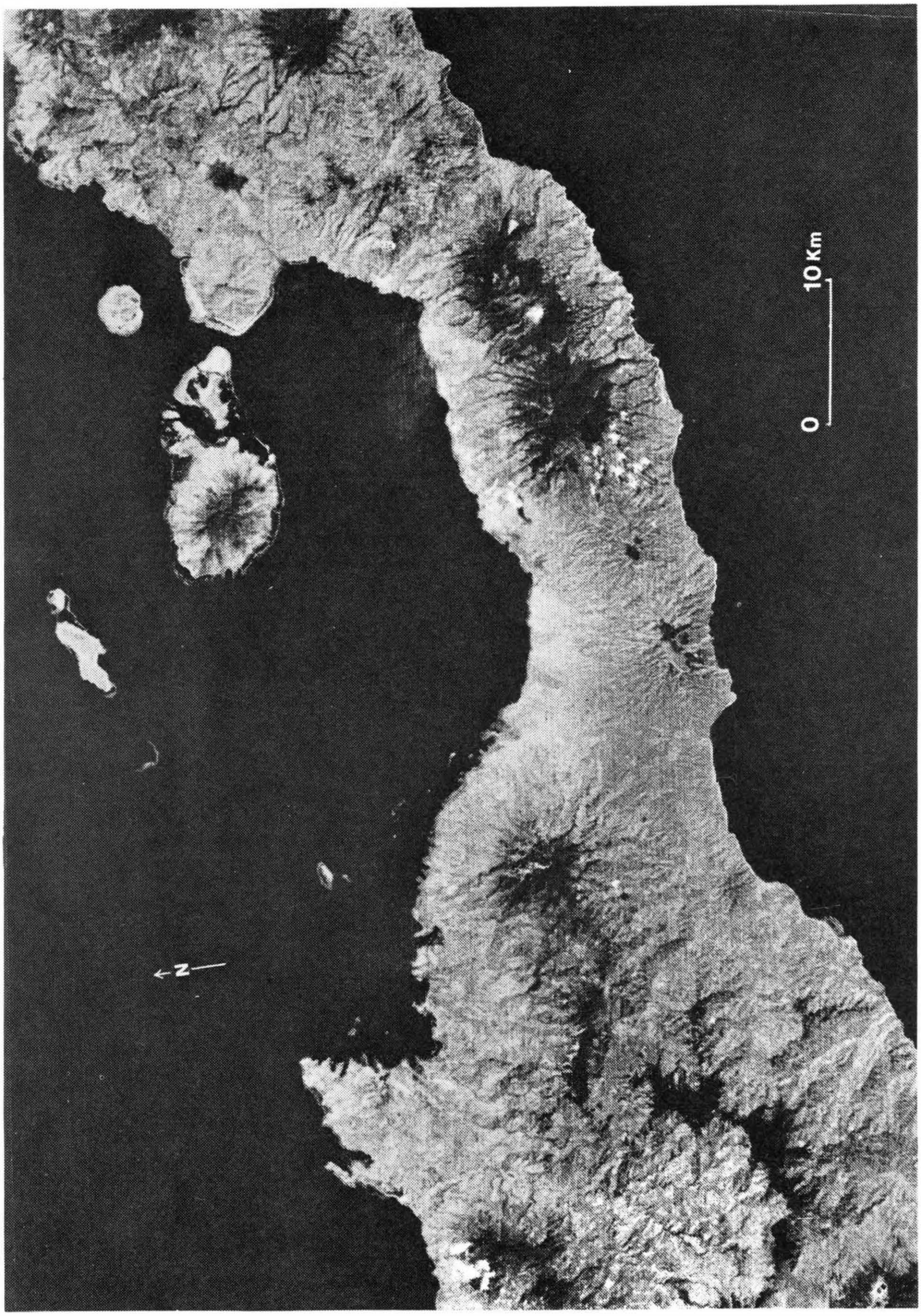


Plate 1 Sikka from space, enlargement from portion of ERTS -1 (now Landsat -1) satellite imagery, band 5 (lower red spectral band, 0.6 to 0.7 micrometres), 2 Sept. 1972; Code 81041012935 NOOO; taken from 909 km altitude. Image clearly shows volcanic cones of Mt Kimang-Buleng, Mt Tolawair, Mt Dobo, Mt Tarat/Egong (only active volcano of Sikka) and deeply incised loose tuffaceous and andesitic material. Note low degree of evergreen forests in Central Sikka. Submarine reefs north of Mt Kimang-Buleng, not depicted on any map so far, are conspicuous. Note high degree of silt in Flores Sea north of Magepanda and north of Wairgete (north of Mt Egong), main centres of local immigration, caused by excessive cultivation. (Courtesy US Department of the Interior, Geological Survey, EROS Data Center, Sioux Falls, South Dakota 57198, USA)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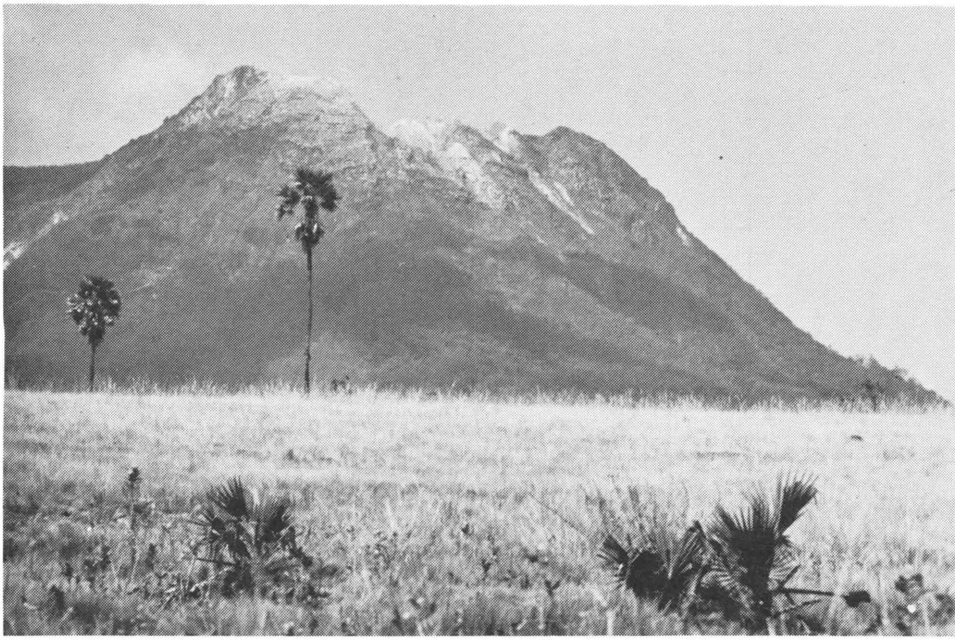

Plate 2 Mt Egong, 1709 m, active vocano in solfataric stage, seen from **the north; sulphur** emissions indicated by light tones at crater rim; grass savanna (*urung rïi rotang*) in foreground; scattered *Borassus flabellifer* trees remind us of the fact that this zone was once entirely covered by these palms. **11.5.1976**

Plate 3 South coast at Sikka, Cape Watugahar (left), Cape Wukur (right); flanks of tuffaceous and andesitic material, deeply incised by ephemeral rivers and creeks, barely covered with grass. Peaks in background from left to right: Ili Weker, Ili Newa (752 m), Ili Gai (909 m). 27.12.1970

