AUSTRALIAN AGENCY for INTERNATIONAL DEVELOPMENT

AGRICULTURAL SYSTEMS OF PAPUA NEW GUINEA

Working Paper No. 17

NEW IRELAND PROVINCE

TEXT SUMMARIES, MAPS, CODE LISTS AND VILLAGE IDENTIFICATION

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R. Grau, P. Hobsbawn, P. Igua, R. Kameata, S. Lyon and N. Miskaram

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THE AUSTRALIAN NATIONAL UNIVERSITY

PAPUA NEW GUINEA DEPARTMENT OF AGRICULTURE AND LIVESTOCK

UNIVERSITY OF PAPUA NEW GUINEA

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Cover Photograph:
The late Gore Gabriel clearing undergrowth from a pandanus nut grove in the Sinasina area, Simbu Province (R.L. Hide).

PREFACE

Acknowledgments

The following organisations have contributed financial support to this project: The Research School of Pacific and Asian Studies, The Australian National University; The Australian Agency for International Development; the Papua New Guinea-Australia Colloquium through the International Development Program of Australian Universities and Colleges and the Papua New Guinea National Research Institute; the Papua New Guinea Department of Agriculture and Livestock; the University of Papua New Guinea; and the National Geographic Society, Washington DC.

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Technical advice and encouragement have been provided throughout the project by John McAlpine, Gael Keig and Sue Cuddy, Australian Commonwealth Scientific and Industrial Research Organization.

Support and advice have been received from Geoff Humphreys and Harold Brookfield of the Land Management Project, and Gerard Ward (formerly Director), Research School of Pacific and Asian Studies, The Australian National University. Brookfield's (1971) study of Melanesian agricultural systems has been particularly influential.

The Papua New Guinea Agricultural Systems Project was developed from two previous studies. Michael Bourke began mapping Papua New Guinea agricultural systems in the 1970s while a Senior Horticulturalist with the PNG Department of Primary Industry (Bourke 1976). Robin Hide created an annotated bibliography of information on Papua New Guinea agricultural systems while working with the CSIRO PNGRIS group (Hide and Cuddy 1988).

Participants

The following persons participated in the production of this paper:

Papua New Guinea Department of Agriculture and Livestock: R.D. Ghodake and Balthazar Wayi (co-ordination and planning).

University of Papua New Guinea: Rodney Kameata (field mapping), Norlie Miskaram (field mapping and writing)

LAES, Keravat: Will Akus (field mapping, data preparation and writing), Passingham Igua (field mapping).

Division of Primary Industry, Department of New Ireland: Gabriel Kolmau, Davidson Somau, Bais Ruchan, Mumule Rulien, Apisai Tilpis, Tamao Tarie (field mapping).

Australian National University: Bryant Allen, Michael Bourke, Robin Hide (conceptualisation, field mapping, data preparation, writing); Robin Grau (GIS management, ARC/INFO, map preparation); Daniel Fritsch (computer programming and database management); Patricia Hobsbawn, Elanna Lowes and Stephen Lyon (research assistance); Merv Commons (technical assistance).

Field survey

Prior to the main field survey in 1995, information was collected during several visits. In September 1971, village and institutional agriculture was surveyed by road between Namatanai and Kavieng for one week; between 1974 and 1981, four visits (three by foot) were made to the Lelet Plateau. In December 1984, village agriculture was surveyed by road between Kavieng and 30 km southeast of Namatanai over one week.

In June-July 1995, the whole province was surveyed over four weeks. In the first fortnight, Mussau and Emira Islands were visited by air (with the team dividing into two parties to cover both islands), and surveyed by road and by boat; Lavongai Island was surveyed by boat, and the east and west coasts of New Ireland as far south as Namatanai by road. After a change of team members, in the second fortnight the coastline south from Namatanai to Metlik was traversed by road; the islands of Anir, Tanga, Lihir, and Tabar were visited by air (the team dividing into two parties), and were surveyed by road and by boat; and Dyaul Island was visited by boat from Kavieng.

Although the main island of New Ireland is aligned roughly northwest to southeast, the two coasts are known customarily, and officially as in census division names, as the east and west coasts. This usage is followed in directional descriptions in this Working Paper.

Revised and reprinted version

The Mapping Agricultural Systems Project database was revised in late 1998 (see Introduction to Working Paper Number 1). This working paper was reprinted in 2002. Karen Lummis, Tess McCarthy, Natalie Stuckings, Laura Vallee, Amber Pares and Veerle Vlassak were responsible for the production of the revised paper.

CONTENTS

1. INTRODUCTION

The major purpose of the Papua New Guinea Agricultural Systems Project is to produce information on small holder (subsistence) agriculture at provincial and national levels. Information is collected by field observation, interviews with villagers and reference to published and unpublished documents. The information is entered into a computer database (dBase IV), from where it is transferred to a mapping program (ARC/INFO). Methods are described by Bourke et al. (1993). This paper contains a written summary of the information on the Agricultural Systems in this Province, maps of selected agricultural features, a complete listing of all information in the database in coded form, and lists of villages with National Population Census codes, indexed by Agricultural Systems. This information will eventually be available on disk as a map-linked database suitable for use on a personal computer.

Identification of agricultural systems and subsystems

An Agricultural System is identified when a set of similar agricultural crops and practices occur within a defined area. Six criteria are used to distinguish one system from another:

1. Fallow type (the vegetation which is cleared from a garden site before cultivation).

2. Fallow period (the length of time a garden site is left unused between cultivations).

3. Cultivation intensity (the number of consecutive crops planted before fallow).

4. The staple, or most important, crops.

5. Garden and crop segregation (the extent to which crops are planted in separate gardens; in separate areas within a garden; or are planted sequentially).

6. Soil fertility maintenance techniques (other than natural regrowth fallows).

Where one or more of these factors differs significantly and the differences can be mapped, then a separate system is distinguished.

Where variation occurs, but is not able to be mapped at 1:500 000 scale because the areas in which the variation occurs are too small or are widely dispersed within the larger system, a subsystem is identified. Subsystems within an Agricultural System are allocated a separate record in the database, identified by the Agricultural System number and a subsystem number.

Sago is a widespread staple food in lowland Papua New Guinea. Sago is produced from palms which are not grown in gardens. Most of the criteria above cannot be applied. In this case, systems are differentiated on the basis of the staple crops only.

Relationship to PNGRIS

The Papua New Guinea Resource Information System (PNGRIS) contains information on the natural resources of PNG (Bellamy 1986). However PNGRIS contains no information on agricultural practices, other than an assessment of land use intensity based on air photograph interpretation by Saunders (1993), and ECOPHYS which is concerned with predicted crop performance in a specific environment (Hackett 1988). The Agricultural Systems Project is designed to provide detailed information on agricultural practices and cropping patterns as part of an upgraded PNGRIS geographical information system. For this reason the Agricultural Systems database contains almost no information on the environmental settings of the systems, except for altitude and slope. The layout of the text descriptions, the database code files and the village lists are modelled on PNGRIS formats (Cuddy 1987).

The mapping of Agricultural Systems has been carried out on the same map base and scale as PNGRIS (Tactical Pilotage Charts, 1:500 000). It is also done within the areas of agricultural land use established by Saunders (1993) from aerial photography. Except where specifically noted, Agricultural Systems boundaries have been mapped without reference to PNGRIS Resource Mapping Unit (RMU) boundaries. Agricultural Systems are defined at the level of the Province (following PNGRIS) but their wider distribution is recognised in the database by cross-referencing systems which cross provincial borders.

A preliminary view of the relationships between RMUs and the Agricultural Systems in this Province can be obtained from the listing of villages by Agricultural System, where RMU numbers are appended (Section 6.3).

Note for reprinted edition

Most of the fieldwork for this project was conducted over a six year period (late 1990 to late 1996). Over this period, a number of minor inconsistencies arose in data classification and presentation. As well, some changes occurred in conventions for the text fields and in the definitions of data fields, for example, for seasonality, fencing and burning. These changes were noted in the Preface of the Provincial Working Papers (first editions) as they occurred. One of the more important changes was that the cutoff points for the classification of cash earning activities were applied more consistently. Because of these inconsistencies and changes in definitions, it was necessary to revise the database so that it was consistent for all 19 provinces and to incorporate changes in agriculture systems since the original papers were produced.

Most changes, as distinct from definitional changes, relate to cash income. The revisions were done in late 1998. The largest number of changes occurred in the first four provincial working papers: East Sepik, West Sepik, Western and Gulf Provinces. Papers for the five Island Region provinces required the least number of changes. Agricultural systems that cross provincial boundaries have been adjusted so that the information is identical on both sides of the boundary, apart from some minor differences in some of the text fields. However the notes have not been updated to incorporate new publications since the Working Papers were completed.

References

Bellamy, J. (ed) 1986 *Papua New Guinea Inventory of Natural Resources, Population Distribution and Land Use Handbook*. CSIRO Division of Water and Land Resources, Natural Resources Series No. 6, Canberra.

Bourke, R.M. 1976 Food crop farming systems used on the Gazelle Peninsula of New Britain. In K. Willson and R.M. Bourke (eds) *Proceedings of the 1975 Papua New Guinea Food Crops Conference*, Department of Primary Industry, Port Moresby, 81-100.

Bourke, R.M., R.L. Hide, B.J. Allen, R. Grau, G.S. Humphreys and H.C. Brookfield 1993 Mapping agricultural systems in Papua New Guinea. In T. Taufa and C. Bass (eds) *Population, Family Health and Development. Volume 1 of Papers from the 19th Waigani Seminar, Port Moresby, 16-22 June 1991*. University of Papua New Guinea Press, Port Moresby, 205-224.

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

Cuddy, S.M. 1987 *Papua New Guinea Inventory of Natural Resources, Population Distribution and Land Use: Code Files* Parts I-VII. CSIRO Division of Water and Land Resources, Canberra.

Hackett, C. 1988 *Matching Plants and Land: Development of a General Broadscale System from a Crop Project for Papua New Guinea*. CSIRO Division of Water and Land Resources, Natural Resources Series No. 11, Canberra.

Hide, R.L. and S.M. Cuddy 1988 *Papua New Guinea Inventory of Natural Resources, Population Distribution and Land Use: Annotated and Selected Bibliography of Smallholder Farming Systems in PNG: Part I New Guinea Mainland, New Guinea Islands.* CSIRO Division of Water and Land Resources, Canberra.

National Nutrition Survey 1982/3. Provincial Tabulations. Papua New Guinea Institution of Medical Research and Nutrition Section, National Department of Health, Goroka.

Ruthenberg, H. 1980 *Farming Systems in the Tropics.* Oxford University Press, London.

Saunders, J.C. 1993 *Agricultural Land Use of Papua New Guinea* [map with explanatory notes]. Scale 1:1 000 000. PNGRIS Publication No. 1. CSIRO, Brisbane.

Smith, T., G. Keig, J. Marks and R. Grau 1992 Summary Results by Environmental Zone from the 1982-3 National Nutrition Survey of Papua New Guinea: Implications for Future Survey Design. Papua New Guinea Institute of Medical Research, Goroka.

2. DATABASE STRUCTURE, DEFINITIONS AND CODES

Information on agricultural systems is stored in a database, one record per agricultural system (or subsystem where identified) and 108 fields per record. This section lists the field ***names*** and their database abbreviations **[NAMES]**. Summary descriptions, explanatory notes and variable codes are given for each field.

LOCATION AND IDENTIFICATION

1. Provincial Identification **[PROVINCE]:** A two digit National Population Census code. Eg. code 14 = East Sepik Province. Provincial codes are listed in Appendix A.1.

2. System Identification **[SYSTIDNO]:** A two digit number identifying the agricultural system within this province. Eg. code 01 = System 01. Numbers are not assigned to systems within a province in any particular order.

3. Agricultural System **[AGSYST]:** Systems are also identified by a unique Papua New Guinea-wide four digit number. The first two digits are the National Population Census provincial code and the second two digits are the system identification number. Eg. 1401 = System 01 in the East Sepik Province.

4. Agricultural Subsystem **[SUBSYSIDNO]:** Subsystems are identified by a single digit. When referred to in the text they are preceded by the agricultural system number and a hyphen. Eg. 1418-1 is Subsystem 1 of System 1418.

5. Number of Subsystems **[NUMSUBSYS]:** A single digit specifying the number of subsystems that occur within this System.

6. District **[DISTRICT]:** The 1990 National Population Census code for the District within which the System is located. More than one District may be listed. District codes are listed in Appendix A.2.

7. Census Divisions **[CENSUSDIV]:** The 1980 National Population Census code for the Census Divisions that occur within the System. Census Division codes for this Province are listed in Appendix A.2.

ENVIRONMENTAL

8. Lowest Altitude **[ALTLOW]:** The lowest altitude, in metres (rounded), to which the System extends.

9. Highest Altitude **[ALTHIGH]:** The highest altitude, in metres (rounded), to which the System extends.

10. Garden Slope **[SLOPE]:** The average slope of gardens in the System.

1	Flat	(<2^{o})
2	Gentle	(2-10^{o})
3	Steep	(10-25^{o})
4	Very steep	(>25^{o})
5	Multiple classes	

***11. Survey Description* [SURVDESC]:** A text description of the areas visited or not visited within the system, the length of time spent in different areas, traverses undertaken, the mode of transport used, the month and year of the survey, and the sources of any documentary information used.

***12. Summary Description* [SYSSUMM]:** A concise text description of the agricultural system, and subsystems (if any), focussed on the occurrence of the major distinguishing criteria.

***13. System Boundary Definitions* [BOUNDDEF]:** A brief description of how the boundaries between systems were identified and mapped. The boundaries between agricultural and non-agricultural land use were taken from Saunders (1993).

***14. Systems Crossing Provincial Borders* [OTHPROV]:** A logical field (yes/no) which indicates whether the System crosses a provincial border.

***15. Same System in Adjacent Province* [PROVSYS]:** A listing of AGSYST numbers (see Field 3 above) of up to two systems in adjacent provinces which are identical to this system, for systems which cross provincial borders.

***16. Subsystem Extent* [SUBSYSEXT]:** An estimate of the proportion of the area of the total system occupied by a subsystem. In the case of there being no subsystems this field is listed as 100 per cent.

1	25 per cent
2	50 per cent
3	75 per cent
4	100 per cent

***17. Type of Fallow Vegetation Cleared* [FALLTYPE]:** The predominant type of vegetation cleared from garden sites at the beginning of a new period of cultivation. Where short fallows are used (see Field 18 below), fallow type refers to the vegetation cleared after a long fallow.

1	Short grass (*eg. kunai < 1.5 m tall*)
2	Tall grass (*eg. Miscanthus or Saccharum > 1.5 m tall*)
3	Grass and woody regrowth *(dense short or tall grass and short woody regrowth*)
4	Short woody regrowth (*shrubs/trees < 10 m tall*)
5	Tall woody regrowth (*trees > 10 m tall*)
6	Forest (*no indication of previous use*)
7	No long fallow
8	Savanna *(Scattered woody growth with grass ground cover)*

***18. Use of Short Fallows* [SHORTFALL]:** A presence and significance measure which indicates whether short fallows are used. Short fallows are brief periods of less than 12 months between plantings during which land is left fallow.

***19. The Long Fallow Period* [FALLPER]:** An estimate of the length of time (greater than 12 months) land is left to revert to regrowth, before it is cultivated again. Class 0 refers to situations where very long cropping intervals (40 plantings or more) make long fallows not significant.

0	Not significant
1	1 to 4 years
2	5 to 15 years
3	Greater than 15 years

***20. Cropping Intensity* [CROPINT]:** The number of times staple crops are planted in the main gardens before those gardens are returned to a long fallow. Short fallows of less than 12 months (see Field 18 above) are excluded for this purpose: they may occur between plantings without affecting the classification. The class 'More than 40 plantings', refers to situations where land has been planted continuously without a long fallow since the Pacific War (1942-45) or longer. In such cases Field 19, Long Fallow Period, is classed as 'Long fallow period not significant'.

1	1 planting only
2	2 plantings
3	3 to 5 plantings
4	6 to 14 plantings
5	15 to 40 plantings
6	More than 40 plantings

CROP COMPONENTS

***21. The Dominant Staple Crops* [DOMSTAP]:** The most important staple food crops grown in the subsystem. A major staple is defined as a crop estimated to cover more than one-third of staple garden area, and therefore no more than 3 dominant staples may be identified for a system. An important exception occurs when sago is the staple. Sago is extracted from palms which are not cultivated in gardens. In the text accounts (System Summaries and Notes), dominant staples are described as the '*most important crops*'.

***22. The Subdominant Staple Crops* [SUBSTAP]:** Staple food crops of lesser importance grown in the subsystem. A subdominant staple is defined as a crop estimated to cover more than 10 per cent of a staple garden area; up to six crops may be listed. An important exception occurs when sago is the staple. Sago is extracted from palms which are not cultivated in gardens. In the text accounts (System Summaries and Notes), subdominant staples are described as '*important crops*'.