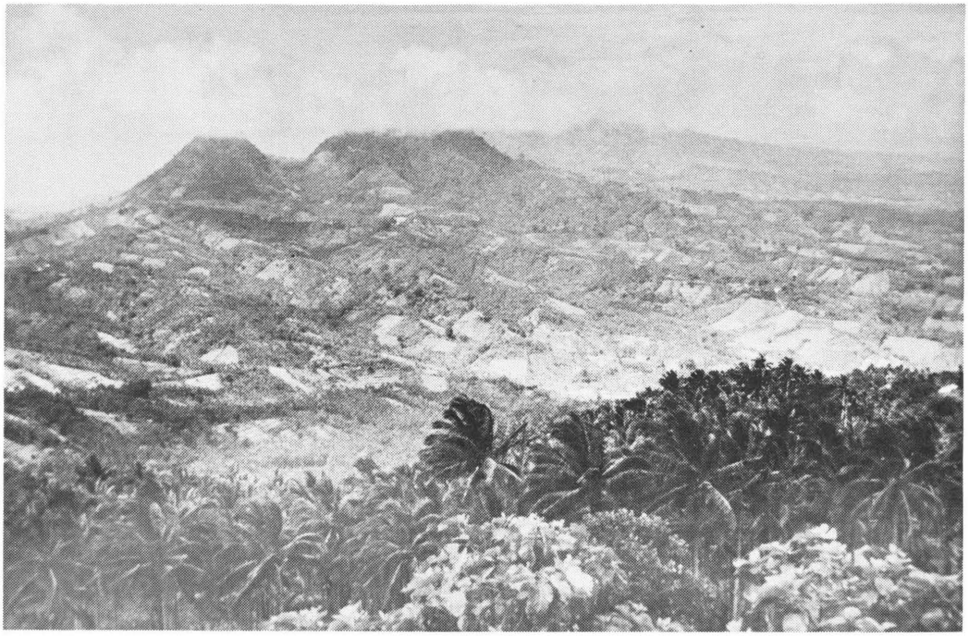

Plate 4 Mt Dobo with cones of Mt Hawoat, 800 m (left) and Mt Ili Ladat/Ili Dobo, 810 m (right) (shrouded by clouds); looking west from Ds Rubit 550 m, intensively used ridge and ravine country ('parasol ribbing'); white church of Mission at Watublapi seen at foot of Mt Dobo. 24.1.1976

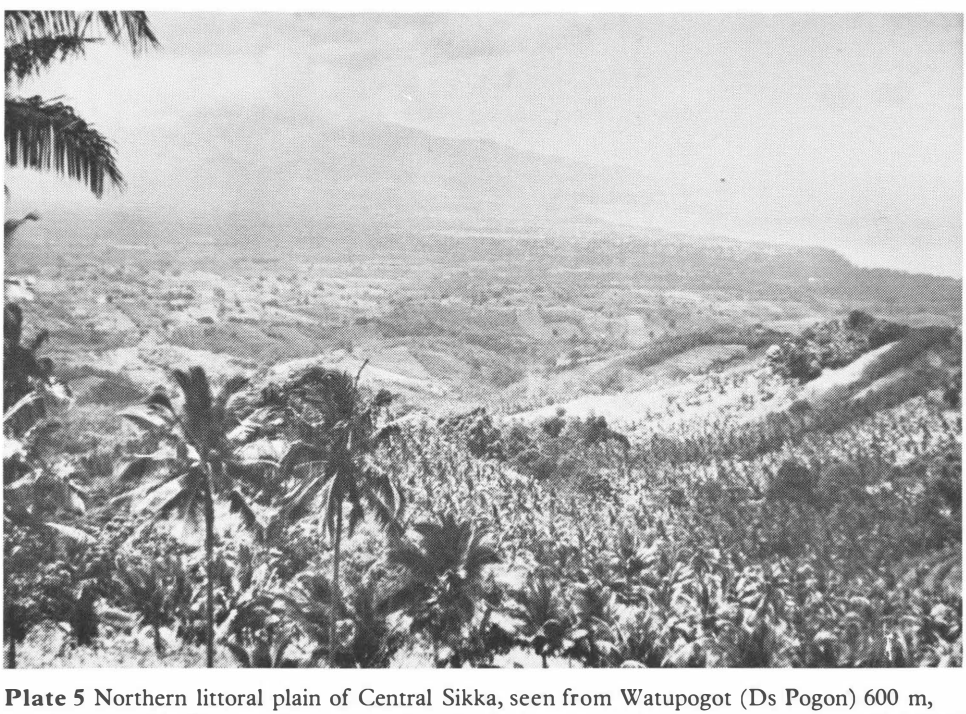

Plate 5 Northern littoral plain of Central Sikka, seen from Watupogot (Ds Pogon) 600 m, looking west; Mt Kimang-Buleng, 1446 m, in the background. 24.1.1976

Plate 6 Gently sloping north coast near Waioti, looking east. *Ipomoea-pes-caprae* and scattered *Calotropis gigantea* cover the beach, while *Borassus flabellifer* palms (*koli*) are found further inland. 8.1.1976

Plate 7 South coast near village of Du (Ds Sikka). Conglomerates dot the beach; escarpment seen at upper left hand corner. 9.2.1976

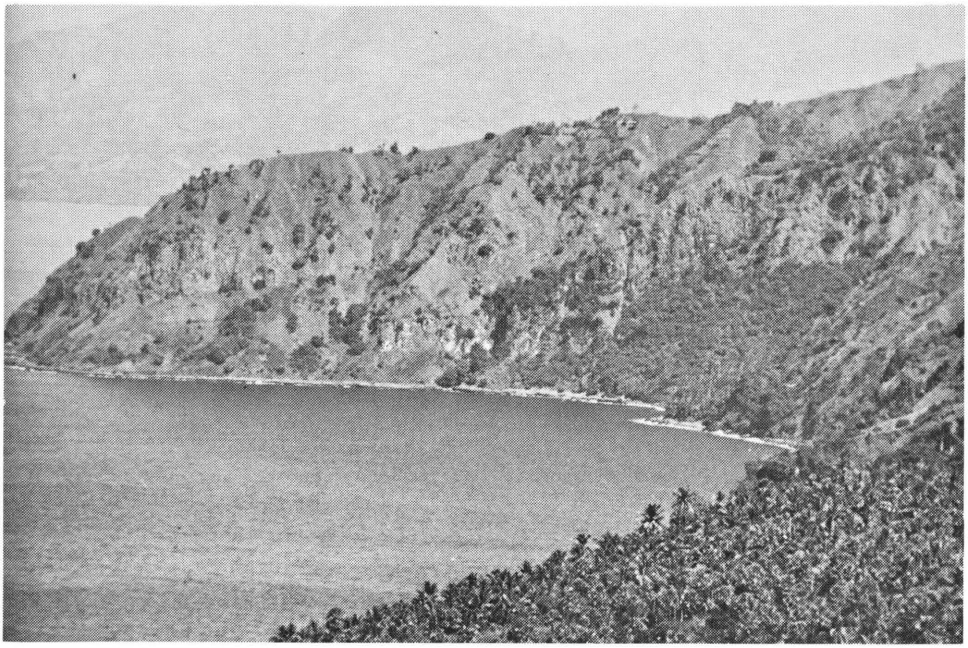

Plate 8 South coast, Cape Wukur (Rungsot), looking west; volcanic ridges drop abruptly into the sea. Only place where coconut growing is more extensive along the southern flanks.
30.4.1976