***23. All Staple Crops* [ALLSTAP]:** A list of up to 10 staple crops including crops classed as dominant and subdominant, as well as other staple crops which occur commonly. In the text accounts (System Summaries and Notes), staple crops which are classified as neither dominant nor subdominant are described as '*other crops*'.

01	Mixed staple (no dominant staple: a mix of some or all of: banana, taro, sweet potato Chinese taro, yam, cassava and corn)		
02	Banana *(Musa* cvs*)*	13	Taro *(Colocasia esculenta*)
03	Breadfruit *(Artocarpus altilis)*	14	Yam *(Dioscorea alata*)
04	Cassava *(Manihot esculenta)*	15	Yam *(Dioscorea esculenta*)
05	Chinese taro *(Xanthosoma sagittifolium)*	16	Yam *(Dioscorea pentaphylla*)
06	Coconut *(Cocos nucifera)*	17	Other
07	Corn *(Zea mays)*	18	Queensland arrowroot (*Canna edulis)*
08	Potato *(Solanum tuberosum)*		
09	Sago *(Metroxylon sagu)*	19	Taro (Amorphophallus) *(Amorphophallus paeoniifolius)*
10	Swamp taro *(Cyrtosperma chamissonis)*	20	Yam *(Dioscorea bulbifera)*
11	Sweet potato *(Ipomoea batatas)*	21	Yam *(Dioscorea nummularia)*
12	Taro *(Alocasia macrorrhiza*)		

***24. Other Vegetable Crops* [VEG]:** A list of up to 10 important vegetable crops:

01 Aibika *(Abelmoschus manihot)*
02 Amaranthus *(Amaranthus* spp.*)*
03 Bean, common *(Phaseolus vulgaris)*
04 Bean, lablab *(Lablab purpureus)*
05 Bean, winged *(Psophocarpus tetragonolobus)*
06 Cabbage *(Brassica oleracea var. capitata)*
07 Chinese cabbage *(Brassica chinensis)*
08 Choko tips *(Sechium edule)*
09 Corn *(Zea mays)*
10 Cucumber *(Cucumis sativus)*
11 Ferns
12 Ginger *(Zingiber officinale)*
13 Highland pitpit *(Setaria palmifolia)*
14 Kangkong *(Ipomoea aquatica)*
15 Kumu musong *(Ficus copiosa)*
16 Lowland pitpit *(Saccharum edule)*
17 Nasturtium *(Nasturtium* spp.*)*
18 Oenanthe *(Oenanthe javanica)*
19 Peanuts *(Arachis hypogaea)*
20 Pumpkin fruit *(Cucurbita moschata)*
21 Pumpkin tips *(Cucurbita moschata)*
22 Rungia *(Rungia klossii)*
23 Tulip *(Gnetum gnemon)*
24 Valangur *(Polyscias* spp.*)*
25 Balbal *(Erythrina variegata)*
26 Bamboo shoots
27 Bean, snake *(Vigna unguiculata)*
28 Spring onion *(Allium cepa var. cepa)*
29 Sweet potato leaves *(Ipomoea batatas)*
30 Taro leaves *(Colocasia esculenta)*
31 Watercress *(Nasturtium officinale)*
32 Other
33 Bean, lima *(Phaseolus lunatus)*
34 Bottle gourd *(Lagenaria siceraria)*
35 Dicliptera *(Dicliptera papuana)*
36 Kalava *(Ormocarpum orientale)*
37 Karakap *(Solanum nodiflorum)*
38 Basil *(Ocimum basilicum)*
39 Bean leaves *(Phaseolus* spp.)
40 Cassava leaves *(Manihot esculenta)*
41 Chilli leaves *(Capsicum frutescens)*
42 Eggplant *(Solanum melongena)*
43 Pigeon pea *(Cajanus cajan)*
44 Tomato *(Lycopersicon esculentum)*

***25. Fruit Crops* [FRUIT]:** A list of up to 8 important fruits grown:

01 Avocado (*Persea americana)*
02 Banana *(Musa* cvs*)*
03 Bukabuk (*Burckella obovata)*
04 Coastal pandanus *(Pandanus tectorius)*
05 Malay apple *(Syzygium malaccense)*
06 Mandarin *(Citrus reticulata)*
07 Mango *(Mangifera indica)*
08 Marita pandanus *(Pandanus conoideus)*
09 Orange (*Citrus sinensis)*
10 Passionfruit, banana *(Passiflora mollissima)*
11 Passionfruit, other *(Passiflora* spp.*)*
12 Pawpaw *(Carica papaya)*
13 Pineapple *(Ananas comosus)*
14 Rambutan *(Nephelium lappaceum)*
15 Sugar *(Saccharum officinarum)*
16 Ton *(Pometia pinnata)*
17 Watermelon *(Citrullus lanatus)*
18 Other
19 Custard apple *(Annona squamosa)*
20 Golden apple *(Spondias cytherea)*
21 Granadilla (*Passiflora quadrangularis)*
22 Grapefruit (*Citrus paradisi)*
23 Guava (*Psidium guajava)*
24 Lemon (*Citrus limon)*
25 Lime *(Citrus aurantifolia)*
26 Parartocarpus *(Parartocarpus venenosa)*
27 Pomelo *(Citrus maxima)*
28 Pouteria *(Pouteria maclayana)*
29 Raspberry *(Rubus* spp.)
30 Soursop *(Annona muricata)*
31 Tree tomato *(Cyphomandra betacea)*
32 Watery rose apple *(Syzygium aqueum)*
33 Governor's plum *(Flacourtia indica)*
34 Lovi-lovi *(Flacourtia inermis)*
35 Mon *(Dracontomelon dao)*
36 Rukam *(Flacourtia rukam)*
37 Ficus *(Ficus* spp.)

***26. Nut Crops* [NUT]:** A list of up to 5 important nuts grown or collected:

01	Breadfruit *(Artocarpus altilis)*	09	Karuka, wild *(Pandanus brosimos)*
02	Candle nut *(Aleurites moluccana)*	10	Okari *(T. kaernbachii/ T. impediens*)
03	Castanopsis *(Castanopsis acuminatissima)*	11	Sis *(Pangium edule)*
		12	Pao *(Barringtonia* spp.)
04	Coconut *(Cocos nucifera)*	13	Tulip *(Gnetum gnemon)*
05	Finschia *(Finschia chloroxantha)*	14	Other
06	Galip *(Canarium indicum*)	15	Polynesian chestnut *(Inocarpus fagifer)*
07	Java almond *(Terminalia catappa*)		
08	Karuka, planted *(Pandanus julianettii)*	16	Cycad *(Cycas* spp.)
		17	Entada *(Entada scandens)*
		18	Dausia *(Terminalia megalocarpa)*

***27. Narcotic Crops* [NARC]:** A list of up to 5 important narcotics grown:

1	Betel nut, highland *(Areca macrocalyx)*
2	Betel nut, lowland *(Areca catechu)*
3	Betel pepper, highland (*Piper gibbilimbum*)
4	Betel pepper, lowland *(Piper betle)*
5	Tobacco *(Nicotiana tabacum)*
6	Kava *(Piper methysticum)*

FORMS OF GARDEN AND CROP SEGREGATION

***28. Garden Segregation* [GARDSEG]:** A presence and significance measure of whether individual staple food crops are planted in different gardens. A garden is a contiguous area of land planted with crops under the management of a social unit such as a family or a household. If some gardens are sited in different vegetation zones, and have different fallow periods, cultivation periods or other agronomic characteristics, then they are assigned to a separate subsystem.

All presence and significance measures are coded as follows:

0	None
1	Minor or insignificant
2	Significant
3	Very significant

***29. Crop Segregation* [CROPSEG]:** A presence and significance measure of whether individual staple food crops are planted separately in different parts of the same garden.

***30. Crop Sequences* [CROPSEQU]**: A presence and significance measure of whether the harvesting of one crop species is usually followed by the planting of another, eg. yams followed by sweet potato, or sweet potato followed by peanuts followed by sweet potato (see also Field 33 below).

***31. Mixed Vegetable Gardens* [MIXGARD]:** A presence and significance measure of whether mixed gardens are used. A mixed garden is typically a garden which is subsidiary to that containing the main staple(s). It is planted with a wide range of either subdominant staples and/or other vegetables. It may or may not be distinguished from the main garden types by different fallow and agronomic techniques.

***32. Household Gardens* [HOUSGARD]:** A presence and significance measure of whether house gardens are used. A house garden is typically a garden that is small relative to the main gardens, is located near houses, and which contains a variety of crops. Also known as door yard or kitchen gardens.

SOIL FERTILITY MAINTENANCE TECHNIQUES

33. Legume Rotation **[LEGUMROT]:** A presence and significance measure of whether a leguminous crop (eg. peanuts or winged bean) is grown between plantings of main food crops.

34. Planted Tree Fallow **[TREEFALL]:** A presence and significance measure of whether tree species (eg. *Casuarina oligodon* or *Parasponia* spp.) are planted into gardens or fallows for the stated purpose of improving soil quality during subsequent cultivations. This measure excludes the practice of planting fruit tree species into gardens and fallows, but does not exclude the planted trees being used for timber or firewood.

35. The Use of Compost **[COMPOST]:** A presence and significance measure of whether organic matter is placed beneath the surface of the soil.

36. The Use of Animal Manure **[MANURE]:** A presence and significance measure of whether animal manure is placed on or in the soil. The measure does not include the deposition of manure by the animals themselves, eg. pigs tethered in gardens.

37. The Use of Island Beds: **[ISLBED]:** A presence and significance measure of whether island beds are used. Island beds are beds of soil on which crops are planted and which are raised above the level of a surrounding area of standing or slowly moving water.

38. The Contribution of Silt from Flooding **[SILT]:** A presence and significance measure of whether silt from floods is deposited either regularly or sporadically on the soil surface in gardens. It is assumed the flooding is of natural causes, but the measure does not exclude deliberate manipulation of stream channels in order to enhance the delivery of silt or for the partial control of flood waters.

39. The Use of Inorganic Fertiliser **[FERT]:** A presence and significance measure of whether inorganic fertiliser is applied to gardens. This measure excludes the use of inorganic fertiliser on cash crops, such as coffee or vegetables.

OTHER AGRICULTURAL PRACTICES

40. The Placing of Pigs in Gardens **[PIGSIN]:** A presence and significance measure of whether pigs are placed in gardens between plantings. Pigs may be placed in gardens between plantings for a number of stated reasons, eg. to eat earthworms, to eat unharvested crops, or to till the soil. This measure excludes the deliberate breaking of fences to allow pigs to forage after the cropping phase.

41. Burning **[BURN]:** A presence and significance measure of whether fallow vegetation cleared and cut in a new garden site is burnt before the planting of the staple crops. The measure includes the burning of material which has been heaped. Significance takes into account the frequency of burning relative to the cropping intensity. So, for example, if the majority of the fallow material cleared from the site is burnt at the initial clearing of a garden, and only one or two plantings are made before fallowing, burning is Very Significant. If the same thing occurs at clearing, but a large number of plantings are made before the next long fallow, with little or no burning between plantings, burning is Minor.

***42. Soil Tillage* [TILL]:** A presence and significance measure of whether soil in the staple food gardens is tilled before planting. Tillage includes the breaking up, or turning over, of the whole or the major part of the soil on the garden surface. The measure includes tillage in either the first planting and/or subsequent plantings. The formation of soil mounds and beds (see Fields 53-58 below) involves working the soil into a tilth, but in order to distinguish clearly between these processes, mounds and beds are not automatically classified as soil tillage.

***43. The Use of Deep Holing* [HOLE]:** A presence and significance measure of whether deep holing is used. Deep holing is sometimes used in yam cultivation in order to influence the dimensions and shape of the tubers. Deep (> 50 cm) holes are dug, the soil is broken into a fine tilth and the hole re-filled before planting. The use of this technique is usually restricted to the cultivation of *Dioscorea alata.*

***44. Cutting Fallow Vegetation Onto the Crops* [FALLCUT]:** A presence and significance measure of whether crops are planted beneath standing fallow vegetation, and the vegetation is later cut down onto the growing crops.

***45. The Use of Fences* [FENCE]:** A presence and significance measure of whether gardens are fenced. Fences are linear barriers made of wood, bamboo, cane grass or stones, and may incorporate a ditch or a bank. The measure excludes low ridges which form between fields when stones are thrown to the perimeter during cultivation. In the assessment of the significance of fences, the occurrence of fences around every individual garden is given greater significance than one fence around a large number of gardens.

***46. The Use of Irrigation* [IRRIG]:** A presence and significance measure of whether water is applied to crops by the use of channels or aqueducts.

***47. The Use of Mulch* [MULCH]:** A presence and significance measure of whether a mulch is used to cultivate the staple crops. A mulch is organic material which is applied to the soil surface. If the material is placed beneath the soil surface it is defined as a compost (see Field 35 above).

***48. The Seasonality of Main Crops* [SEASMAJ]:** A presence and significance measure of whether the dominant staples (most important food crops) and the subdominant staples (important food crops) are planted at about the same time each year.

***49. The Seasonality of Other Crops* [SEASMIN]:** A presence and significance measure of whether other staple crops and vegetable crops are planted at about the same time each year.

***50. The Use of Drains* [DRAIN]:** A presence and significance measure of whether ditches are used in and around gardens to remove surface water or to lower the groundwater table.

***51. The Use of Soil Retention Barriers* [SOILRET]:** A presence and significance measure of whether structures (pegged logs, fences or hurdles, stone walls) are constructed along the contour or below individual plants, in order to prevent or reduce the down slope movement of soil.

***52. The Use of Staking* [STAKE]:** A presence and significance measure of whether crops are trained or tied up stakes, trellises or standing dead trees to lift them off the soil surface. The practice is usually applied to yams (*Dioscorea* spp.), beans, sugarcane, and sometimes gourds, cucumber and choko.

MOUNDING TECHNIQUES

In many parts of Papua New Guinea the soil is formed into circular mounds of varying dimensions and crops are planted on them. Mounding should not be confused with composting (see Field 35 above). Mounds may or may not contain compost and composting may take place in the absence of mounds. Mounds are usually re-formed at each new planting. Mound formation usually involves extensive soil disturbance. The effect can be similar to complete soil tillage (see Field 42 above).

The following fields contain presence and significance measures of whether mounds of the specified dimensions are used in the system.

53. Very Small Mounds **[VSMMOUND]:** Mounds up to 10 cm high.

54. Small Mounds **[SMMOUND]:** Mounds 10 to 40 cm high.

55. Medium Sized Mounds **[MOUND]:** Mounds 40-70 cm high and between 1 m and 2.5 m in diameter.

56. Large Mounds **[LRGEMOUND]:** Mounds > 70 cm high and > 2.5 m in diameter.

GARDEN BED TECHNIQUES

In some locations the soil is also raised into beds and crops planted on them. Bed formation usually involves extensive soil disturbance. The effect can be similar to complete soil tillage (see Field 42 above). Two shapes of beds are distinguishable:

57. Square Beds **[BEDSQ]:** Square beds are constructed by digging shallow ditches typically 2 to 4 metres apart on a grid layout, and throwing the soil removed onto the surface to form a bed. The outcome is a characteristic chequerboard or gridiron pattern in gardens.

58. Long Beds **[BEDLONG]:** Long beds are constructed by digging shallow ditches down slope typically 2 to 4 metres apart and over 10 metres in length, and throwing the soil removed to the centre to form a bed.

59. Mechanical Soil Tillage **[MECHAN]:** The use of tractors or hand-held cultivators in the preparation of a garden site for food crops. The measure includes the use of machinery in the cultivation of crops for sale.

CASH EARNING ACTIVITIES

A presence and significance measure of the importance of the following common rural cash income sources. The list includes sources related to agricultural or land based production from the farmers' own resources.

60. Animal Products **[ANSKIN]:** The sale of animal skins, furs and bird plumes, but not fresh meat.

61. Betel Nut **[BETEL]:** The sale of betel nuts (*Areca catechu* or *A. macrocalyx)* and associated items like pepper and lime.

62. Cardamom **[CARDAM]:** The sale of cardamom (*Elettaria cardamomum).*

63. Cattle **[CATTLE]:** The sale of cattle as live beasts or as fresh meat.

***64. Chillies* [CHILLIE]:** The sale of dried chillies (*Capsicum frutescens).*

***65. Cocoa* [COCOA]:** The sale of cocoa (*Theobroma cacao)* beans.

***66. Copra* [CNUT]:** The sale of copra and nuts from coconut palms (*Cocos nucifera).*

***67. Arabica Coffee* [COFFARAB]:** The sale of Arabica coffee (*Coffea arabica*).

***68. Robusta Coffee* [COFFROB]:** The sale of Robusta coffee (*Coffea canephora*).

***69. Crocodile Products* [CROC]:** The sale of freshwater and saltwater crocodile (*Crocodylus* spp.) skins or meat, from managed and wild animals.

***70. Firewood* [FIREWOOD]:** The sale of firewood.

***71. Fish* [FISH]:** The sale of fresh or smoked freshwater or saltwater fish, shellfish or crustacea.

***72. Fresh Food:* [FOOD]:** The sale of fresh vegetables, fruits, nuts and fresh or smoked meat from domesticated or wild animals.

***73. Oil Palm* [OILPALM]:** The sale of palm oil fruit (*Elaeis guineensis).*

***74. Potato* [POTATO]:** The sale of Irish potatoes (*Solanum tuberosum).*

***75. Pyrethrum* [PYRETH]:** The sale of dried pyrethrum flowers (*Chrysanthemum cinerariaefolium).*

***76. Rice* [RICE]:** The sale of rice (*Oryza sativa).*

***77. Rubber* [RUBB]**: The sale of latex from rubber trees (*Hevea brasiliensis).*

***78. Sheep and Wool* [SHEEP]:** The sale of sheep as live animals, or meat and the sale of wool.

***79. Tea* [TEA]:** The sale of unprocessed tea (*Camellia sinensis).*

***80. Tobacco* [TOBACCO]:** The sale of the dried tobacco leaf (*Nicotiana tabacum).*

***81-82. Other* [OTHER1] [OTHER2]:** Other unlisted sources of cash include the sale of copal gum (*Agathis* sp.), massoi bark (*Massoia aromatica*), tigasso oil (*Campnosperma* sp.), salt extracted from plants or natural springs and deposits, mineral oil, bêche-de-mer, insects and butterflies, live birds, marsupials, pigs and horses, house building materials including thatching and sheets of woven cane, canoe hulls, clothing, weapons, string bags, carvings and artefacts. This category excludes other sources of cash income such as wages and salaries, logging or mining royalties, gold mining, banditry, gambling and remittances. These are mentioned in Notes (Field 83) if they are important.

***83. Further Notes* [NOTES]:** Additional notes on particularly outstanding features of the system and further information drawn from published and unpublished documents.

SURVEY DETAILS

Fields ***84-101*** contain details of dates when observations were made of the system for the purposes of this project and the names of the persons who made the observations. Up to three survey visits can be accommodated. The field names are:

Month of a short visit [**SVDATMON**]: Eg. 01 = January.
Year of a short visit [**SVDATYR**]: Eg. 1992.
Period of a longer term study [**SVPERYRA**]: Eg. 1971-72.
Person making the visit [**SURVNAME**]: Initials of person(s). Full names are given in a Key on the relevant page in Section 5.

The type of survey [**SURVTYPE**]

1	Very brief visit to one place (less than an hour), or interviews
2	Short visit to a few places (less than 1 day)
3	Visits to several places (1 to 3 days)
4	Multiple visits to many places (4 to 15 days)
5	Multiple visits to many locations over several years (more than 15 days)

102. Information From the National Nutrition Survey 1982-83 **[NNS]:** The National Nutrition Survey 1982/83, selected families in villages across most of the country from a sampling frame based on environments drawn from PNGRIS classifications. Amongst other questions, people were asked what foods they had eaten during the previous day (NNS 1982/3). For systems in which more than 10 families were interviewed, responses for particular foods are presented as percentages of the total number of families interviewed. Results are presented only for staple foods, fresh fish and purchased rice. The entry includes the number of families and number of villages surveyed, and the month and year of survey.

This information is more than 10 years old and is independent of the information collected by the Agricultural Systems Project. It should be used carefully (Smith et al. 1992). In some Systems the sample size is small and villages sampled may be restricted to one part of the System. It is possible that Chinese taro (*Xanthosoma sagittifolium*) has been included in the general term 'taro', increasing the importance of taro (*Colocasia esculenta*) and decreasing the importance of Chinese taro. Where diets change seasonally, the results may also be unrepresentative.

103. Main References **[REF]:** References to published and unpublished documents that contain substantial information on agriculture in the System.

104. Other References **[REF2]:** References to published and unpublished documents that contain additional information directly relevant to the Agricultural System.

105. The Area of the System **[AREA]**: The area, in square kilometres, occupied by the System. The figure is calculated by the mapping program ARC/INFO.

106. Total Resident Population 1980 **[TOTPOP]:** The total population resident within the area covered by the System at the time of the 1980 National Population Census. The 1990 National Population Census figures are not used because of questions over their reliability, but the 1990 National Population Census maps are used to locate most Census Units.

***107. The Number of People Living Outside the System* [ABSPOPPER]:** An estimate of the proportion of the population absent from villages in the system in 1978-79, expressed as a percentage of the total population. The figure is the difference between the 'total' population and the 'resident' population listed in the 1978-79 Provincial Data System (PDS) Rural Community Register for the Province. The 'total' population is the total number of persons listed in the Village Book and the 'resident' population the number living in the village, or who have been absent for less than 6 months at the time of the census. In some cases 'total' and 'resident' populations in the PDS are the same.

***108. The Population Density* [POPDEN]:** The number of persons per square kilometre in 1980, calculated by dividing Field 106 (total population) by Field 105 (area). There are two situations where adjusted figures are given (indicated by "*"). In some systems sago is the staple food and there is little or no agriculture or subsistence is based completely on non-agricultural activities (eg. fishing or trading) and no agricultural land use can be identified. For these systems the area has been adjusted to include a 5 kilometre buffer strip around the system boundary, or centred on settlements where no land use is identified. The 5 kilometre buffer zone is assumed to be the area of non-agricultural land, usually forest, in which wild plants and animals are exploited. In the latter case, settlements are identified with point symbols. The second kind of adjustment occurs where the populations of two adjoining systems, both of which use both systems, are unequally distributed in the two system areas due to the locations of the census units. In such cases, adjusted population density figures are shown (for example, Milne Bay Province Systems 0501 and 0502), with explanations in Notes (Field 83).

***109. The Intensity of Land Use* [RVALUE]:** The R value (Ruthenberg 1980, 15) is an estimate of the intensity of land use, derived from the ratio of the Cropping Period in years to the length of the cultivation cycle in years. Cropping Period is estimated from the number of plantings of the staple crops before a long fallow (see Field 20 above). The cultivation cycle is the sum of the Cropping Period and the Long Fallow Period (see Field 19 above). The R value is thus:

$$\frac{\text{Cropping Period} \times 100}{\text{Cropping Period} + \text{Long Fallow Period}}$$

Because in this survey both the cropping period and the long fallow period are described as classes, conversion of the class ranges to single year values is necessary in order to calculate R values. The following conversions are used for most crops:

Cropping period	Years	Long fallow period	Years
1 planting only	1	Not used	0
2 plantings	2	1-4 years	3
3-5 plantings	4	5-15 years	10
6-14 plantings	10	>15 years	20
>14 plantings	20		

Triploid banana or Chinese taro may produce for several years from a single planting. In systems in which these crops are dominant staples or subdominant staples with significant land use, the cropping period is adjusted upwards. The adjustment is based on estimates of how long these crops produce from a single planting before a long fallow. Where there is evidence of a cropping period without a long fallow of longer than 20 years, the cropping period is adjusted upwards, to a maximum of 50 years.

3. AGRICULTURAL SYSTEMS: TEXT SUMMARIES

Text summaries take two forms: those for the first or only subsystem in an Agricultural System, and those for subsequent subsystems.

1. The headers on text summaries for the first or only subsystem in an Agricultural System are as follows:

PROVINCE 15 West Sepik	**AGRICULTURAL SYSTEM No**. 1	**Subsystem No** 1 **of** 1
Districts 4 Telefomin	**Subsystem Extent** 100%	**Area (sq km)** 1259
Population 8,530	**Population Density** 7 **persons/sq km**	**Population absent** 7%

This header contains information in the top right hand corner on the number of subsystems descriptions which follow.

This header also contains information for the *whole* Agricultural System on Districts, area, population, population density and absenteeism.

2. Headers on text summaries of subsequent subsystems are as follows:

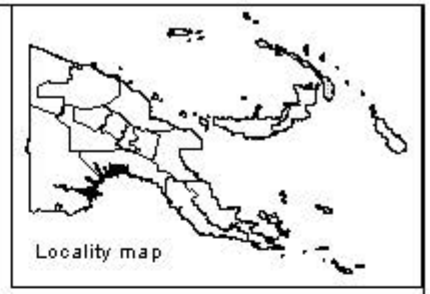
PROVINCE 15 West Sepik	**AGRICULTURAL SYSTEM No**. 3	**Subsystem No** 2 **of** 2
Districts 4 Telefomin	**Subsystem Extent** 25 %	

They contain information on Districts and subsystem extent only.

Headers on second and subsequent pages of summaries are as follows:

PROVINCE 15 West Sepik	**AGRICULTURAL SYSTEM No**. 1	**Subsystem No** 1 **of** 1

NEW IRELAND PROVINCE
Agricultural systems



Lavongai (New Hanover) I
Taskul
Kavieng
Tingwon I
Tabar I
Dyaul I
Konos
Uhlir I
Poziaka
Tanga Is
Kamatanai
Saint Matthias Group
Emira I
Mussau I
Tench I
Anir (Feni) I

30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 1	**Subsystem No.** 1 **of** 1
Districts 1 Palakau	**Subsystem Extent** 100 %	**Area (sq km)** 380
Population 2,687	**Population density** 7 **persons/sq km**	**Population absent** 31 **%**

System Summary

Located on the islands of the St Matthias group (Mussau, Eloaua, Emananus, Emira and Tench). Fallow vegetation is short woody regrowth, typically 3-7 years old, though there is also some use of older, tall woody regrowth. Vegetation is cut, dried and burnt. All gardens are fenced on Mussau. Taro and sweet potato are the most important crops; cassava and coconut are important crops; other crops are banana, Chinese taro, Alocasia taro, swamp taro and sago. Taro is grown in separate gardens from other root crops. Single plantings of either taro or sweet potato before a fallow are usual, but both crops are sometimes followed by a planting of cassava. Sweet potato is planted in very small mounds. Fruit and nut tree crops are important. Fish is generally an important food.

Extends across provincial border to System(s) None

Altitude range (m) 0-200 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato, Taro (Colocasia)
STAPLES SUBDOMINANT	Cassava, Coconut
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Swamp taro, Sweet potato, Taro (Alocasia), Taro (Colocasia)
OTHER VEGETABLES	Aibika, Amaranthus spp., Corn, Ferns, Kumu musong, Pumpkin tips, Bean (snake), Spring onion, Taro leaves
FRUITS	Bukabuk, Coastal pandanus, Pawpaw, Sugarcane, Ton, Golden apple, Lemon, Watery rose apple
NUTS	Breadfruit, Galip, Java almond, Pao, Polynesian chestnut
NARCOTICS	None

FALLOW & CROPPING PERIOD

FALLOW TYPE	Short woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	1 planting
R VALUE	9 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Very significant
CROP SEGREGATION	Minor
CROP SEQUENCES	Minor
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	None

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Coconuts	Significant
2 Fish	Minor
3 Fresh food	Minor
4 Rubber	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	Very significant
SMALL MOUNDS	None
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	Very significant
STAKING OF CROPS	None
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	None

OTHER DOCUMENTATION

Survey description

In June 1995, vehicle traverses on Mussau Island from Epo station to Tavol village on the east coast, and to Tanaliu village on the northwest coast, with a visit by dinghy to Tangatunata village on Eloaua Island (2 days); on Emira Island, a vehicle traverse from the airstrip to Eleleua, Tasingina, Buliale, Tavilu, Pakane and Lounusa villages (1 day, 1 team member). The small island of Tench (or Enus), 70 km east of Emira, was not visited but information was obtained by interviews on Mussau Island, and from Parkinson (1907) and Nevermann (1933).

Boundary definition

The islands of the St Matthias group were allocated to a separate system after they had been visited, and after Lavongai Island and its surrounding islands (Systems 1702, 1703, 1704 and 1705) had been surveyed.

Notes

This system is distinguished from System 1703, the major system on Lavongai Island to the southeast, where sago and sweet potato are the most important crops, the fallow period is longer, the fallow vegetation is generally taller and there are usually two plantings before fallow. It is also different from System 1704 in inland Lavongai where cassava and sweet potato are the most important crops, and fallow periods are longer. It is more similar to System 1702, located on the small islands offshore from Lavongai, but there cassava replaces taro as a dominant staple, and there are two plantings before fallow.

The system includes: two major islands, Mussau and Emira (sometimes spelt Emirau), with 87 and 9 per cent respectively of the area, and with 86 and 12 per cent respectively of the population; four small raised coral islands close to the south coast of Mussau (4 per cent of the area, 11 per cent of the population); and Tench, the tiny isolated island (2 per cent of the population on only a few hectares), 70 km to the east of Emira. Some variation in agriculture between these islands is described below.

Historically, agriculture on the islands of the St Matthias group was briefly described in about 1900 by Parkinson (1907), in 1908 by Nevermann (1933), and in 1925 by Chinnery (1925). In recent years, besides a very brief account (Croyden 1981), there is a detailed ethnobotanical study of arboriculture on the small raised coral island of Eloaua in the late 1980s (Lepofsky 1992). Lepofsky's work followed up the discovery of large quantities of prehistoric seed in archaeological sites (Kirch 1988; 1989).

Prehistoric research on the islands of Eloaua and, to a lesser extent, Mussau has shown human occupation some 3500 years ago (Egloff 1975, Kirch 1988, 1989, 1990; Kirch et al. 1991). Large amounts of fish and marine turtle bone indicated a substantial use of marine resources with little change over the period (Kirch 1988, 334-337; Kirch et al. 1991, 155). A change in overseas economic links was suggested by a shift in the sources of obsidian: while the earliest obsidian came equally from both Talasea in West New Britain Province and Lou Island in Manus Province, most later material came only from Lou (Kirch 1990, 124). Long distance links with Manus still existed on an irregular basis in 1900 (Parkinson 1907). There was little pig bone in the early prehistoric period, but it became common subsequently, possibly marking a shift from long distance trade to an increasing emphasis on internal production and exchange (Kirch 1990, 129; Kirch et al. 1991, 154).

Although sago was mentioned as the staple for Mussau-Emira in the early German Reports (Sack and Clark 1979, 187), by 1900 taro and bananas were described as the main crops in Mussau gardens, with breadfruit an important tree crop (Parkinson 1907). Coconuts appeared relatively scarce; fishing was very important. Parkinson suggested that there was better food on Emira Island. In 1908, the main foods were described by Nevermann (1933, 32, 83-85, 93-6) as taro, taro leaves, banana, coconut, and such nuts and fruits as ton, Polynesian chestnut, Pangium, Terminalia sp., bukabuk, golden apple, pao and Pandanus species. Cassava had already been introduced in a small way on both Mussau and Emira, but sweet potato was not recorded. The 1908 expedition apparently only visited the eastern coast of Mussau (Enu and Roitan villages), and did not see either sago or swamp taro; on Emira, there was said to be only a small sago swamp in the middle of the small island of Eanusau just off the west coast (Nevermann 1933, 84, 94-5).

In 1925, on Mussau, Chinnery (1925, 203, 205) distinguished between large leafed taro (presumably Alocasia, on the evidence of a photograph), which was grown on lowland areas on which trees had been killed but not removed, and small leafed taro (Colocasia), which was grown on cleared ground. On Emira, taro was said not to grow well and Chinnery (1925, 139) reported banana, sweet potato, cassava and large leafed taro (presumably Alocasia) as the main crops. Previously, woven garments had been made on Emira and traded to Mussau for taro, pigs and betel nut

Notes continued

(Chinnery 1925, 201). In the early 1940s, the main crops of Emira were reported as sweet potato, banana and coconut, with yam and taro secondary, and some sago 'available' (Allied Geographical Section 1943, 8). However, food security was said to be poor, with people buying rice during droughts. By the 1980s, Croyden (1981, 6) reported sweet potato as the main crop on Mussau, while Kirch (1988, 334), after initially describing taro and yams as the main crops, later added cassava (Kirch 1989, 226; see also Lepofsky 1989, 229).

In 1995, large gardens of several hectares with taro as a monocrop, were a major feature on Mussau. On Emira Island in 1995, taro was of much less importance than on Mussau. Sweet potato, followed by cassava and Chinese taro were the main crops. On Mussau, Chinnery's 1925 distinction between gardens with felled and unfelled trees can still be observed (with the killed, unfelled trees giving some gardens a very distinctive appearance, especially marked on Eloaua Island), but it is no longer correlated with a crop difference. In 1995, villagers said the standing short trees provided shade for the taro crop. The decline in the importance of taro, and the increased importance of sweet potato and cassava, is linked by villagers to the vulnerability of taro to disease (blight) and insects (bugs, caterpillars). The greater importance of cassava than taro in late 1982 recorded by the National Nutrition Survey (see below), could either have been a very short term effect of the 1982 drought, or the result of a longer term decline in taro, which, on the evidence of 1995, may have been partially reversed. Considerable plantings of swamp taro were seen on Mussau at the west coast village of Lavorang, located just inland from the coastal settlement area. Sago was also observed on the west coast.