Plate 9 Town of Maumere, seen from the air looking west. Commercial centre at upper right near sea front bordered towards the west by dried-up river Nanga Limang forming the alluvial fan near the pier. In foreground schools and administrative buildings. Mission-owned coconut plantation at upper left hand corner. Mangal-fringed coast at Cape Titir and further west. In the vicinity of Cape Titir the abandoned fish-ponds of Koliaduk are to be found amidst mangal. (Courtesy V. Parera). May 1977

Plate 10 Watublapi (Ds Kajowair) 450 m: Man holding huge elephant tusk commonly used as bridewealth (*ling weling*). Only three to four tusks of this size are said to exist in Sikka. Most tusks are smaller. 5.4.1976

Plate 11 Watublapi (Ds Kajowair) 420 m: Sikkanese women covering themselves with hand-woven *ikat*-cloths against cool breeze. 23.5.1976

Plate 12 Village of Koker (Ds Pogon), 650 m, looking west: sacred stones (*watu mahe*) in centre of village. 24.1.1976

Plate 13 Watublapi, 420 m, man hoeing (*sako*) at slope of over 60 per cent gradient; note young *lamtoro* hedges. 6.10.1975

Plate 14 Mt Ili Lorat, seen from the south, 100 m south of village of Hokor, 300 m; encroachment of forest reserve Ili Gai (RTK No. 60). Boundary of the reserve runs at the foot of the mountain. **1.5.1976**

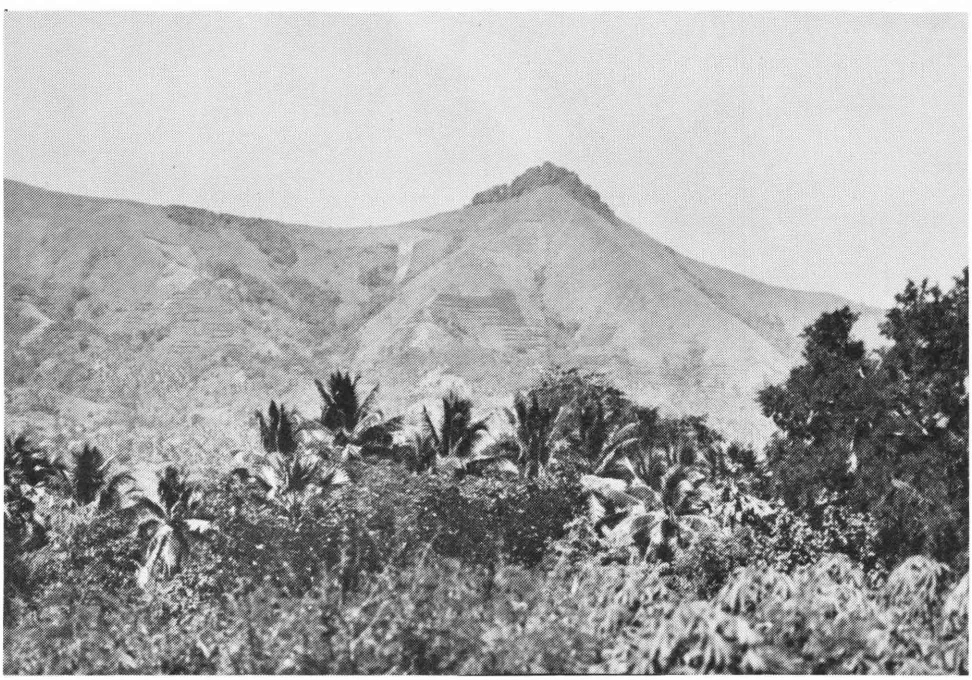

Plate 15 Mt Iligai 909 m, seen from Ds Kokowahor; forest remnant on top, grass savannas conspicuous, reforestation by means of agro-forestry project (*tumpang sari*) at lower sections of mountain (400-500 m); mainly *Cassia vera* (*johar*) is planted between rows of *lamtoro* which are spaced 6 m. 11.5.1976

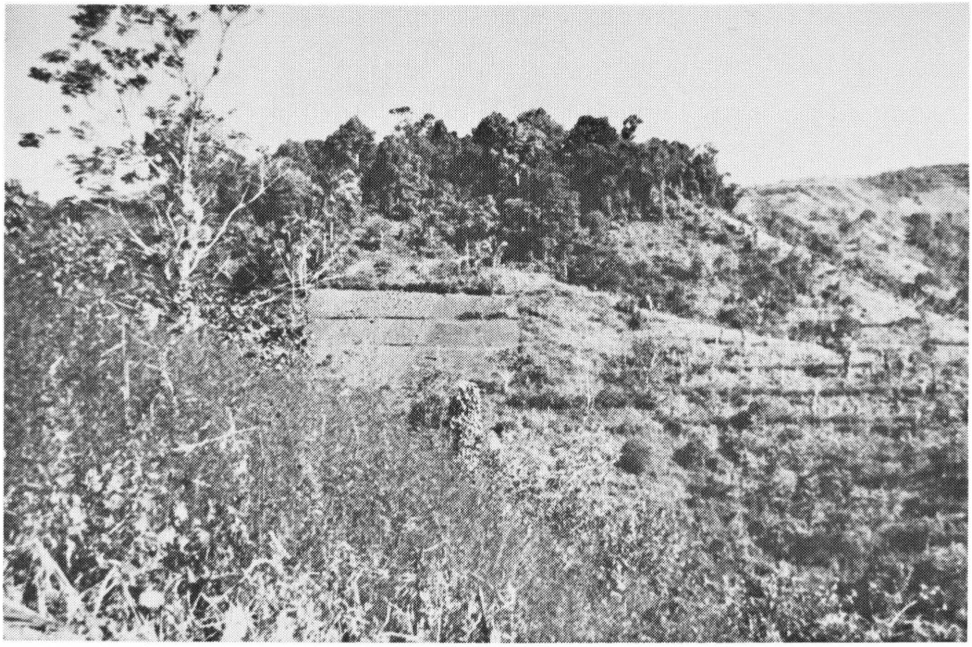

Plate 16 Ds Blatatating/Ds Mekendetung: remnants of sacred forest Natarloar looking south, 300 m. 28.3.1976

Plate 17 Kloangaur (Ds Hewotkloang) 150 m: looking north, bamboo pole on newly opened field (*uma weru*) indicates place of sacrifice (*ai puä*) where goats, chicken and rice are offered to appease the spirits. 20.12.1975