Parkinson (1907) briefly visited the small eastern island of Tench, where he saw no evidence of significant gardens, and described fish as the main staple of the population of some 150 people. He saw only a few very small taro tubers, noted food storage houses on piles to evade the large numbers of rats, and noted pandanus and Polynesian chestnut trees as important crops. There were only a few coconuts with very small nuts. On the basis of unstained teeth, he thought there was no betel nut. A similar account was given after a visit in 1908, except that more coconuts, some swamp taro and no bananas were reported (Nevermann 1933, 32, 96, 98). By the 1990 National Population Census, the Tench population numbered 64. According to information obtained on Mussau in 1995, fish is still the staple on Tench Island, with triploid banana grown among coconuts, and fruit and nut crops (pao, Polynesian chestnut, Java almond) important. Both swamp taro and Alocasia taro are said to be grown, but gardens are said to be minimal with little or no sweet potato or cassava. Copra is produced, but transport costs are excessive. There are no pigs.

The low population density of 7 persons/sq km calculated for the system as a whole is deceptive. Land use on the high island of Mussau is not of equal intensity over the whole island: most cultivation occurs below 100 m on the periphery of the island (Lepofsky 1992, 193), with the higher central half of the island used at much lower intensity, if at all (Saunders 1993). On Eloaua Island, there is one area of relatively high intensity. Characteristically, fallow vegetation is shorter (less than 5 m high), and fallow periods briefer (3-7 years), in these more intensively cultivated areas. Elsewhere, there is some use of tall woody regrowth, fallowed for longer periods (favoured for bananas and Chinese taro). On Eloaua and Emira Islands, cultivated land is typically flat or very gently sloping: on Mussau, a wider range of slopes are used.

To improve soil fertility through ash application, villagers carry dried coconut fronds to newly cleared gardens and burn them, though the extent of this practice is not known. There is only one planting of taro, and it is said that pigs, which break through older rotten fences, are a major constraint on second plantings of sweet potato and cassava. On Emira, two plantings of sweet potato, or sweet potato followed by cassava are common. Three instances of a peanut planting following a sweet potato crop were also seen on Emira.

The mass conversion of islanders to the Seventh Day Adventist (SDA) church in the 1930s resulted in significant changes to the diet and subsistence activity: shellfish, fruit bats, marsupials and pork were no longer eaten, and the use of betel nut and tobacco were forbidden (Lepofsky 1992, 193). No betel nut or tobacco was observed growing on Mussau in 1995, but they were growing on Emira. According to Nevermann (1933, 116), tobacco was not known on the islands prior to the late 19th Century, but had been accepted by 1908. Pigs were numerous in 1900 on Mussau according to Parkinson (1907). Although no longer husbanded, they are still present there in large numbers of feral animals which represent a major hazard to agriculture, according to villagers. There are no pigs on Eloaua Island; on Emira there are either none, or very few, as gardens are not fenced (there are however some goats, and also a crocodile farm). In 1908, however, Emira gardens were protected by fences up to 2 m high (Nevermann 1933, 94). Unlike

Notes continued

central New Ireland, where most fencing is made of bamboo, on Mussau fencing is made of other woody materials. During the 1979/80 DPI crop survey (islands not specified; Woodhouse n.d., Dignan 1981), 50 per cent of respondents reported house to garden distances of less than 30 minutes, 76 per cent of gardens were fenced, 80 per cent of gardens had suffered pig damage, and 52 per cent of respondents considered that garden soil fertility was poor. Ninety-six per cent reported that there was a regular period of food shortage, usually falling in the period June-October, but especially August and September. Bourke (1981) suggested that this might be related to reduced planting, particularly of sweet potato, in the period of highest rainfall.

Tree species providing edible fruits, nuts and leaves as well as other useful products, are grown in a distinct arboriculture zone around houses (Lepofsky 1992; see also Nevermann 1933, 31-33, 98-99, for an earlier listing of species seen in 1908). These zones are an area of 'tended gardens': cuttings or seeds are transplanted, valued volunteers are tended, there is fertilisation of most trees throughout their growing period, and there is periodic weeding (Lepofsky 1992, 209). In Lepofsky's (1992, 205) sample of 13 areas on Eloaua Island, coconuts were by far the most common tree, followed by Pandanus dubius, pawpaw, Pandanus tectorius, banana, pao, Syzygium spp., lemon, breadfruit, cycad, Java almond and some six others. Coconuts predominated in a canopy layer from 14-32 m high, and Pandanus species in a subcanopy layer between 5-14 m high (Lepofsky 1992, 206). Pandanus dubius were frequently planted under coconut trees. One of the more uncommon species (of which both the fruit, and seeds after leaching, are eaten), which was recorded as Terminalia whitmorei by Lepofsky (1992, 196-7), is more likely to be Terminalia megalocarpa. The former is known only from parts of the Solomon Islands, where it has not previously been reported as edible (Coode 1978,107; Hancock and Henderson 1988, 131).

There appear to have been significant changes in some tree species exploited for food over the long term of the last 2000 years: for example, mon (Dracontomelon dao), which was previously abundant, is today virtually absent, while Diospyros peckelii and bukabuk (Burckella obovata), both previously absent, are now present (Kirch 1988, 1989; Lepofsky 1992). Over the much shorter term of the last generation, Lepofsky (1992, 208) has described a general decline in the importance of tree crops: some (Terminalia catappa, Syzygium malaccense, Syzygium samarangense), which were previously eaten regularly, are today only eaten incidentally, and then mainly by children; and some which require extensive processing (Cycas rumphii, Pangium edule) are no longer eaten. Tree planting is now mainly done only by older people. She suggested that the increasing importance of cassava in the diet, the preparation of which requires specific wrapping leaves for baking, as well as coconut milk, was probably having a major impact on changing the composition of tree species in the arboriculture zone (Lepofsky 1992, 209).

Lepofsky (1989) recorded an interesting case of a woman on Eloaua Island encouraging megapodes (scrub fowl) to lay eggs by means of site preparation and food provision.

Until recent years, copra has been the major source of cash income for islanders. A coconut plantation of 42 ha had been established on Emira as early as 1913 (Sack and Clark 1980, 43-44). In 1995 on Mussau, copra was still regarded as a major income source, with households typically selling 10-15 bags a year. Transport costs are K3 per bag from Mussau to Kavieng, and K4 from Tench Island to Kavieng. Other cash crops include rubber; and a very little cocoa and, most recently, vanilla. By 1992, there was some 115 ha of rubber planted on Mussau Island; tapping began in 1988 (Agricultural Development Services 1992, 56-58, Appendix 1 p. 15). A study of 10 growers showed an average planting of 0.75 ha, with annual incomes ranging from 69-235 kina between 1988 and 1991 (Agricultural Development Services 1992, Appendix 1 p. 15). In 1995, there were said to be 215 growers, but there was no tapping in the first half of the year. There are some small new plantings of vanilla on Eloaua Island, and on Emira, but none had been sold by 1995. There are also recent plantings of cocoa on Emira.

There has been logging on Mussau since at least the early 1980s, with the almost monospecific stands of Calophyllum euryphyllum a major target. Currently, there is a Timber Rights Purchase with an area of some 25,000 ha under exploitation. Royalties and wages are a major source of income for some people.

There are minor sales of fresh foods. Some sago is sold from Mussau to Emira. Marine products are a minor source of income. In 1994, there were recorded sales of lobsters from mainly Mussau and Emira worth some K3000, and some K5000 of fish, mainly from Tench Island.

Notes continued

Lack of economic opportunity, possibly combined with relative pressure on land, has resulted in considerable numbers of Mussauans migrating to the Kavieng area (Miskaram 1985, 42). While Mussau was relatively unaffected by World War II, Emira became a major US airbase with large areas bulldozed and concreted. In 1994-95, some initial interest was expressed in using the island as a site of a spaceport.

National Nutrition Survey 1982/83

69 families from 5 villages were asked in September or December 1982 what they had eaten the previous day. 97 per cent reported eating coconut, 68 per cent sweet potato, 45 per cent cassava, 28 per cent taro, 20 per cent sago, 17 per cent Chinese taro, 9 per cent banana and 1 per cent yam. 42 per cent reported eating rice. 61 per cent reported eating fresh fish. This is similar to the crop pattern, except for the reversed importance of cassava and taro.

Main References

Lepofsky, D. 1992 Arboriculture in the Mussau Islands, Bismarck Archipelago. Economic Botany 46, 2, 192-211.

Other References

Agricultural Development Services (Singapore) in association with Sime Darby Services and ADS (PNG) 1992 Smallholder Rubber Development in Selected Provinces Project (Project Reference: TA1344-PNG): Draft Final Report. Working Paper No. 11: Economics and Marketing Aspects, Department of Agriculture and Livestock and Asian Development Bank, Port Moresby.
Allied Geographical Section 1943 Area Study of New Hanover and Islands North and East of New Ireland. Southwest Pacific Area: Terrain Study No. 62.
Bourke, R.M. 1981 Food shortages in New Ireland Province. Unpublished letter to PRDO, Division of Primary Industry, Kavieng.
Chinnery, E.W.P. 1925 Notes on the natives of E. Mira and St. Matthias. Anthropological Report No. 2, Government Printer for Territory of New Guinea, Melbourne.
Coode, M.J.E. 1978 Combretaceae. In Womersley, J.S. (ed), Handbooks of the Flora of Papua New Guinea. Volume 1. Melbourne, Melbourne University Press, 43-110.
Croyden, R. 1981 Report of trip to New Ireland. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.
Dignan, C. 1981 DPI Rural Survey New Ireland Province 1979/80: report on the nutrition and food garden surveys. Unpublished report, Department of Primary Industry, Kavieng.
Egloff, B.J. 1975 Archaeological investigations in the coastal Madang area and on Eloaue Island of the St. Matthias Group. Records of the Papua New Guinea Public Museum and Art Gallery No. 5, Papua New Guinea Public Museum and Art Gallery, Port Moresby.
Gosden, C., J. Allen, W. Ambrose, D. Anson, J. Golson, R. Green, P. Kirch, I. Lilley, J. Specht and M. Spriggs 1989 Lapita sites of the Bismarck Archipelago. Antiquity 63, 561-586.
Hancock, I.R. and C.P. Henderson 1988 Flora of the Solomon Islands. Research Bulletin No. 7, Dodo Creek Research Station, Research Department, Ministry of Agriculture and Lands, Honiara.
Kirch, P.V. 1988 The Talepakemalai Lapita site and Oceanic prehistory. National Geographic Research 4, 3, 328-342.
Kirch, P.V. 1989 Second millennium B.C. arboriculture in Melanesia: archaeological evidence from the Mussau Islands. Economic Botany 43, 2, 225-240.
Kirch, P.V. 1990 Specialization and exchange in the Lapita complex of Oceania (1600-500 B.C.). Asian Perspectives 29, 2, 117-133.
Kirch, P.V., T.L. Hunt, M. Weisler, V. Butler and M.S. Allen 1991 Mussau Islands prehistory: results of the 1985-86 excavations. In Allen, J. and C. Gosden (eds), Report of the Lapita Homeland Project. Occasional Papers in Prehistory No. 20. Canberra, Research School of Pacific Studies, Australian National University, 144-163.
Lepofsky, D. 1989 Eating eggs on Eloaua: the initiation of a mutualistic relationship. Journal of Ethnobiology 9, 2, 229-231.
Miskaram, N. 1985 Migration and ethnic segregation in Kavieng. Malaysian Journal of Tropical Geography 11, 32-43.
Nevermann, H. 1933 St. Matthias-Gruppe. In Thilenius, G. (ed), Ergebnisse der Südsee-Expedition 1908-1910. II. Ethnographie: A. Melanesien Band 2. Hamburg, Friederichsen, de Gruyter.
Parkinson, R. 1905 St. Matthias und die Inseln Kerue und Tench. Globus 88, 5, 69-72.
Parkinson, R. 1907 Dreissig Jahre in der Südsee. Land und Leute, Sitten und Gebräuche im Bismarckarchipel und auf den Deutschen Salomoinseln. (Thirty Years in the South Seas. The Bismarck Archipelago: Land, Natives and Customs - English translation by N.C. Barry). Stuttgart, Berlag von Strecker and Schröder.

Other References continued

Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.
Sack, P. and D. Clark 1980 German new Guinea: The Draft Annual Report for 1913-14. Canberra, Department of Law and Research School of Social Sciences, Australian National University.
Woodhouse, S.D. n.d. DPI New Ireland Crop Survey: district breakdown of data. Unpublished report, Department of Primary Industry, Kavieng.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 2	**Subsystem No.** 1 **of** 1
Districts 2 Lavongai	**Subsystem Extent** 100 %	**Area (sq km)** 23
Population 1,668	**Population density** 73 **persons/sq km**	**Population absent** 26 **%**

System Summary

Located on the small islands west, north and northeast of Lavongai (New Hanover) Island (including Tingwon, Kavitongong, Sosson, Ungalabu, Kung, Tunung and Tsoi). Fallow vegetation is short woody regrowth, typically 3-7 years old. Vegetation is cut, dried and burnt. Sweet potato and cassava are the most important crops; coconut and taro are important crops; other crops are Chinese taro, banana, and yam (D. esculenta and D. alata). Taro is either grown in separate gardens from other root crops, or in separate sections; cassava is planted separately from sweet potato. After a first planting of either taro or sweet potato there is commonly a planting of cassava before fallow. Sweet potato is grown in small mounds. Fish is a very important food.

Extends across provincial border to System(s) None

Altitude range (m) 0-15 **Slope** Flat (<2 degrees)

CROPS

STAPLES DOMINANT	Cassava, Sweet potato
STAPLES SUBDOMINANT	Coconut, Taro (Colocasia)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sweet potato, Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Amaranthus spp., Chinese cabbage, Corn, Cucumber, Pumpkin fruit, Pumpkin tips, Bean (snake)
FRUITS	Coastal pandanus, Malay apple, Pawpaw, Sugarcane, Ton, Watermelon
NUTS	Breadfruit, Java almond, Pao
NARCOTICS	Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Short woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	2 plantings
R VALUE	17 (low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Significant
CROP SEGREGATION	Significant
CROP SEQUENCES	Significant
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	None

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Coconuts	Very significant
2 Fish	Significant
3 Betel nut	Minor
4 Marine products	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	None
SMALL MOUNDS	Significant
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	None
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	None

OTHER DOCUMENTATION

Survey description

In December 1990, a visit to Tingwon Island (3 days). In July 1995, a visit by dinghy to Tunung Island off the northwest coast of Lavongai (New Hanover) Island, and to Tsoi Island off the northeast coast (half day).

Boundary definition

These small islands were allocated to a separate system after some had been visited, and after the St Matthias group (System 1701), Lavongai Island (Systems 1703 and 1704), and the Tigak Islands (System 1705) had been surveyed.

Notes

Restricted to the small islands lying to the north and west of Lavongai Island, this system is distinguished from System 1703, covering the coast of Lavongai, where sago is one of the most important crops, and the fallow vegetation is taller and fallow periods are longer; from System 1704, in inland Lavongai, where fallow periods are longer; and from System 1705, on the Tigak Islands and the northwestern corner of New Ireland, where sago is the most important crop, and fallow vegetation is older and taller. It is distinguished from System 1701, on the islands of the St Matthias group to the north, where sweet potato and taro are the most important crops and there is only one planting before fallow.

These small islands have either sandy or coralline soils, and the secondary vegetation is considerably less diverse and vigorous than on the main island of Lavongai. Most fallow cleared for new gardens is less than 5 m tall. Casuarina is a common component of the fallow vegetation. Land on many of the islands (e.g. Tingwon, Ungalabu, Kung, Tunung, Nemto and Tsalui) was alienated for plantations early in the colonial period - on Tingwon, 220 ha had been planted by 1913 (Sack and Clark, 1980, 44). Most of these plantations have been returned to national ownership, and most are no longer productive. In the 1980s, some returned plantations were subdivided into household plots (Miskaram 1993, 449-454). Some gardens are now being made on land that has been under coconuts for many years. Several islands also have a central swampy area. On Tunung, swamp taro used to be grown in this site. Sago, however, is either absent or extremely rare. Some sago palms have recently been planted in the centre of Ungalabu, Kung and Tunung Islands. Some of the people resident on the islands have access to land on the main island of Lavongai, either to make gardens (for instance, Tunung), or to process sago (for instance, Tsoi). This practise extends from Tsoi Islands to the east to Kavitongong Island to the west and includes the outlying islands of Sosson, Ungalabu, Kung, Tunung, Naitab, Ungalik, Nemto, Lukus and Unusa. It undoubtedly provides a major extension of the resource base of some islanders. For instance, in 1982/83 the National Nutrition Survey surveyed for this system the single village of Ungalik, located on a very small island less than 1 km off the village of Puas. The very high consumption figure of 86 per cent recorded for sago (see below), must reflect supplies from Lavongai. In 1908, Friederici (1912, 140-141) reported that the people from Ungalik Island were exploiting huge sago stands on the lower reaches of the Matanalaua and Min Rivers, as well as making major taro gardens further upstream. He also described similar arrangements for the islands of Kabatang and Kung further to the west. The implication of this is that the calculated population density for this system overestimates the situation on the ground.

The nature of the soils means that agriculture on the islands appears to be particularly vulnerable to extended drought. In 1980, the Tingwon Islands were strongly affected by drought; swamp taro planting material was supplied for swampy areas, and advice was given on such short term measures as compost use, the use of grass cuttings from the airstrip and commercial fertiliser (Woodhouse 1981). Rats were reported to be eating sweet potato, cassava and fruits. DPI introduced two pythons, which later died, in an attempt to get rid of the rats.

Taro was said to have previously been the most important crop. In 1995, cassava and sweet potato were by far the most important crops grown on the islands visited, as they also were in 1980 on Tingwon Island (Woodhouse 1981). The change from taro probably began in the late 19th century. In 1897, for instance, a visitor to Kung Island reported great quantities of both sweet potato and taro, and noted that many people had already worked overseas on plantations in Fiji and Queensland (Cayley-Webster 1898, 290). On another of the islands, he saw huge heaps of taro, banana, pineapple and yam at a ceremony (Cayley-Webster 1898, 283).

Inclusion in the colonial economy dates from at least the 1880s, with taxation introduced as early as 1907 (Sack and Clark, 1979, 100, 288). Cash incomes are now an important part of livelihoods. Copra remains a major source of income. People from a number of the islands grow cocoa on Lavongai Island, in System 1703. However, marine products are particularly significant, including green snail shell ('talvung'), trochus shell ('lalai'), bêche-de-mer as

Notes continued
well as lobsters/crayfish, mudcrabs, oysters and fish. Fisheries data for 1994 suggests the following approximate figures for sales of specific items from the Tsoi Islands alone; bêche-de-mer K8600, lobster K4000, mudcrab nearly K2000, oysters K500 and fish K2850. In 1995, green snail was said to have been over exploited. Buyers from Kavieng visited the islands weekly to purchase crayfish. Villagers also sell fish and betel nut (primarily grown on Lavongai) occasionally at Kavieng market, and at small local markets on Lavongai Island. Sago, in particular, is bought at the latter markets. Between 1975 and 1981, and to a lesser extent in 1984-85, bait fish royalties were probably a major income source for some villagers (Croyden 1981, 6; Otto 1990).

National Nutrition Survey 1982/83
29 families from 1 village were asked in October 1982 what they had eaten the previous day. 93 per cent reported eating sweet potato, 86 per cent sago, 72 per cent coconut, 10 per cent Chinese taro, 7 per cent cassava, 7 per cent taro, 3 per cent yam and none banana. 52 per cent reported eating rice. 93 per cent reported eating fresh fish. The high consumption of sago, and the low consumption of both cassava and taro, all differ from the crop pattern.

Main References
None.

Other References
Cayley-Webster, H. 1898 Through New Guinea and the Cannibal Countries. London, T. Fisher Unwin.
Croyden, R. 1981 Report of trip to New Ireland. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.
Friederici, G. 1912 Wissenschaftliche Ergebnisse einer amtlichen Forschungsreise nach dem Bismarck-Archipel im Jahre 1908. II. Beiträge zur Völker- und Sprachenkunde von Deutsch-Neuguinea. Ergänzungsheft Nr. 5, der Mitteilungen aus den Deutschen Schutzgebieten, Ernst Siegfried Mittler und Sohn, Berlin.
Miskaram, N. 1993 The effects of increasing costs, changing technology and the monetisation of Tungak communities on Lavongai, New Ireland Province, Papua New Guinea. PhD thesis, James Cook University of North Queensland, Townsville.
Otto, T. 1990 New Hanover and Tigak Islands (New Ireland). In Filer, C. (ed), The sociology of Baitfish royalties in Papua New Guinea. Department of Anthropology and Sociology, Occasional Paper No. 6. Port Moresby, University of Papua New Guinea, 1-18.
Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.
Sack, P. and D. Clark 1980 German new Guinea: The Draft Annual Report for 1913-14. Canberra, Department of Law and Research School of Social Sciences, Australian National University.
Woodhouse, S.D. 1981 Controlling rats and growing more food on Tingwon Island, New Ireland Province. Harvest 7, 1, 1-4.
Wright, A., M.R. Chapau, P.J. Dalzell and A.H. Richards 1983 The marine resources of New Ireland Province. A report on present utilization and potential for development. Research Report 83-13, Department of Primary Industry, Port Moresby.
Wright, A. and A.H. Richards 1985 A multispecies fishery associated with coral reefs in the Tigak Island, Papua New Guinea. Asian Marine Biology 2, 69-83.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 3	**Subsystem No.** 1 **of** 1
Districts 2 Lavongai	**Subsystem Extent** 100 %	**Area (sq km)** 300
Population 7,150	**Population density** 24 **persons/sq km**	**Population absent** 15 **%**

System Summary

Located on the coastal fringe of Lavongai (New Hanover) Island below 100 m. Fallow vegetation is tall woody regrowth, more than 15 years old. Vegetation is cut, dried and burnt. Sweet potato and sago are the most important foods; cassava, taro, banana and coconut are important crops; other crops are Chinese taro and yam (D. esculenta and D. alata). There is variation between villages in crop patterns. Typically, sweet potato, taro and cassava are grown in separate garden sections. Taro is sometimes grown in separate gardens from other root crops, with interplanted banana. After one planting of either taro or sweet potato, a further planting of cassava is common before fallowing. Sweet potato is planted in very small mounds. Fish is an important food.

Extends across provincial border to System(s) None

Altitude range (m) 0-100 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sago, Sweet potato
STAPLES SUBDOMINANT	Banana, Cassava, Coconut, Taro (Colocasia)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Amaranthus spp., Cucumber, Ferns, Lowland pitpit, Pumpkin fruit, Pumpkin tips, Bean (snake), Taro leaves
FRUITS	Mango, Pawpaw, Pineapple, Sugarcane, Ton
NUTS	Breadfruit, Galip, Java almond, Pao, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	>15 years
CROPPING PERIOD	2 plantings
R VALUE	9 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Minor
CROP SEGREGATION	Significant
CROP SEQUENCES	Significant
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	None

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	Significant
2 Coconuts	Significant
3 Fresh food	Significant
4 Cocoa	Minor
5 Fish	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	Very significant
SMALL MOUNDS	Minor
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	None
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	None

OTHER DOCUMENTATION

Survey description

In June-July 1995, traverse by dinghy from Kavieng around Lavongai (New Hanover) Island, with stops at Patipai, Bolpua, Unusa, Puas and Noipuas villages on the north coast (one and a half days); and at Baungung, Meteran and Kulapuas villages on the south and east coasts (1 day).

Boundary definition

The boundary with System 1704 in the inland of Lavongai Island was determined, on the north coast, by traverses up the Taimo River to Mateun and Elava hamlets, and between Noipuas and Neikonomon villages, and, on the south coast, between Baungung and Tutuila villages. It was extrapolated along the 100 m contour. The small offshore islands were allocated to two separate systems (1702 and 1705).

Notes

Restricted to the coastal region of Lavongai Island below 100 m, this system is distinguished from System 1702, on the offshore islands, where sago is not grown and the fallow vegetation is shorter and younger; and from System 1704, inland above 100 m, where sweet potato and cassava are the most important crops, and a single planting before fallow is usual. It is distinguished from System 1701 in the St Matthias group, by the importance here of sago.

Some islanders from System 1702 have access to land in this system, either for processing (or buying) sago or for agriculture. This practise extends from Tsoi Islands to the east to Kavitongong Island to the west and includes the outlying islands of Sosson, Ungalabu, Kung, Tunung, Naitab, Ungalik, Nemto, Lukus and Unusa. It undoubtedly provides a major extension of the resource base of some islanders. In 1908, Friederici (1912, 140-141) reported that the people from Ungalik Island were exploiting huge sago stands on the lower reaches of the Matanalaua and Min Rivers, as well as making major taro gardens further upstream. He also described similar arrangements for the islands of Kabatang and Kung further to the west. This implies that the calculated population density for this system, which includes only villages located on Lavongai, is an underestimate.

While most gardens are made in tall woody regrowth, there is also minor use of previously uncleared forest, and, on the northeast coast near Patipai village, some short grassland. At this location in 1995, it was said that kunai grass had recently been replacing woody regrowth. Gardens are made on a wide range of slopes, from steep valley sides to flat land.

There is some variation in the relative importance of different crops at different locations, and over time. During the German colonial period, sago and taro were reported as the important foods (Sack and Clark 1979, 187; 1980, 44-45; Cayley-Webster 1898, 297). In 1981, Croyden (1981, 1, 6) reported taro as the main crop up to three hours from the coast, with only the Manatau people of the inland villages of Patiagaga and Vaisavamvam on the north coast using sago to any extent, and selling it to other groups. During the 1995 survey, villagers at most locations said that taro had previously been the most important crop. It was said to be particularly important still for customary ('kastam') feasts. Throughout the north coast area, sago was said now to be the most important food, with cassava and sweet potato the major garden crops. At Metaran village on the south coast, where taro, cassava and banana were the main foods, sago was said to be used mainly for feasting.

During the 1980 DPI crop survey, most gardens were reported to be located close to villages (less than 30 minutes distance); and most people considered that the period June-July was a regular period of food shortage. No gardens were reported as fenced, though nearly half the people mentioned pig damage to food gardens.

For sweet potato cultivation, hoes are commonly used to break the soil at the planting site.

There is evidence from several locations of prehistoric patterns of land use, which appear to differ from the raised bed forms seen at the inland village of Neikonomon in System 1704. First reported in 1970 by R.E. Randolph (Papua New Guinea Museum Site EAP) as adjacent to most villages throughout New Hanover, they were described as earth mounds arranged in geometrical shapes about 1 m high, and more or less like low walls or rice padis. They were compared by Swadling (1991, 554) to apparently similar mounds in West New Britain Province, which she suggested may have functioned as long term field markers. During a reconnaissance visit to Lavongai Bay on the south coast in 1985, Gorecki, accompanied by Kirch, found evidence on the entire valley floor behind the beach of a '... peculiar prehistoric garden system. It consists of low ridges encircling 'ponds'. The system covers many hectares if not a few square kilometres. It is huge.' (Gorecki 1985, 22). Kirch, according to Gorecki, compared it to contemporary Futuna

Notes continued
taro ponds. In 1995, evidence of what appeared to be similar past land use practices were seen in the foothills immediately inland of Metaran village. These consisted of extensive low ridges (measuring from about 0.5 to 1 m high, and up to 1.5 m wide) around some of the edges of some currently used gardens on the sides of some small valleys. In some cases the ridges followed the contours, apparently forming fields behind the ridges. In some cases, the current gardens made use of the raised ridges as paths, with logs placed on either side of the path and weeds from the garden were being thrown between the logs, thus continuing to raise the ridge. In some cases, cassava, Chinese taro, snake bean and sugarcane were planted on the raised ridges. Further investigation would be worthwhile.

Lavongai Island was included in the colonial economy from at least the 1880s, initially with extensive labour recruitment, and later with cash cropping. Following the establishment of trading stations on New Hanover, trading in whole coconuts was prohibited in 1890, in order to encourage copra production (Sack and Clark 1979, 100, 176, 220, 288). By 1913, some 869 ha had been alienated and planted to coconuts (Sack and Clark 1980, 44); on the south coast, village coconut plantings had been made, and some Lavongai villages were producing surplus food, particularly taro, for sale to planters for feeding their labourers (Sack and Clark 1980, 44-45). During the early 1940s, one hundred tons per month of sago was traded and used to maintain plantations and vessels in New Ireland (Allied Geographical Section 1943, 4), and traded to feed labourers on the plantations in Madang Province (Miskaram 1993, 161, 185).

In the mid 1980s, the main sources of cash income were copra, cocoa and remittances (Miskaram 1993, 333-420, 429-433). By 1995, cash income sources were varied, including copra, cocoa, logging, sales of food, betel nut, fish and other marine products. Remittances undoubtedly continued to be important. Copra is still produced in some locations. Cocoa was grown quite extensively on the west, south and northwest coasts, with some 10 tonnes produced in 1980 (Croyden 1981, 5), but is no longer being produced in any quantity. Rubber has been grown for some time by a small number of farmers. A 1991 study reported a total of 70 ha planted on Lavongai, with a sample of 10 growers near Taskul station showing average incomes of 105-180 kina per year for the period 1989-91 from average plantings of 1.23 ha (Agricultural Development Services 1992, 55-8 and Appendix 1 p. 16). In 1995, an insignificant amount of rubber was produced.

Royalties and employment from logging are particularly important in the west of the island where the Umbukul Timber Rights Purchase covers an area of 22,700 ha. Between 1975 and 1981, and to a lesser extent in 1984-85, some eastern villages shared in bait fish royalties (Croyden 1981, 6; Otto 1990).

There are considerable sales of fresh food and betel nut at both Kavieng market, and at small local markets. Sago and betel nut are probably the major items sold at Kavieng. Most of the small local markets are held at fortnightly intervals, and are attended by people from this system, and from both the adjoining systems, System 1704 inland and System 1702 on the offshore islands. In the past this exchange of products from different ecological zones was conducted by trade or barter, but is now a market place trade using money.

Lavongai was linked by air from Kavieng up to the 1980s, but there were no air links by 1995.

National Nutrition Survey 1982/83
142 families from 12 villages were asked in September, October or December 1982, or April 1983 what they had eaten the previous day. 86 per cent reported eating coconut, 79 per cent sago, 59 per cent sweet potato, 21 per cent cassava, 16 per cent banana, 8 per cent taro, 7 per cent Chinese taro and 3 per cent yam. 25 per cent reported eating rice. 58 per cent reported eating fresh fish. This is similar to the crop pattern. The relatively low taro consumption was due to the 1982 drought; large taro areas in west, south and north Lavongai (as well as in central parts of Ungalabu, Tunung and the Tsoi Islands, in System 1702) were destroyed during this drought.

Main References
None.

Other References
Agricultural Development Services (Singapore) in association with Sime Darby Services and ADS (PNG) 1992 Smallholder Rubber Development in Selected Provinces Project (Project Reference: TA1344-PNG): Draft Final Report. Working Paper No. 11: Economics and Marketing Aspects, Department of Agriculture and Livestock and Asian Development Bank, Port Moresby.