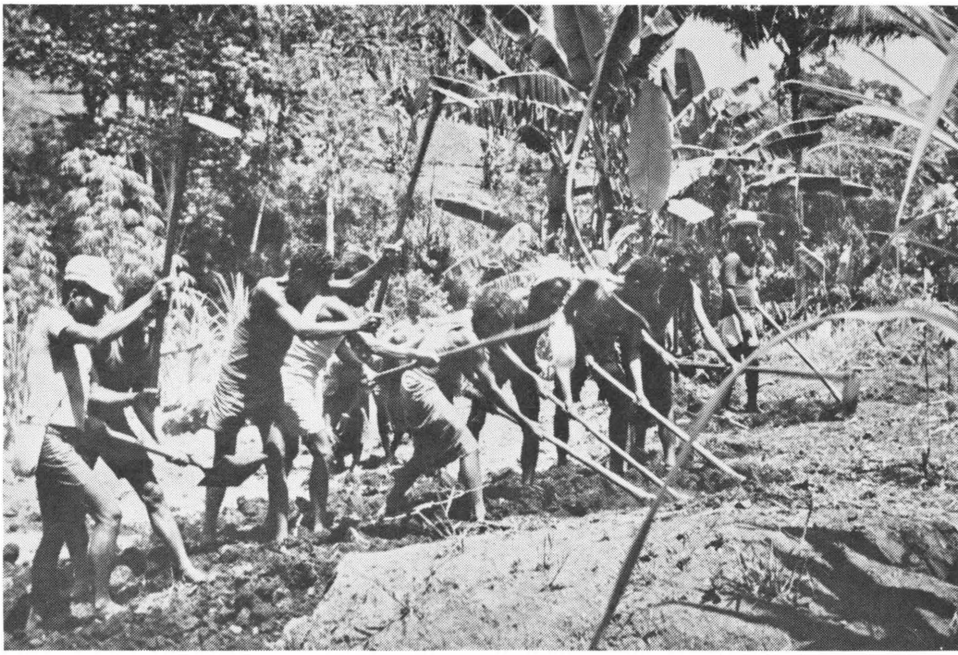

Plate 18 Group labour (*hokot seng*) in Ds Kokowahor. The gardens of each member of the group are worked by the team. Food is brought along by each person. 5.10.1975

Plate 19 *Desa* Watugong, north of Brai, 75 m; intercropping of maize, cassava, green gram and sorghum on one of Central Sikka's driest portions. *Borassus flabellifer* palms (*koli*) in background used for *tua*-production. 17.2.1976

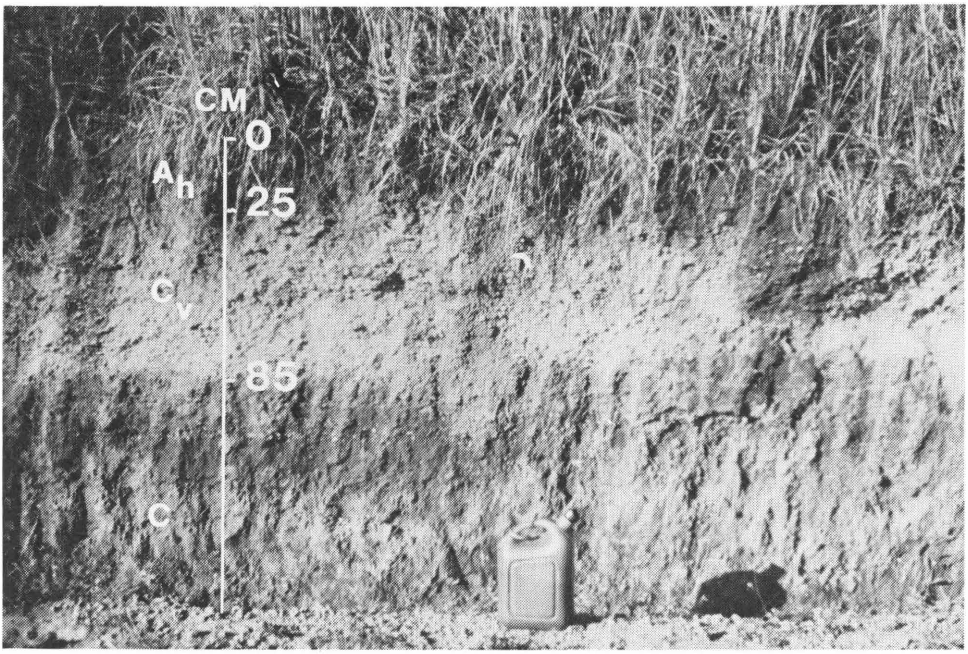

Plate 20 Wolon Ili-Leku (Ds Wolonwalu), south coast, 150 m; immaturely developed andosol consisting of thin A_h horizon on top of weathered tuffs and andesites, covered with *Imperata cylindrica* grass (*rii*). 3.5.1976

Plate 21 Light weeding by means of bamboo splinter (*keke*) near Watublapi on *amak*. 7.12.1976

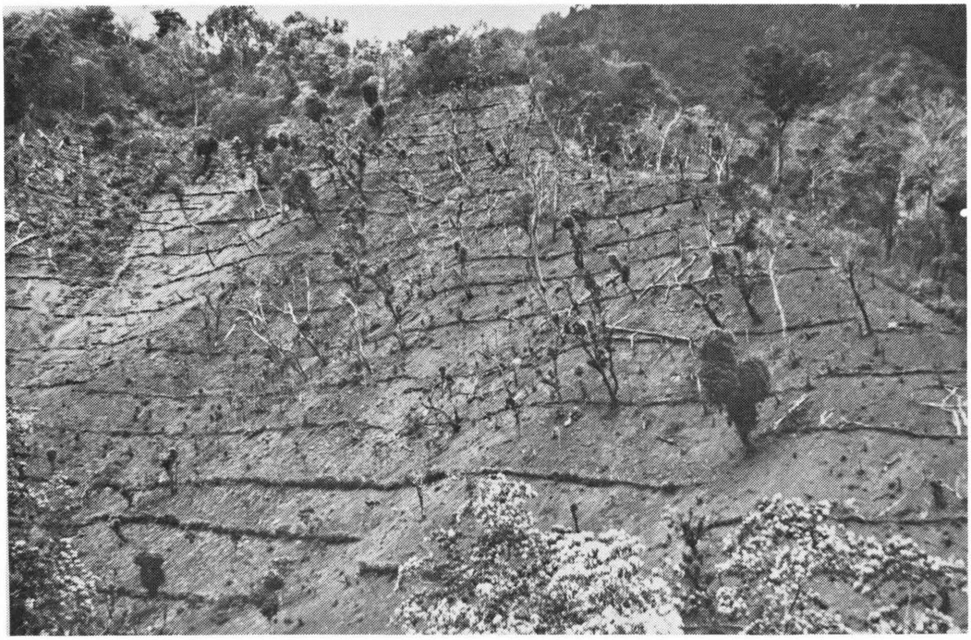

Plate 22 *Desa* Dobo, south of road to Lekebai, 250 m; *blepeng*, indigenous method of harnessing erosion by means of bamboo poles laid along contour lines. Given the steep slopes of most of the volcanic ridges of Sikka, these *blepeng* are inadequate as evidenced by damage. Note lopped trees on *ladang*. *Aleurites moluccana* tree (*gelo*) in foreground.