Other References continued

Allied Geographical Section 1943 Area Study of New Hanover and Islands North and East of New Ireland. Southwest Pacific Area: Terrain Study No. 62.
Billings, D.K. 1971 Styles of culture: New Ireland and New Hanover. PhD thesis, University of Sydney, Sydney.
Bourke, R.M. 1981 Food shortages in New Ireland Province. Unpublished letter to PRDO, Division of Primary Industry, Kavieng.
Cayley-Webster, H. 1898 Through New Guinea and the Cannibal Countries. London, T. Fisher Unwin.
Croyden, R. 1981 Report of trip to New Ireland. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.
Dignan, C. 1981 DPI Rural Survey New Ireland Province 1979/80: report on the nutrition and food garden surveys. Unpublished report, Department of Primary Industry, Kavieng.
Filer, C. 1991 Two shots in the dark: the first year of the Task Force on Environmental Planning in Priority Forest Areas. Research in Melanesia 15, 1, 1-48.
Friederici, G. 1912 Wissenschaftliche Ergebnisse einer amtlichen Forschungsreise nach dem Bismarck-Archipel im Jahre 1908. II. Beiträge zur Völker- und Sprachenkunde von Deutsch-Neuguinea. Ergänzungsheft Nr. 5, der Mitteilungen aus den Deutschen Schutzgebieten, Ernst Siegfried Mittler und Sohn, Berlin.
Godin, P. 1980 Note sur la production des malanggan en Nouvelle-Irlande de 1870 à 1914. Journal de la Société des Océanistes 65, 35, 283-285.
Gorecki, P.P. 1985 Test excavation at Lamau, New Ireland Province and report of an excursion to Lavongai, New Hanover, New Ireland Province. Lapita Homeland Project: Report of the 1985 Field Season, Department of Archaeology, La Trobe University, Melbourne.
Holdsworth, D., B. Pilokos and P. Lambes 1982 A survey of plants used for medicinal purposes in New Hanover, Papua New Guinea. Science in New Guinea 9, 2, 103-109.
Miskaram, N. 1975 Recent changes in agriculture on New Hanover. BA (Hons) thesis, University of Papua New Guinea, Port Moresby.
Miskaram, N. 1985a Cargo cultism on New Hanover: a psychopathological phenomenon or an indication of unequal development? In Loeliger, C.E. and G.W. Trompf (eds), New Religious Movements in Melanesia. Suva, Institute of Pacific Studies, University of the South Pacific, 75-89.
Miskaram, N. 1985b Migration and ethnic segregation in Kavieng. Malaysian Journal of Tropical Geography 11, 32-43.
Miskaram, N. 1993 The effects of increasing costs, changing technology and the monetisation of Tungak communities on Lavongai, New Ireland Province, Papua New Guinea. PhD thesis, James Cook University of North Queensland, Townsville.
Otto, T. 1990 New Hanover and Tigak Islands (New Ireland). In Filer, C. (ed), The sociology of Baitfish royalties in Papua New Guinea. Department of Anthropology and Sociology, Occasional Paper No. 6. Port Moresby, University of Papua New Guinea, 1-18.
Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.
Sack, P. and D. Clark 1980 German new Guinea: The Draft Annual Report for 1913-14. Canberra, Department of Law and Research School of Social Sciences, Australian National University.
Swadling, P. 1991 Garden boundaries as indicators of past land-use strategies: two case studies from coastal Melanesia. In Pawley, A. (ed), Man and a Half: Essays in Pacific Anthropology and Ethnobiology in Honour of Ralph Bulmer. Auckland, The Polynesian Society, 550-557.
Woodhouse, S.D. n.d. DPI New Ireland Crop Survey: district breakdown of data. Unpublished report, Department of Primary Industry, Kavieng.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 4	**Subsystem No.** 1 **of** 1
Districts 2 Lavongai	**Subsystem Extent** 100 %	**Area (sq km)** 396
Population 961	**Population density** 2 **persons/sq km**	**Population absent** 5 **%**

System Summary

Located on hills in inland Lavongai (New Hanover) Island above 100 m. Fallow vegetation is tall woody regrowth, more than 15 years old. Vegetation is cut, dried and burnt. Sweet potato and cassava are the most important crops; taro, banana and coconut are important crops; other crops are Chinese taro, sago and yam (D. esculenta and D. alata). Taro is usually grown in separate sections within gardens. Taro is only planted once before fallow. Sweet potato and cassava are also usually only planted once, but are sometimes planted twice before fallow. Occasionally, sweet potato or cassava may be planted after taro. Sweet potato is grown in very small mounds.

Extends across provincial border to System(s) None

Altitude range (m) 100-200 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Cassava, Sweet potato
STAPLES SUBDOMINANT	Banana, Coconut, Taro (Colocasia)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Amaranthus spp., Corn, Cucumber, Ferns, Lowland pitpit, Pumpkin fruit, Pumpkin tips, Bean (snake)
FRUITS	Malay apple, Mango, Pawpaw, Pineapple, Sugarcane, Ton
NUTS	Breadfruit, Galip, Pao, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	>15 years
CROPPING PERIOD	1 planting
R VALUE	5 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	None
CROP SEGREGATION	Very significant
CROP SEQUENCES	Minor
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Minor

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	Significant
2 Fresh food	Significant
3 Tobacco	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	Very significant
SMALL MOUNDS	Minor
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	None
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	None

OTHER DOCUMENTATION

Survey description

In July 1995, on the north coast of Lavongai (New Hanover) Island, a dinghy/walking traverse up the Taimo River to Mateun and Elava hamlets, and a vehicle/dinghy traverse from Noipuas to Neikonomon villages (1 day, two parties). On the south coast, a walk inland from Baungung to Tutuila villages (quarter day).

Boundary definition

The boundary with System 1703 on the coast of Lavongai Island was determined, on the north coast, by traverses up the Taimo River to Mateun and Elava hamlets, and between Noipuas and Neikonomon villages; and, on the south coast, between Baungung and Tutuila villages. It was extrapolated along the 100 m contour.

Notes

This system, restricted to the inland part of Lavongai Island above approximately 100 m, is distinguished from System 1703, located in the coastal zone, where sago and sweet potato are the most important crops, and a second planting before fallowing is usual. It is distinguished from System 1702 on the small offshore islands where the fallow vegetation, and the fallow periods, are shorter and there are two plantings before fallow.

It is likely that the population of inland Lavongai was considerably greater prior to the colonial period. Further, in 1933-1934 a major drought resulted in the failure of taro production in parts of Lavongai and a rise in mortality (Clements 1936, 624).

Although some gardens are cut from previously uncleared forest, most are made in tall woody regrowth more than 15 years old. When new forest is used, trees are commonly felled, allowed to dry, burnt and then the clearing is left for 6-12 months before the new regrowth is again cleared and the garden established. Taro is planted by dibbling. Gardens are not fenced, and wild pigs are said to be deterred from damaging crops by frequent hunting.

In the northwest of the island, at Neikonomon village, some gardens are made in short grasslands which cover distinctive patterns of past land use. These are beds measuring approximately 10 m by 5 m, and raised about 30 cm high. Their origin is not known to present villagers. They appear to differ from the relict raised ridges around garden areas or fields, which also appear to be evidence of prehistoric patterns of land use, notable on the south coast in System 1703. Currently, they are cleared following relatively short fallows of less than five years, and planted two or three times with sweet potato or cassava before returning to fallow. These mounds may be similar to those first reported in 1970 by R.E. Randolph (Papua New Guinea Museum Site EAP) as adjacent to most villages throughout New Hanover. These were described as arranged in geometrical shapes about 1 m high, and more or less like low walls or rice padis. They were compared by Swadling (1991, 554) to apparently similar mounds in West New Britain Province, which she suggested may have functioned as long term field markers.

In 1995, villagers said that taro was historically the most important crop. It may have been so until as recently as 1981, when taro was reported as the main crop up to three hours from the coast (Croyden 1981, 1, 6). By 1995, however, cassava was said to be the most important crop, followed by sweet potato, with taro in third place. The most common fruit and nut tree crops are mango, Malay apple, ton, breadfruit, galip, Polynesian chestnut and pao. Others seen included bukabuk, coastal pandanus, lemon, guava and Java almond.

The main sources of cash income are the sale of betel nut, betel pepper, tobacco and fresh foods, at markets located near the coast, which are held at fortnightly intervals. These small markets are attended by people from this system, and from Systems 1703 and 1702, on the coast and offshore islands respectively. The major foods sold include taro, sweet potato, cassava and banana. In the past, some rubber was produced.

The use of marine resources varies according to location. In the south of the island, inland settlements are commonly closer to the coast than in the north, thus allowing ready access to fishing.

National Nutrition Survey 1982/83

30 families from 2 villages were asked in September, October or December 1982 what they had eaten the previous day. 97 per cent reported eating sweet potato, 90 per cent coconut, 40 per cent cassava, 20 per cent taro, 13 per cent banana, 10 per cent sago, 3 per cent Chinese taro and 3 per cent yam. 57 per cent reported eating rice. 43 per cent reported eating fresh fish. This is similar to the crop pattern.

Main References

None.

Other References

Clements, F.W. 1936 Tropical ulcer, with special reference to its aetiology. Medical Journal of Australia 2, 19, 615-644.

Croyden, R. 1981 Report of trip to New Ireland. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.

Friederici, G. 1912 Wissenschaftliche Ergebnisse einer amtlichen Forschungsreise nach dem Bismarck-Archipel im Jahre 1908. II. Beiträge zur Völker- und Sprachenkunde von Deutsch-Neuguinea. Ergänzungsheft Nr. 5, der Mitteilungen aus den Deutschen Schutzgebieten, Ernst Siegfried Mittler und Sohn, Berlin.

Miskaram, N. 1975 Recent changes in agriculture on New Hanover. BA (Hons) thesis, University of Papua New Guinea, Port Moresby.

Miskaram, N. 1993 The effects of increasing costs, changing technology and the monetisation of Tungak communities on Lavongai, New Ireland Province, Papua New Guinea. PhD thesis, James Cook University of North Queensland, Townsville.

Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.

Swadling, P. 1991 Garden boundaries as indicators of past land-use strategies: two case studies from coastal Melanesia. In Pawley, A. (ed), Man and a Half: Essays in Pacific Anthropology and Ethnobiology in Honour of Ralph Bulmer. Auckland, The Polynesian Society, 550-557.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 5	**Subsystem No.** 1 **of** 1
Districts 3 Kavieng	**Subsystem Extent** 100 %	**Area (sq km)** 179
Population 2,260	**Population density** 13 **persons/sq km**	**Population absent** 6 **%**

System Summary

Located on the Tigak Islands between Lavongai (New Hanover) Island and Kavieng, on Dyaul Island, and on the south coast of the northern tip of New Ireland west of Kaut village. Sago is the most important food. Purchased rice is also very important. Important crops are banana, sweet potato, cassava and coconut; other crops are taro, Alocasia taro, Chinese taro and yam (D. esculenta and D. alata). Fallow vegetation is generally tall woody regrowth, more than 15 years old. Vegetation is cut, dried and burnt. Sweet potato is planted in very small mounds. Fruit and nut tree crops are important. Fish is a very important source of food and income.

Extends across provincial border to System(s) None

Altitude range (m) 0-150 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sago
STAPLES SUBDOMINANT	Banana, Cassava, Coconut, Sweet potato
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (Alocasia), Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Corn, Kangkong, Lowland pitpit, Pumpkin fruit, Pumpkin tips, Bean (snake)
FRUITS	Mango, Pawpaw, Pineapple, Sugarcane, Ton
NUTS	Breadfruit, Galip, Java almond, Pao, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	>15 years
CROPPING PERIOD	2 plantings
R VALUE	9 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Minor
CROP SEGREGATION	Minor
CROP SEQUENCES	Minor
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Minor

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Fish	Very significant
2 Betel nut	Significant
3 Coconuts	Significant
4 Fresh food	Significant

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	Very significant
SMALL MOUNDS	Minor
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	None
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	None

OTHER DOCUMENTATION

Survey description

In July 1995, by dinghy from Kavieng to Sumuna village on Dyaul Island; meeting and garden visits (half day).

Boundary definition

A separate system was allocated to these islands after a visit to Dyaul Island; after the surveys of Lavongai Island (Systems 1703 and 1704), and its other offshore islands (System 1702); and a review of the literature. On the main island of New Ireland, the boundaries with Systems 1706 and 1707 were determined from road traverses on the Kavieng-Kaut road.

Notes

This system is distinguished from System 1702 on the small islands offshore of Lavongai Island, where little or no sago is grown, the most important crops are sweet potato and cassava, and fallows are typically short woody regrowth. It also differs from System 1703 on the coastal fringe of Lavongai, where there is less reliance on sago and more on cultivation, and sweet potato is a most important crop; and from System 1706, on the northern tip of New Ireland, where there is a wider range of important crops, the fallow period is shorter and the fallow vegetation is short woody regrowth. It differs from System 1707, which covers the major part of northern New Ireland, where taro and sweet potato are the most important crops.

Most of the islands consist of raised reefal limestone, though some consist of an atoll of reef-derived beach rock and coralline sand (Dalzell and Wright 1990, 25). The vegetation fringing the islands is primarily mangrove swamps bordered by either forest or planted coconuts. The amount of land suitable for agriculture varies considerably: for instance, Upuas village has little cultivable land, and its population is thus most dependent on fishing, while the islands of Enuk, Nusailas and Nonovaul are considerably better endowed (Wright and Richards 1985, 62). In general, therefore, agriculture is limited, with sago the most important food, and fishing of great significance. Purchased rice is also a major component of diets.

There are no specific published accounts of agriculture in this system. Beney (1980) is a generalised account, dating to the late 1960s, for the whole of the mainland Kavieng District with little reference to the Tigak Islands, but the Tigak language terms for crops are useful. In 1976, E. Young (pers. comm. 1985) spent one week at Piliwa village on Dyaul Island, recording the staple foods as sago and sweet potato. Banana seems to have been a more important crop in 1880 (Hernsheim 1983, 161).

Evidence of possible prehistoric land use has been reported from Selapiu Island (Papua New Guinea Museum Site EBB). This was described as low rectangular earth mounds located on the north west slope of the main hill on the island, measuring some 5 m on the short axis and 12 m on the long one. Only the short axis followed the contour, and the slope of the enclosed area suggested that the mounds had nothing to do with water retention. Swadling (1991, 554) suggested that similar mounds in West New Britain Province may have functioned as long term field markers.

Many plantations were established on the Tigak Islands during the colonial period. On Nusa Island, for instance, 12,000 coconut trees had been planted by 1900, three quarters of which had been planted by local villagers for pay (Sack and Clark 1979, 217-8). Villagers were also contracted to weed the trees; and they held rights to cultivate food crops between the rows of coconuts - intercropping was an early innovation here (Sack and Clark 1979, 218). By 1913, 1036 ha had been alienated for plantations on the Tigak Islands, and a further 125 ha on Dyaul Island (Sack and Clark 1979, 44). In the 1970s, after the Burns Philp plantation on Nusa Island was occupied by villagers, the Tigak plantations of Enuk (138 ha), Usien (59 ha), Kabotoran (60 ha), Ungau (34 ha), Nausalamon (23 ha) and Nusa (85 ha) were purchased from their owners by the government for return to village claimants (Walter 1981, 24-27). By the mid 1970s, copra production from them all had rapidly declined.

Fishing, and the collection of other marine products, including shellfish, mudcrabs and lobsters, provide an important part of both subsistence and cash incomes. For the period 1970-82, the estimated annual production of fin fish totalled nearly 36 tonnes, composed of 12.4 tonnes of subsistence production and 23.3 tonnes of commercial artisanal production and an additional unknown amount sold at Kavieng markets and stores (Dalzell and Wright 1990, 35). Analysis of fish landings from Enuk village and Sivisat settlement between 1970 and 1982, showed a significant negative correlation between fishing effort and the annual price of copra; that is, when the price of copra fell, more effort was put into fishing (Dalzell and Wright 1990). Although some other villages also had access to large plantings of coconuts they did not show the same relationship, possibly because they had additional income sources such as fresh

Notes continued
food sales and timber royalties (Dalzell and Wright 1990, 34). Commercial fishing effort was shown to decline markedly with distance from the Kavieng buying point (Dalzell and Wright 1990, 33-35). Overall, the estimated harvest of Tigak small-scale fishermen operating in waters less than 30 m deep is 4.2 kg/ha/year, perhaps 20 times less than the yield of a reef fishery near Port Moresby, suggesting that the level of exploitation is low (Wright and Richards 1985, 80-81). This may be due to the low demand for reef fish by Kavieng. A sample study of subsistence fishing by four families on different islands in 1982 showed a daily harvest of 23 g/person (Wright and Richards 1985, 74). Fishing is partly seasonal, with activity limited during the period of the northwest monsoon between December and March (Wright and Richards 1985, 81).

The major sources of cash income include fish, and other marine products (bêche-de-mer, lobster and mudcrabs), copra, and sales of betel nut and fresh food. Between 1975 and 1981, and to lesser extent in 1984-85, royalties from live bait fishing were also a major component (Dalzell and Wright 1990, 34; Croyden 1981, 6; Otto 1990). Copra is still produced. From Dyaul Island in particular, sales of betel nut and sago to Kavieng market are important. For villages on the main island of New Ireland such as Kaut, logging in the West Kaut Timber Rights Purchase, which covers some 11,200 ha, contributed to incomes from at least the mid 1980s.

National Nutrition Survey 1982/83
47 families from 4 villages were asked in September or October 1982 what they had eaten the previous day. 87 per cent reported eating coconut, 70 per cent sago, 36 per cent banana, 32 per cent sweet potato, 30 per cent cassava, 21 per cent taro, 17 per cent Chinese taro and none yam. 81 per cent reported eating rice. 96 per cent reported eating fresh fish. This is similar to the crop pattern.

Main References
None.

Other References
Beney, J.K. 1980 Coastal subsistence of the mainland, Kavieng District. In, Six studies in subsistence agriculture. Extension Bulletin No. 11. Port Moresby, Department of Primary Industry, 45-64.
Croyden, R. 1981 Report of trip to New Ireland. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.
Dalzell, P. 1985 Some aspects of the reproductive biology of Spratelloides gracilis (Schlegel) in the Ysabel Passage, Papua New Guinea. Journal of Fish Biology 27, 229-237.
Dalzell, P.J. and A. Wright 1990 Analysis of catch data from an artisanal coral reef fishery in the Tigak Islands, Papua New Guinea. Papua New Guinea Journal of Agriculture, Forestry and Fisheries 35, 1-4, 23-36.
Dignan, C. 1981 DPI Rural Survey New Ireland Province 1979/80: report on the nutrition and food garden surveys. Unpublished report, Department of Primary Industry, Kavieng.
Hernsheim, E. 1983 South Sea Merchant. Port Moresby, Institute of Papua New Guinea Studies (edited and translated by P. Sack and D. Clark).
Hide, R.L. 1985 Notes on subsistence agriculture (farming systems) in West New Britain and New Ireland Provinces: report of a field trip to Papua New Guinea 14 November 1984 to 14 December 1984. Unpublished report, Division of Water and Land Resources, Commonwealth Scientific and Industrial Research Organization, Canberra.
Lomas, P. 1981 The early contact period in northern New Ireland (Papua New Guinea): from wild frontier to plantation economy. Ethnohistory 28, 1, 1-21.
Mobiha, A. 1991 The reproductive biology of eight reef fish species from the Tigak Islands of Papua New Guinea. Science in New Guinea 17, 3, 133-142.
Otto, T. 1990 New Hanover and Tigak Islands (New Ireland). In Filer, C. (ed), The sociology of Baitfish royalties in Papua New Guinea. Department of Anthropology and Sociology, Occasional Paper No. 6. Port Moresby, University of Papua New Guinea, 1-18.
Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.
Sack, P. and D. Clark 1980 German new Guinea: The Draft Annual Report for 1913-14. Canberra, Department of Law and Research School of Social Sciences, Australian National University.

Other References continued

Saulei, S.M. and R. Kiapranis 1996 Forest regeneration following selective logging operations in a lowland rain forest in Papua New Guinea. Science in New Guinea 22, 1, 27-37.

Swadling, P. 1991 Garden boundaries as indicators of past land-use strategies: two case studies from coastal Melanesia. In Pawley, A. (ed), Man and a Half: Essays in Pacific Anthropology and Ethnobiology in Honour of Ralph Bulmer. Auckland, The Polynesian Society, 550-557.

Walter, M.A.H.B. 1981 Dear Simon (an informal report to Simon Kanamon, Research Officer to the Manus Provincial Government, on the operation of localized plantations). IASER Special Publication No. 1, Institute of Applied Social and Economic Research, Port Moresby.

Wright, A., M.R. Chapau, P.J. Dalzell and A.H. Richards 1983 The marine resources of New Ireland Province. A report on present utilization and potential for development. Research Report 83-13, Department of Primary Industry, Port Moresby.

Wright, A., P.J. Dalzell and A.H. Richards 1986 Some aspects of the biology of the red bass, Lutjanus bohar (Forskal), from the Tigak Islands, Papua New Guinea. Journal of Fish Biology 28, 533-544.

Wright, A. and A.H. Richards 1985 A multispecies fishery associated with coral reefs in the Tigak Island, Papua New Guinea. Asian Marine Biology 2, 69-83.

Young, E.A. 1977 Simbu and New Ireland migration. PhD thesis, Australian National University, Canberra.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 6	**Subsystem No.** 1 **of** 1
Districts 3 Kavieng	**Subsystem Extent** 100 %	**Area (sq km)** 70
Population 891	**Population density** 13 **persons/sq km**	**Population absent** 15 **%**

System Summary

Located on the northern tip of the main island of New Ireland around Kavieng, and near the Kavieng-Kaut road. The system includes a complex inter-ethnic mixture of periurban agricultural blocks, coastal village land use and informal settlement blocks on the cross-island road to Kaut. Detailed information is incomplete. Purchased rice is probably the most important food. Important crops are sweet potato, cassava, banana, sago and coconut; other crops are taro, Chinese taro, Alocasia taro, and yam (D. esculenta and D. alata). Fallow vegetation is typically short woody regrowth, 5-10 years old, but there is also some use of older tall woody regrowth, and partially cleared old coconut groves. Vegetation is cut, dried and burnt. Two plantings before fallow are common. Sweet potato, cassava and banana are planted in separate garden sections. Cassava is commonly planted following sweet potato. Sweet potato is planted in small mounds.

Extends across provincial border to System(s) None

Altitude range (m) 0-150 **Slope** Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	None
STAPLES SUBDOMINANT	Banana, Cassava, Coconut, Sago, Sweet potato
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (Alocasia), Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Corn, Kangkong, Lowland pitpit, Pumpkin fruit, Pumpkin tips, Bean (snake)
FRUITS	Mango, Pawpaw, Sugarcane, Ton
NUTS	Breadfruit, Java almond, Pao
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Short woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	2 plantings
R VALUE	17 (low)

GARDEN SEGREGATION

GARDEN SEGREGATION	None
CROP SEGREGATION	Very significant
CROP SEQUENCES	Significant
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	None

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	Minor
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Coconuts	Very significant
2 Fish	Significant
3 Betel nut	Minor
4 Cocoa	Minor
5 Fresh food	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	Minor
SMALL MOUNDS	Very significant
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	None
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	None

OTHER DOCUMENTATION

Survey description

In September-October 1971, a road traverse on the Boluminski Highway south of Kavieng with garden visits at Kaselok village and Utu High School (less than half a day). In December 1984, a road traverse on the Highway south of Kavieng, and to Kaut village on the cross-island road (less than half a day). In July 1995, vehicle traverses on the road network around Kavieng, garden visits in the settlement areas, and at Kulangit, Kaselok and Putput villages (half day).

Boundary definition

The boundary with System 1705 on the New Ireland mainland was determined from road traverses on the Kavieng-Kaut road. The eastern boundary with System 1707 was determined by traverses on the Boluminski Highway, and on the cross-island road to Kaut village.

Notes

This system is distinguished from System 1705 on the Tigak Islands and some adjoining areas of the main island, where sago and fish are very important foods. It has also been separated from System 1707, the major system in the northern part of New Ireland, where sweet potato and taro are the most important crops; and because in this system agriculture involves a complex mixture of periurban agricultural blocks, larger informal settlement blocks on the cross-island road to Kaut, and village-based land use which has long been strongly influenced by wage employment and by substantial planting of export tree crops. Although difficult to quantify, the current extent of dependence on purchased foods is probably at least 50 per cent of requirements.

The census population total of 891 only includes formal village census units, and thus underestimates the total number of people resident, and using land, within the system.

There is no recent, detailed account of agriculture but there are several partial descriptions which are useful.

The relative significance of the important crops has varied through time and by location. In addition, the establishment of Kavieng town within the area meant that most neighbouring villages were centrally involved in the monetised colonial economy, resulting in substantial dependence on purchased foods. Before the colonial period, taro is said to have been the most important staple. In 1967, Beney (1980, 60-61) described sweet potato, cassava and taro as the main crops. He noted that there were some regional differences, with banana being the primary staple in Tigak and Kara Census Divisions (though this was not the case in 1995). In 1880, banana seems to have been a more important crop as Hernsheim described ‘miles of banana groves’ and ‘vast banana plantations round a village’ (Hernsheim 1983, 122). In contrast, in 1967 at Kulangit village close to Kavieng town, taro had been replaced by Chinese taro as the most important crop grown (Lomas 1973). However, there was major consumption of purchased foods, with rice the preferred daily staple (Lomas 1973, 211-213). Sago was a delicacy, primarily used for feasts; market sales data indicated that, besides Chinese taro, both sweet potato and banana were common (Lomas 1973, 23, 67, 211, 244). Similarly, at Kaselok village in 1976, the main foods were purchased rice and tinned fish, and subsistence effort in both agriculture and fishing appeared to have declined due to monetisation (E. Young, pers. comm. 1985). Other foods included sago, taro and cassava, and the mixture of crops observed in gardens also included banana, sweet potato, Chinese taro, yam, pawpaw, watermelon, aibika and sugarcane.

In 1967, Beney (1980, 46, 56) suggested fallow periods of 4-5 years, but implied that at times fallows were longer. He reported a single planting only before fallow; soil tillage for yam cultivation; and the use of small mounds for sweet potato, cassava, yam and Chinese taro (Beney 1980, 46, 57-8). He suggested there was use of water diversion for taro; some soil retention on sloping ground; and no seasonal planting pattern (Beney 1980, 56-7).

No garden fencing was apparent in 1995, as was the case 30 years earlier when few pigs were held by villagers (Lomas 1973, 265).

The system includes two non-village sectors: near Kavieng airport there are 50 agricultural blocks averaging 2 ha each (Croyden 1981, 4-5); and, located mainly along the cross-island road to Kaut, there are a considerable number of larger blocks held under informal contracts with local landowners. These are held by people from other parts of the province, as well as other provinces. While the former primarily produce root crops and vegetables for consumption and urban marketing, many of the latter also have export tree crops planted.

Notes continued

Cash incomes have been a major part of livelihoods for many years. In 1967-69, at Kulangit village close to Kavieng, the major income sources were copra, cocoa, market sales and wage employment (Lomas 1973, 111, 116, 202-235). Although coffee was planted in the 1950s, there was no market for the crop and the trees were later used for firewood (Lomas 1973, 209-210). In 1981, 55 per cent of the produce at Kavieng market originated from within 25 km of the town (Croyden 1981, 2). In 1995, the major income sources were copra, wage employment, timber royalties and market sales, at Kavieng, of fresh food, betel nut, fish and other marine products. Cocoa was less important. In 1994, major new rubber projects were proposed in the area of Lokono, Kaut, Tome, Nono and Putput villages (Buruka 1994), but these have not yet been developed. Logging in the West Kaut Timber Rights Purchase, which covers some 11,200 ha, has contributed to incomes since at least the mid 1980s.

There is considerable, but variable, exploitation of marine products, both for subsistence and marketing purposes. For instance, Tome village is reported to produce large amounts of shellfish (cockles: Anadara sp.), and mudcrabs (Scylla serrata), but very little fin fish, while considerable amounts of lobster and mudcrab (estimated respectively at 8.4 and 7.6 tonnes annually in the 1980s) were produced from the reefs and mangroves adjacent to Kavieng (Dalzell and Wright 1990, 28, 35).

National Nutrition Survey 1982/83

No villages in this system were included in the survey.

Main References

None.

Other References

Baseden, S.C. and P.J. Southern 1959 Evidence of potassium deficiency in coconut palms on coral-derived soils in New Ireland from analysis of nut waters, husks, fronds and soils. Papua and New Guinea Agricultural Journal 11, 4, 101-115.

Beney, J.K. 1980 Coastal subsistence of the mainland, Kavieng District. In, Six studies in subsistence agriculture. Extension Bulletin No. 11. Port Moresby, Department of Primary Industry, 45-64.

Buruka, S. 1994 Rubber has good future in New Ireland Province. Didimag Newsletter 26, 9-12, 24-25.

Croyden, R. 1981 Report of trip to New Ireland. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.

Dalzell, P.J. and A. Wright 1990 Analysis of catch data from an artisanal coral reef fishery in the Tigak Islands, Papua New Guinea. Papua New Guinea Journal of Agriculture, Forestry and Fisheries 35, 1-4, 23-36.

Greenfield, H. 1975 The energy needs for pregnancy and lactation. Unpublished paper presented at 10th International Congress of Nutrition, Tokyo, Japan, August 3-9, 1975.

Hernsheim, E. 1983 South Sea Merchant. Port Moresby, Institute of Papua New Guinea Studies (edited and translated by P. Sack and D. Clark).

Lomas, P. 1978 Copra and councillors: village enterprise in northern New Ireland. Ethnos 43, 1-2, 30-50.

Lomas, P. 1981 The early contact period in northern New Ireland (Papua New Guinea): from wild frontier to plantation economy. Ethnohistory 28, 1, 1-21.

Lomas, P.W. 1973 Economic and political organization in a northern New Ireland village. PhD thesis, Simon Frazer University, Vancouver.

Miskaram, N. 1976 Kavieng. In Jackson, R. (ed), An introduction to the urban geography of Papua New Guinea. Department of Geography, Occasional Paper No. 13. Port Moresby, University of Papua New Guinea, 397-414.

Miskaram, N. 1985 Migration and ethnic segregation in Kavieng. Malaysian Journal of Tropical Geography 11, 32-43.

Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.

Saulei, S.M. and R. Kiapranis 1996 Forest regeneration following selective logging operations in a lowland rain forest in Papua New Guinea. Science in New Guinea 22, 1, 27-37.

Scragg, R.F.R. 1955 Birth weight, prematurity and growth rate to thirty months of the New Guinea native child. Medical Journal of Australia January 29, 128-132.

Other References continued

Sharrock, S.L. 1989 Report on fourth IBPGR/QDPI banana germplasm collecting mission to Papua New Guinea: 4 June to 9 July 1989. Consultant's report, Maroochy Horticultural Research Station, Nambour.

Van Wijk, C.L. 1959 Reconnaissance soil survey - east coast New Ireland. Papua and New Guinea Agricultural Journal 11, 4, 95-100.

Young, E.A. 1977 Simbu and New Ireland migration. PhD thesis, Australian National University, Canberra.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 7	**Subsystem No.** 1 **of** 1
Districts 3 Kavieng, 4 Konos	**Subsystem Extent** 100 %	**Area (sq km)** 904
Population 11,714	**Population density** 13 **persons/sq km**	**Population absent** 19 **%**

System Summary

Located in the northern half of the main island of New Ireland, between Kavieng and Namatanai, and below 750 m altitude. Gardens are cleared typically from tall woody regrowth fallow, 10-20 years old, but there is also use of regrowth less than 10 m tall and 5-10 years old. Vegetation is cut, dried and burnt. Most gardens are fenced, commonly with bamboo. Sweet potato and taro are the most important crops: banana and coconut are important crops; other crops are cassava, sago, Chinese taro and yam (D. esculenta and D. alata). A single planting of either sweet potato or taro is most common. However, a planting of sweet potato sometimes follows a taro crop and, more frequently, a first sweet potato crop. Sweet potato is usually planted in very small mounds. Separate gardens are usually made for taro and sweet potato; where they appear in the same garden they are planted separately. Household gardens are common. Fish and shellfish are important foods.

Extends across provincial border to System(s) None

Altitude range (m) 0-750 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato, Taro (Colocasia)
STAPLES SUBDOMINANT	Banana, Coconut
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Amaranthus spp., Corn, Ferns, Kumu musong, Lowland pitpit, Pumpkin tips, Bean (snake), Taro leaves
FRUITS	Mango, Pawpaw, Pineapple, Sugarcane, Ton, Watermelon, Pomelo, Watery rose apple
NUTS	Breadfruit, Galip, Java almond, Pao, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	>15 years
CROPPING PERIOD	1 planting
R VALUE	5 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Very significant
CROP SEGREGATION	Minor
CROP SEQUENCES	Minor
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Significant

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Coconuts	Very significant
2 Cocoa	Significant
3 Fresh food	Significant
4 Betel nut	Minor
5 Fish	Minor
6 Oil Palm	Minor

Water Management:

DRAINAGE	None
IRRIGATION	None

Soil Management:

PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None

Mounding Techniques:

VERY SMALL MOUNDS	Very significant
SMALL MOUNDS	Minor
MOUNDS	None
LARGE MOUNDS	None

Garden Bed Techniques:

BEDS SQUARE	None
BEDS LONG	None

Other Features:

FENCES	Very significant
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	None

OTHER AGRONOMIC PRACTICES

OTHER DOCUMENTATION

Survey description

In September-October 1971, a road traverse on the Boluminski Highway south of Kavieng, with garden visits at Mangai, Fissoa, Konos, Lamassong and Konongusgus villages on the east coast, and Panana village on the west coast (3 days); and Manggai and Mongop High Schools (1 day). In December 1981, a road traverse with observations at Lamassong village. In December 1984, road traverse on the Boluminski Highway south of Kavieng, with garden visits at Lemusmus village on the west coast, and Tandes, Lemeris and Silom villages on the east coast (one and a half days). In July 1995, road traverse on the Boluminski Highway with garden visits at Madina, Mangai, Lamalawa and Bol villages on the east coast, and Lemusmus village on the west coast (1 day).

Boundary definition

The northwestern boundary with System 1706 was determined by traverses on the Boluminski Highway, and the trans-island road to Kaut village. The northwestern boundary with System 1705 was determined by a traverse on the Kavieng-Kaut road, and information from villagers at Kaut. The southern inland boundary with System 1708 was determined by walking and vehicle traverses from the east coast to the Lelet Plateau, and extrapolated along the 750 m contour. In the south, the east coast boundary with System 1709 was determined by a road traverse on the Boluminski Highway, and the west coast boundary with System 1709 by a road traverse on the west coast road between Labur and Kono villages.