7.10.1975

Plate 23 Wolon Bolat, near Sari (Ds Tekaiku), 150 m, looking east; *ladang* field deeply scarred by gullies due to erosion. 2.1.1976

Plate 24 Maumere, river Nanga Limang. Owing to heavy deforestation in the upper courses the riverbed has rapidly silted up since the 1950s giving rise to annual flooding in the town of Maumere. Even reinforced embankments built at its course through the town have not stopped the river from spilling over. In the portion of the river shown here Buginese sailing boats (*prau*) used to enter from the sea before World War II. Today thick layers of sand, several metres above high water mark, prevent boats from entering. Some sand is used for construction purposes. 28.1.1976

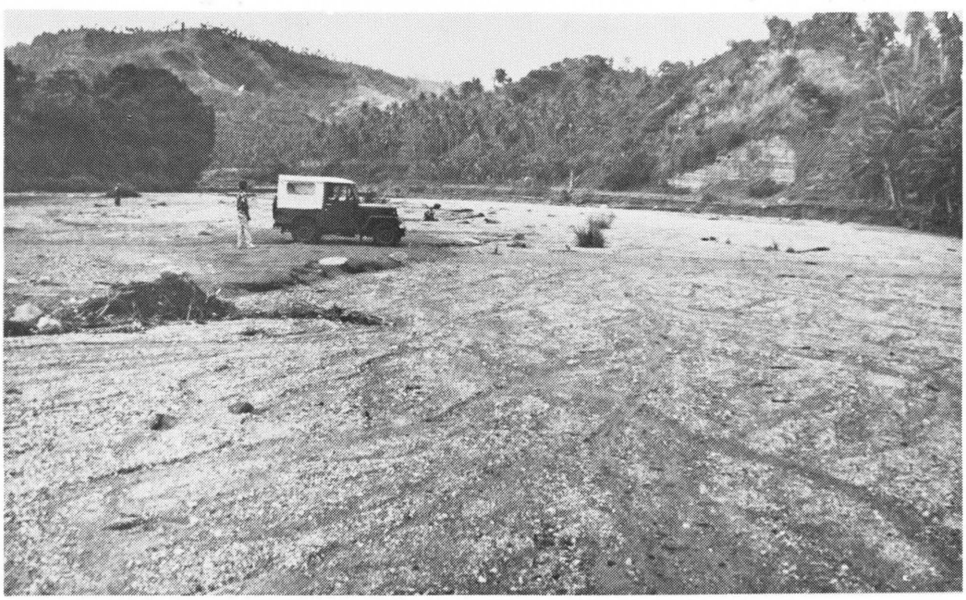

Plate 25 Dried-up riverbed of river Batikwair, south coast, west of Lela; since the late 1950s it has become an ephemeral creek, dried up for much of the year. 9.2.1976

Plate 26 Kloangpopot: women and children carrying bamboo poles filled with water (by courtesy of Father H. Weritz, Watublapi). No date

Plate 27 Southern flanks, seen from Ds Wolokoli looking west; low degree of soil protecting devices as well as lack of large-scale cultivation of tree crops are characteristic. Ridges drop abruptly towards the Sawu Sea. 2.1.1976

Plate 28 River Nanga Limang, 2 km south of Maumere; heavily damaged embankment caused by annual floods, whereby main road (*Floresweg*) between Nita and Maumere was partly washed away. 9.2.1976

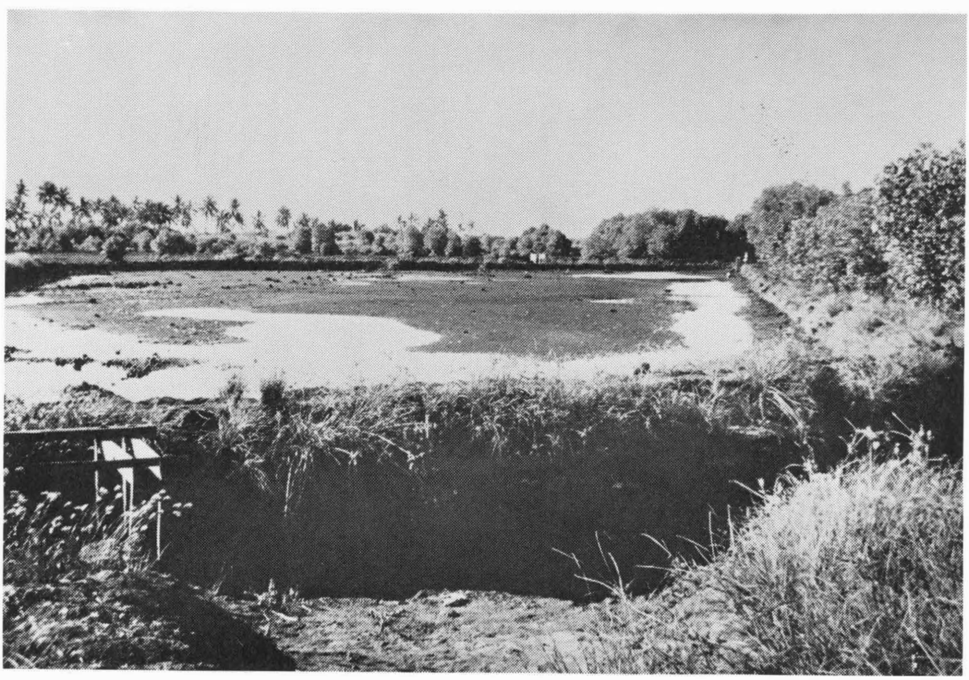

Plate 29 Koliaduk, 1 km west of Maumere; looking west, fishponds abandoned after heavy flooding in 1969 and 1970. Mangal seen at right. Salt production is encouraged in these ponds by Department of Fisheries of Sikka. 14.4.1976

Plate 30 Wuradohor (Ds Umauta), 350 m: woman harvesting maize and root crops; traditional way of carrying basket with string bound around her forehead. 20.2.1976

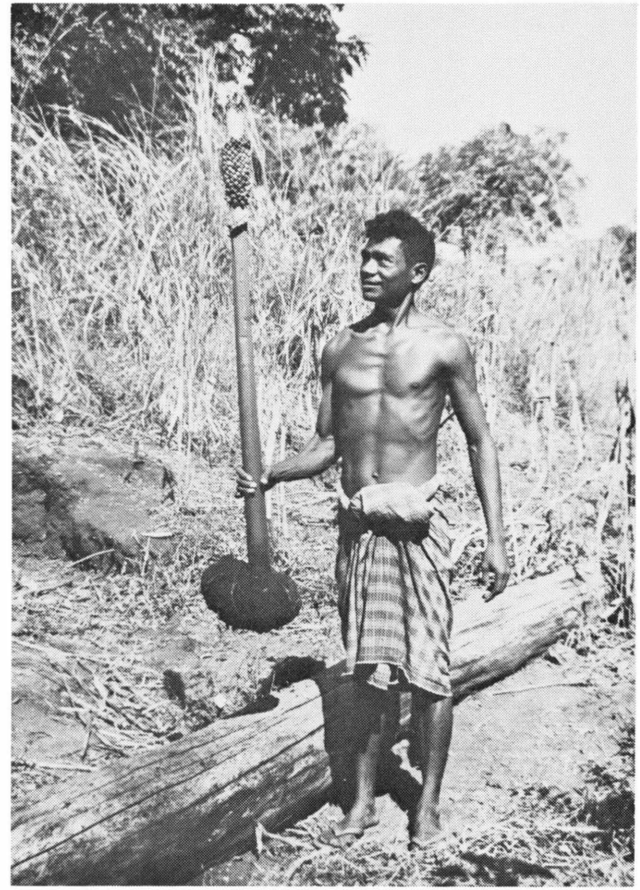

Plate 31 Between Lua and Degit (Ds Waibleler), north coast, 50 m, man holding wild tuber (*Araceae: Amorphophallus oncophyllus*) (locally called *tiri*). 11.5.1976

Plate 32 Nitakloang, 300 m; *Mimosa invisa* (*putri malu*), legume planted underneath coconut trees to accelerate restoration of soil fertility. 4.5.1976

Plate 33 Lua (Ds Egon), north coast, 50 m; *koli* tapper climbing *Borassus flabellifer* palm on bamboo pole; receptacle hanging from his waist is made of Areca tree (*Areca catechu*). *Sesbania grandiflora* tree (*luma*) at right. 11.5.1976

Plate 34 Kewapante (Ds Namangkewa): Moang Petrus Jacobus Bapa Mekeng, relative of the late *raja* of the kingdom of Kangae, whom he was supposed to succeed, but prevented from doing so by merger of three kingdoms of Sikka under *raja* Thomas Ximenes da Silva of Sikka in 1929. Declaration of allegiance (*korte verklaring*) dated 1902 and a silver-headed staff of office given by the Dutch are still carefully preserved. 16.5.1976

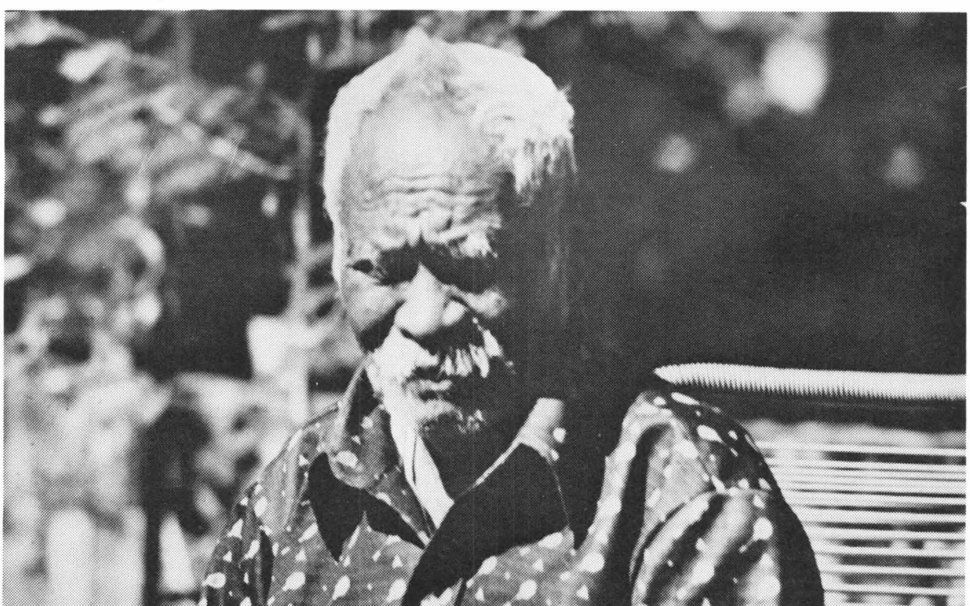

Plate 35 Bola (Ds Bola): Moang Alexius Boer Parera, chief adviser of late *raja* Thomas Ximenes da Silva of Sikka for issues on traditional law (*adat*); one of the few experts on Sikkanese law relating to land. 3.5.1976

Plate 36 Watublapi, 420 m: high quality cacao bought by local co-operative (Usaha Bersama Watublapi) dried in the sun; 22 tons of dried cacao were believed to have been harvested in the saddle of Baomekot in 1977. Cacao has become a new cash crop since the late 1960s. 9.4.1976

Plate 37 Watublapi, 420 m; copra carried on horseback to local dealer; sun-dried copra at left. 18.4.1976

Plate 38 Lekebai (Kecamatan Paga), western Sikka: weekly market where native population from the mountainous interior trades tobacco, vegetables, maize and chiefly *Aleurites moluccana* (*gelo*) against imported goods from Maumere. As Chinese merchants are forbidden to trade they send native Sikkanese middlemen (*papalele*) instead. 18.10.1975

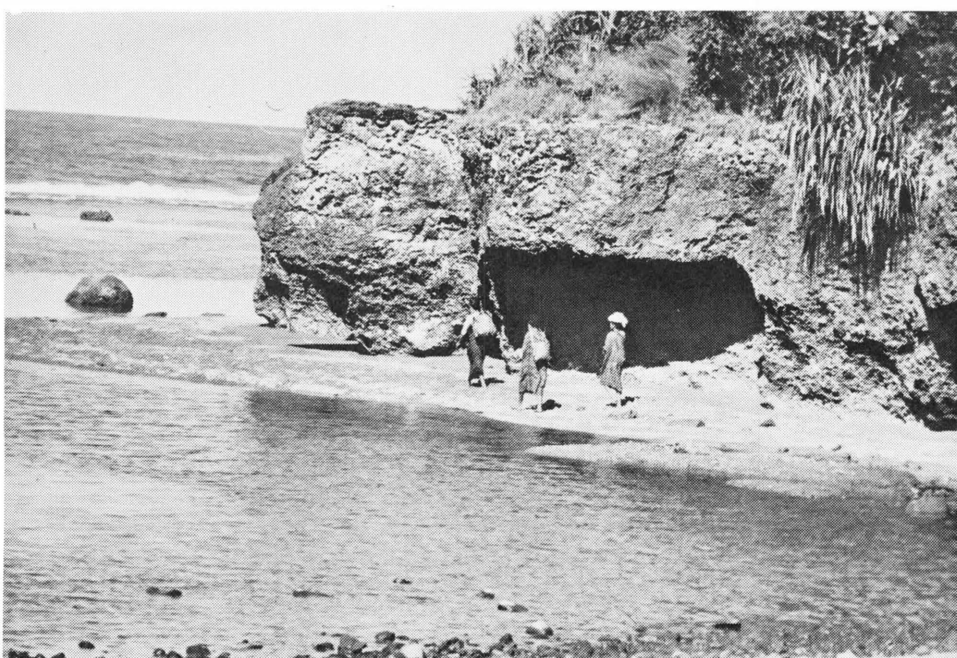

Plate 39 Bola: coral reef limestone, wave-cut notches. Women on their way home from weekly market at Watukrus (Ds Ipir) near Bola. *Pandanus sp.* at upper right. 3.5.1976

Plate 40 Mini-buses (*bemo*), in use since end of 1974, have linked major centres of population with the administrative and commercial centre of Maumere even though road conditions are frequently daunting. 12.7.1976

Plate 41 Watukrus (Ds Ipir), south coast: weekly market; vendors of pottery are from Ds Wolokoli, specializing in this commodity. 3.5.1976

Plate 42 Habiheret (Ds Waibleler), 50 m; tree legume *Sesbania grandiflora (luma)* is locally used as an excellent restorer of soil fertility. Either cut branches are planted (together with the crops in the second year of cultivation) or the seed is simply broadcast. Until World War II the 'lord of the earth' (*tana puang*) and the *raja* required every farmer to plant this legume as a fallow vegetation. *Imperata cylindrica* grass in foreground. 11.5.1976

Plate 43 Wolon Hewerbura north of Watublapi; *lamtoro* seed put into rows on top of small dikes (about 15-20 cm in height) along contour lines. 3.6.1976

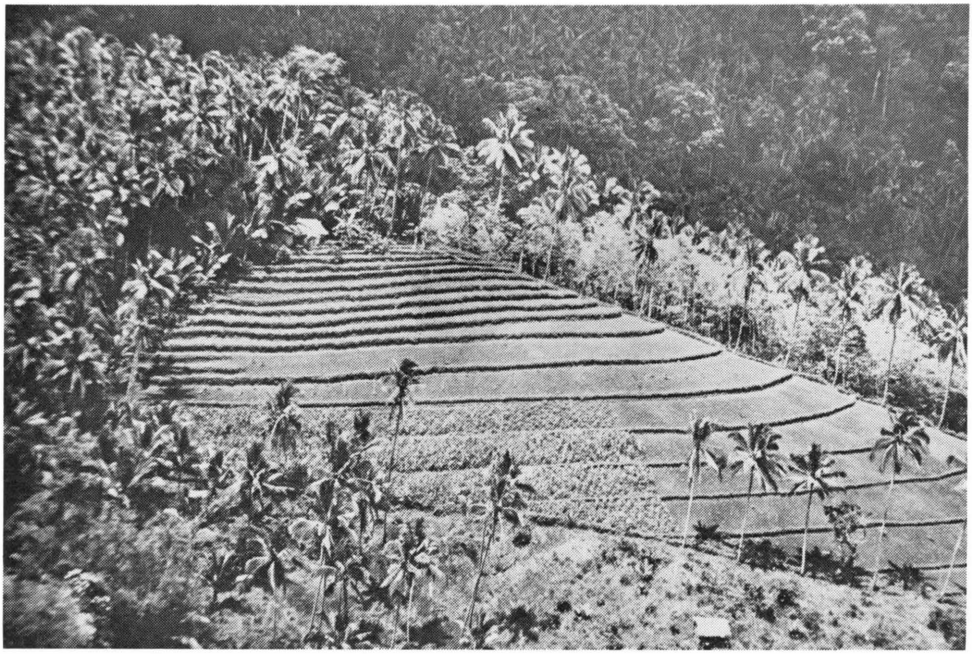

Plate 44 Wolondalo (Ds Hewotkloang), 350 m; *lamtoro* hedges spaced 6-8 m, slope gradient 50 per cent; maize and cassava planted at lower left. 6.1.1976

Plate 45 Wolon Tobong (Ds Kajowair), 450 m; *lamtoro* hedges spaced 3-4 m, slope gradient 75 per cent; maize and dry-land rice planted in between rows. 15.3.1976

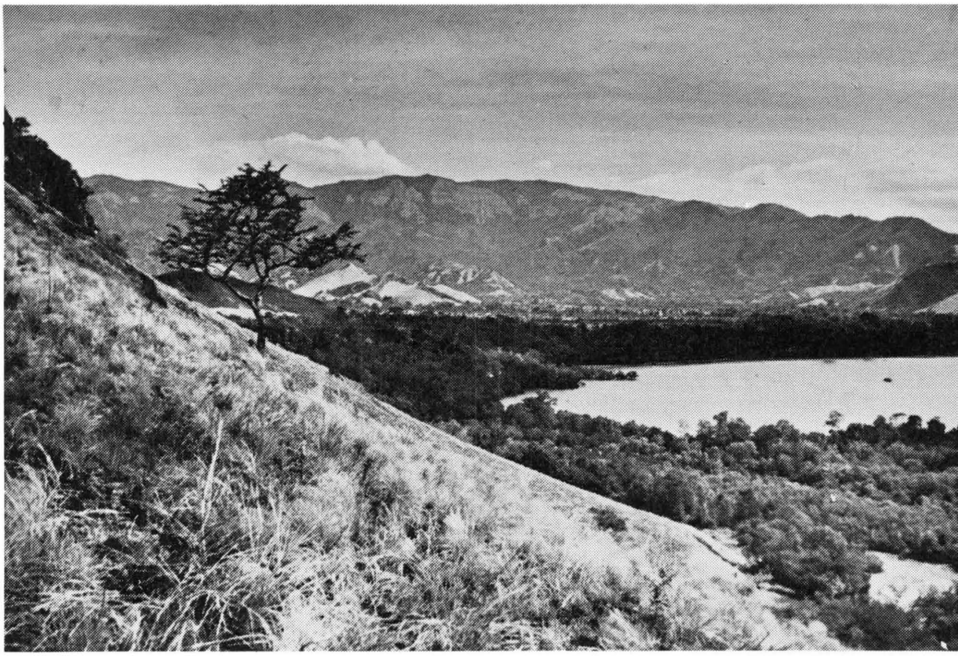

Plate 46 Plain of Magepanda, seen from Wolon Watusoka looking south, Mt Serukune (about 1000 m) in background, mangal-fringed bay; excessive *ladang* cultivation gave rise to deforestation, erosion and flooding in the plain. 4.6.1976

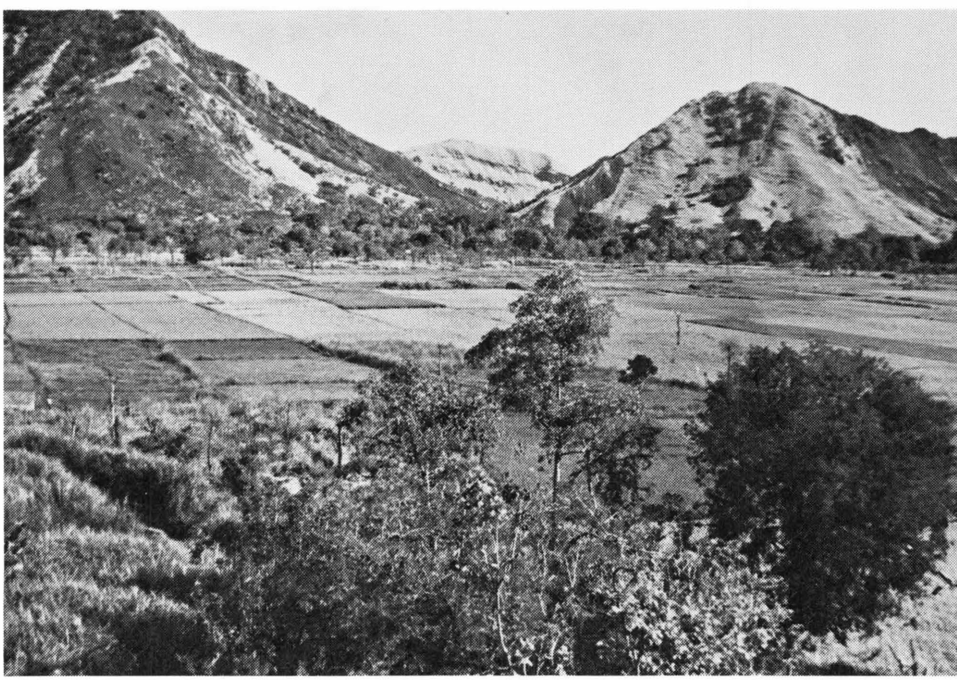

Plate 47 Plain of Magepanda, seen from Mboto Nusaloo, looking east; irrigated rice fields of Ijura and Welasegu. Grassy slopes in background are burnt annually to provide fresh grass shoots for livestock. 4.6.1976

Plate 48 Wuring, west of Maumere, settlement of Buginese and Bajau from South Sulawesi; houses on stilts. Indiscriminate *ladang* cultivation at Mt Keling visible in background and other parts of Mt Kimang-Buleng gave rise to flooding along northern littoral — e.g. at Koliaduk (see also Plate 29). 28.2.1976

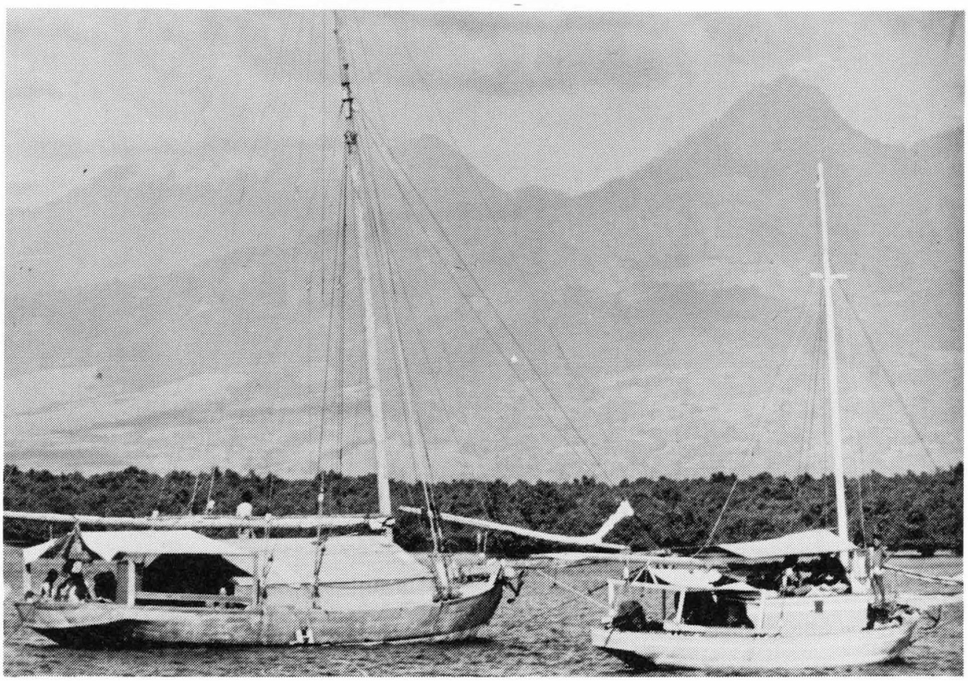

Plate 49 Buginese trading vessels (*prau*), which ply between Surabaya (Java), South Sulawesi and the Lesser Sundas, at anchor near Wuring. Volcanic cones from left to right: Mt Egong (1709 m), Mt Lau (1448 m) and Mt Mapi (1472 m); in background grass savannas (*urung rii rotang*), formerly used for hunting at lower reaches of northern flanks; mangal fringed bay in foreground. 14.4.1976

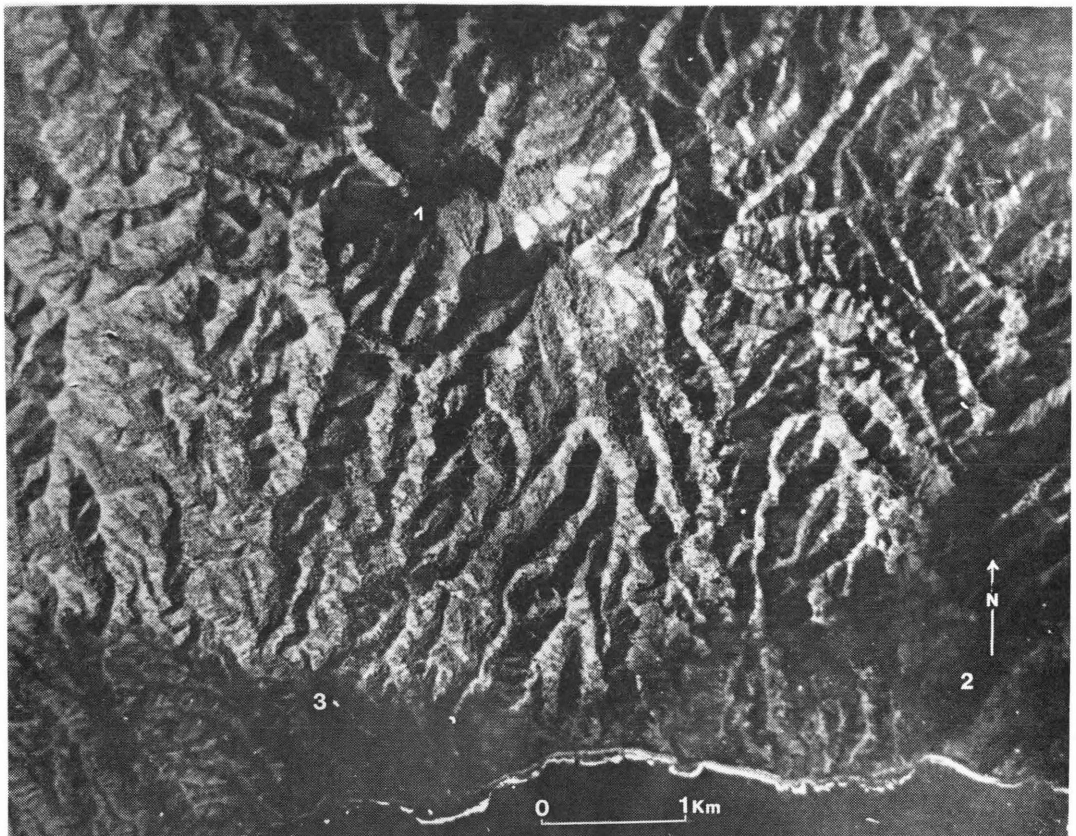

Plate 50 Central Sikka, south coast; Mt Dobo, 810 m in centre(1), river Wairgete at lower right(2), note low degree of forest cover. Seen from right (i.e. east), encompassing portions of Ds Wolokoli to Ds Kloangpopot. White roof of church of Bola (3) and Mission station at Watublapi (4) clearly visible.
Vertical aerial photograph No. 4CS-5ME22-IV-8; sun from the east; date of flight: 1945.
Produced with kind permission of late Governor El Tari of Province Nusa Tenggara Timur by letter of 10 Sept. 1976.

Plate 51 Central Sikka, south coast encompassing Ds Sikka in the west, Ds Hokor and part of Ds Wolonwalu; deeply incised andesites giving rise to knife-edged ridges (*wolong*) and V-shaped valleys (*napung*); Mt Iligai (1), Mt Jele (2), (Mt Tolawair (3) ridge forming watershed. Note almost complete absence of forest vegetation except on upper reaches of Mt Tolawair. Vertical airphoto No. 4CS-5ME 22-IV-10; sun from the east; date of flight: 1945; height unknown. Reproduced with kind permission of late Governor El Tari of Province of Nusa Tenggara Timur by letter of 10 Sept. 1976.

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<u>Aerial photographs</u> (for location see Fig. 3)

Sikka - south coast: No. 4Cs-5Me22-IV-6 to 12 approx. scale 1: 40,000, taken 1945.

Sikka - north coast: No. 4CS-5MB-13V-24 to 29.

<u>Satellite imagery</u>: ERTS-1, Code 81041012935 NOOO, Sept. 2, 1972, band 5 (Lower red spectral band 0.6 to 0.7 micrometres), altitude 909 km, US Department of the Interior, Geological Survey, EROS-Data Center, Sioux Falls, South Dakota 57198, USA.

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