Notes

This system is distinguished, in the northwest, from both System 1705, where sago is the most important food produced, and from System 1706, where there are no dominant staples, and the fallow vegetation is short woody regrowth, 5-10 years old. It differs from System 1708 located above 750 m on the Lelet Plateau, where there are no subdominant staples, and the fallow vegetation consists of ferns, grass and short woody regrowth, 5-15 years old. It also differs from System 1709 to the southeast, where taro is replaced by yam (D. esculenta) as a dominant staple, and the fallows are short woody regrowth, 5-15 years old. It is distinguished from System 1714 on the islands of the Tabar Group, where cassava replaces taro as a most important crop.

Human occupation of this part of New Ireland began at least 14,000 years ago, as shown by the major prehistoric sites at Balof and Panakiwuk (Allen et al. 1988, 1989; Marshall and Allen 1991; White et al. 1991). Recent analyses of use-wear and residues on stone and shell tools excavated at Balof showed no evidence of Colocasia taro, but did show traces of other aroids such as possibly swamp taro and Alocasia taro (Barton and White 1993). Faunal evidence from these sites suggest that several animals were introduced by people to New Ireland thousands of years ago (Flannery and White 1991; Flannery et al. 1988). An early study at Pinikidu showed that several species of shellfish which were exploited previously are no longer part of the diet (R.B. Clay 1974, 6-7). The full implications of this long period for human use of the New Ireland environment have yet to be understood, though it is likely that agriculture has a considerable history.

Over the last 100 years, three major changes have affected land use:

1. The forced resettlement, by the German administration, of all inland populations, except those living on the Lelet Plateau, to the coastal strip (eg Fatmilak village, Young 1977, 361; Lokon village, Jessep 1980a; 1980b; White and Downey 1980; White et al. 1991, 47; R. B. Clay 1972), thus reducing agricultural use of inland areas, and increasing pressure on the coastal zone. (Although the boundary of this system with System 1708 has been drawn at 750 m, there is currently little land use between about 250 m and 750 m.) Inland of Lesu village, and at other locations, past land usage is indicated by heaped stones (White and Downey 1980). In 1969, White also reported (Papua New Guinea Museum Site EBG) what appeared to be earth mounds 1 m high and covering an area of some 10 m by 50 m, at the northern end of the Lauan Valley. These may be evidence of past land use patterns, and perhaps similar to the mounds reported in Systems 1703, 1704 and 1705. Swadling (1991, 554) compared these Lauan mounds to apparently similar ones in West New Britain Province and suggested that they may have functioned as long term field markers. Previously, there was an ecologically based exchange of coastal products against inland ones: seaweed, salt, fish and coconuts moving inland against taro, green vegetables, tobacco, yam and betel nut moving to the coast (B.J. Clay 1977, 19). Currently, coastal people from Pinikindu, Lamasong and other villages visit the Lelet Plateau to buy taro for mortuary feasts (Eves 1994, 1).

2. A substantial decline in population during the first 40 years of the 20th century (Ring and Scragg 1973); and

Notes continued

3. The planting of very large areas of export tree crops (initially coconut, later cocoa, and most recently oil palm) under both plantation and smallholder control.

The resident population of this system includes considerable numbers of Papua New Guineans from other provinces, many of whom originally came to New Ireland to work on plantations. There has been a major increase in the consumption of imported foods associated especially with the great rise of cash cropping after World War II. As early as 1950, imported foods, in particular rice, had already become very important along the east coast, although taro, yam and sweet potato were reported as the most common foods (Massal 1951, 6, 10-11). For two year old children in 1950, sweet potato and taro were the most important foods, followed by rice, then yam, pawpaw and a little cassava (Massal 1951, 38-39). By 1967, Beney (1980, 60-61) noted that cash cropping had resulted in substantial reductions in garden areas. Although difficult to quantify, the current extent of dependence on purchased foods is probably about 30 per cent of requirements.

Descriptions of agriculture include both regional surveys (Bourke 1971; Dignan 1981; Woodhouse n.d.; Hide 1985), and five village studies (B.J. Clay 1977, 1986; Jessep 1977, 1980a, 1980b, 1987; Powdermaker 1971; Brouwer 1980; Young 1977, pers. comm., 1985).

Taro is said to have been the major crop before the colonial period. Probably since at least 1950 (Massal 1951), it is generally agreed that sweet potato and taro have been the two most important crops, with some variation in their relative importance both spatially and through time. In the Konos area, Bourke (1971, 3-4) observed that sweet potato was the main crop near the coast, while taro was the main crop in most inland gardens; north of Konos, sweet potato and taro were of equal importance. In 1981, sweet potato was described as the main crop along the coastal fringe on both east and west coasts (Croyden 1981, 1). In 1984, sweet potato and taro were described as joint staple crops (Hide 1985). Evidence from five village studies between 1929 and 1980 is very similar, except that the earliest study, at Lossu village (Lesu) in 1929, reported taro as the staple with no mention of sweet potato (Powdermaker 1971, 165). At Pinikindu village, in 1970-71 and 1979, taro and sweet potato were the two major staples, usually planted in separate gardens (B.J. Clay 1977, 16; 1986, 83-84). At Lokon village in 1974-75, and 1980, taro was the staple crop, with sweet potato, cassava and yams of less importance (Jessep 1977, 12). At Lemeris and Panatgin villages in the 1970s, gardens usually contained a main crop of either taro or sweet potato, with other crops such as yams, cassava, sugarcane, corn, banana, pawpaw and aibika (Brouwer 1980, 30-31). At Fatmilak/Bol village in 1976, sweet potato was the main crop in most gardens, though there was also some taro, Chinese taro and cassava (E. Young, pers. comm. 1985).

The status of sago has also varied both by place and time. In the 1920s it was described as a wild food, primarily used in times of scarcity by villages between Kavieng and Konos (Chinnery n.d., 45), which was still the case in 1971 (Bourke 1971, 6). In 1984 and 1995, the boundary for sago processing for food was placed at about the villages of Bol and Tandes, just to the north of Konos. At Pinikidu village, just to the south of Konos, sago was no longer produced by 1970 (B.J. Clay 1977, 20), and at Lokon further south on the west coast, sago was only used for thatching (Jessep 1977, 12). Villagers in 1995 reported that people previously living inland had then lacked sago, but had subsequently planted some after removal to the coast. In addition to the generally minor occurrences of other crops such as cassava, yam, Chinese taro and Alocasia taro, swamp taro was also recorded growing just to the north of Konos at Lamassong village in 1971 (Bourke 1971, 6), and at Tandes village in 1984 (Hide 1985), and to the south of Konos in 1981. More D. alata yam is reported than D. esculenta, but very little of either.

Most accounts also agree that there is usually only a single planting of taro (though taro may be followed by a further planting of sweet potato before fallow), but there may be two or more plantings of sweet potato before a long fallow (Bourke 1971, 5; Croyden 1981, 1, 9; Powdermaker 1971,165; B.J. Clay 1977, 16; 1986, 83-84; Jessep 1977, 12). Reported fallow periods include 10-20 years (Bourke 1971, 5); 6-10 years (Powdermaker 1971, 165); 10 or more years (B.J. Clay 1986, 84: correcting the figure of 2-3 years given earlier, B.J. Clay 1977, 16; see also Chowning 1980, 353), and 5 to many more years (Jessep 1977, 12). From the 1970s onwards, it has commonly been noted that food crops are grown concurrently with newly planted coconuts and cocoa, and recently oil palm, implying that considerable areas have not reverted to fallow but have been converted to export tree crops. Typically, separate gardens are made for taro and sweet potato (often reflecting different perceptions of soil requirements), but where they are both planted in the

Notes continued

same garden, they are usually in separate sections. A taro crop may be followed by a planting of sweet potato. Gardens are typically divided internally by wooden or bamboo plot dividers, and bamboo fencing is general. Households are reported to have several gardens at different stages of maturity, located at distances from villages ranging from very close (Jessep 1977, 12), to as much as two hours walk away (B.J. Clay 1986, 83-4).

On both east and west coasts, villages are surrounded by extensive areas of arboriculture, which, though dominated by coconut, also contain a wide range of other fruit and nut crops in addition to those included in the crop lists. Peekel (1984) is an important historical and linguistic source for the ethnobotany of the Lamekot area (40 km south of Kavieng), dating from the period 1911-42.

From the 1950s on, copra has been the major source of cash income. Cocoa was planted later, but generally on a smaller scale. By the 1970s, household annual incomes derived largely from copra were reported in the K200-500 range; food and betel nut sales were limited, with only irregular visits to urban markets and use of roadside stalls (B.J. Clay 1977, 17, 19; Jessep 1977, 12; Young 1977, 366). Logging took place in the period 1975-79 inland of Bol and Lamalava villages. Currently, there is a Timber Rights Purchase in central New Ireland extending from Katedan River to Nabuto Bay in Konos and Namatanai Districts.

During the 1980s, a major oil palm industry was established in New Ireland based on both an estate sector, and, to a lesser extent, a smallholder one. The estate sector has incorporated some 28 previously established plantations on the east coast with a total area of 7276 ha. Oil palm (4461 ha planted by late 1994) is the sole crop on 19 estates between Kapsu in the north and Kabil in the south; cocoa (1054 ha) is the sole crop on five estates to the south of Kabil; and both crops are grown on a further two estates at Lamasong and Lamerika. In the oil palm smallholder sector, by mid 1995, some 390 growers had planted nearly 600 ha. On the east coast, in 36 villages between Ngavalus village in the north to Konos in the south, there were some 296 growers with 522 ha of oil palm planted. On the west coast, in 10 villages between Lavolai in the north and Namasalang in the south, there were 93 growers with 77 ha.

Marine products are a minor income source. They include sales of lobsters (especially in the East Coast Kara Nalik census division between Lakurumau and Paruai villages), with small amounts of mudcrab, oysters, bêche-de-mer and fish. Fishing and the collection of marine foods (shellfish, seaweed), however, provide regular food supplements, though varying by place and season.

National Nutrition Survey 1982/83

197 families from 15 villages were asked in September, October or December 1982 what they had eaten the previous day. 87 per cent reported eating coconut, 53 per cent sweet potato, 26 per cent sago, 20 per cent taro, 15 per cent banana, 11 per cent cassava, 4 per cent yam and 2 per cent Chinese taro. 84 per cent reported eating rice. 39 per cent reported eating fresh fish. This is similar to the crop pattern, except for the relatively high sago consumption and low taro consumption. These differences may have been due to the 1982 drought.

Main References

Bourke, R.M. 1971 New Ireland food crop survey. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.

Clay, B.J. 1977 Pinikindu: Maternal Nurture, Paternal Substance. Chicago, University of Chicago Press.

Hide, R.L. 1985 Notes on subsistence agriculture (farming systems) in West New Britain and New Ireland Provinces: report of a field trip to Papua New Guinea 14 November 1984 to 14 December 1984. Unpublished report, Division of Water and Land Resources, Commonwealth Scientific and Industrial Research Organization, Canberra.

Other References

Allen, J., C. Gosden, R. Jones and J.P. White 1988 Pleistocene dates for the human occupation of New Ireland, Northern Melanesia. Nature 331, 707-709.

Allen, J., C. Gosden and J.P. White 1989 Human Pleistocene adaptations in the tropical island Pacific: recent evidence from New Ireland, a Greater Australian outlier. Antiquity 63, 548-561.

Barton, H. and J.P. White 1993 Use of stone and shell artifacts at Balof 2, New Ireland, Papua New Guinea. Asian Perspectives 32, 2, 169-181.

Other References continued

Baseden, S.C. and P.J. Southern 1959 Evidence of potassium deficiency in coconut palms on coral-derived soils in New Ireland from analysis of nut waters, husks, fronds and soils. Papua and New Guinea Agricultural Journal 11, 4, 101-115.

Beney, J.K. 1980 Coastal subsistence of the mainland, Kavieng District. In, Six studies in subsistence agriculture. Extension Bulletin No. 11. Port Moresby, Department of Primary Industry, 45-64.

Billings, D.K. 1971 Styles of culture: New Ireland and New Hanover. PhD thesis, University of Sydney, Sydney.

Bourke, R.M. 1981 Food shortages in New Ireland Province. Unpublished letter to PRDO, Division of Primary Industry, Kavieng.

Brouwer, E.C. 1980 'A malangan to cover the grave': funerary ceremonies in Mandak. PhD thesis, University of Queensland, Brisbane.

Charles, A.E. 1959a Coconut experiment work in New Ireland. I. Field survey and introduction. Papua and New Guinea Agricultural Journal 11, 4, 89-94.

Charles, A.E. 1959b Coconut experiment work in New Ireland. II. Progress report on field trials. Papua and New Guinea Agricultural Journal 11, 4, 116-120.

Charles, A.E. and L.A. Douglas 1965 Coconut experiment work in New Ireland. III. Progress of fertilizer trials 1958-1964. Papua and New Guinea Agricultural Journal 17, 2, 76-86.

Chinnery, E.W.P. n.d. Studies of the native population of the east coast of New Ireland. Anthropological Report No. 6, Government Printer for Territory of New Guinea, Canberra.

Chowning, A. 1980 Review of 'Pinikindu: Maternal Nurture, Paternal Substance' by B.J. Clay (1977). Journal of the Polynesian Society 87, 3, 353.

Clay, B.J. 1986 Mandak Realities: Person and Power in Central New Ireland. New Brunswick, Rutgers University Press.

Clay, R.B. 1972 The persistence of traditional settlement pattern: an example from central New Ireland. Oceania 43, 40-53.

Clay, R.B. 1974 Archaeological reconnaissance in central New Ireland. Archaeology and Physical Anthropology in Oceania 9, 1, 1-17.

Croyden, R. 1981 Report of trip to New Ireland. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.

Dignan, C. 1981 DPI Rural Survey New Ireland Province 1979/80: report on the nutrition and food garden surveys. Unpublished report, Department of Primary Industry, Kavieng.

Eves, R. 1994 Seating the place: magic and embodiment on the Lelet Plateau, New Ireland (Papua New Guinea). PhD thesis, Australian National University, Canberra.

Flannery, T.F., P. Kirch, J. Specht and M. Spriggs 1988 Holocene mammal faunas from archaeological sites in island Melanesia. Archaeology in Oceania 23, 89-94.

Flannery, T.F. and J.P. White 1991 Animal translocation. National Geographic Research and Exploration 7, 1, 96-113.

Godin, P. 1980 Note sur la production des malanggan en Nouvelle-Irlande de 1870 à 1914. Journal de la Société des Océanistes 65, 35, 283-285.

Golson, J. 1991 Two sites at Lasigi, New Ireland. In Allen, J. and C. Gosden (eds), Report of the Lapita Homeland Project. Occasional Papers in Prehistory No. 20. Canberra, Research School of Pacific Studies, Australian National University, 244-259.

Gosden, C., J. Allen, W. Ambrose, D. Anson, J. Golson, R. Green, P. Kirch, I. Lilley, J. Specht and M. Spriggs 1989 Lapita sites of the Bismarck Archipelago. Antiquity 63, 561-586.

Jessep, O.D. 1977 Land tenure in a New Ireland village. PhD thesis, Australian National University, Canberra.

Küchler, S. 1993 Landscape as memory: the mapping of process and its representation in a Melanesian society. In Bender, B. (ed), Landscape: Politics and Perspectives. Providence and Oxford, Berg, 85-106.

Jessep, O. 1980a Land and spirits in a New Ireland village. Mankind 12, 4, 300-310.

Jessep, O. 1980b Land demarcation in New Ireland. Melanesian Law Journal 8, 1-2, 112-133.

Jessep, O. 1987 Pigs, children and land among the Barok of New Ireland. Land Studies Centre, Occasional Paper 87/1, University of Papua New Guinea, Port Moresby.

Küchler, S. 1993 Landscape as memory: the mapping of process and its representation in a Melanesian society. In Bender, B. (ed), Landscape: Politics and Perspectives. Providence and Oxford, Berg, 85-106.

Lomas, P. 1981 The early contact period in northern New Ireland (Papua New Guinea): from wild frontier to plantation economy. Ethnohistory 28, 1, 1-21.

Other References continued

Manning, M. 1991 Development and performance of management agencies in Papua New Guinea agriculture. Discussion Paper No. 45, Institute of National Affairs, Port Moresby.
Marshall, B. and J. Allen 1991 Excavations at Panakiwuk Cave, New Ireland. In Allen, J. and C. Gosden (eds), Report of the Lapita Homeland Project. Occasional Papers in Prehistory No. 20. Canberra, Research School of Pacific Studies, Australian National University, 59-91.
Massal, E.L. 1951 Researches into nutrition and alimentation: report on investigations carried out by Miss S. Malcolm in 1950, prepared from the preliminary reports. Research Projects H.2-H.5, South Pacific Commission, Noumea.
Peekel, P.G. 1984 Flora of the Bismarck Archipelago for Naturalists. Lae, Office of Forests, Division of Botany.
Powdermaker, H. 1971 Life in Lesu: The Study of a Melanesian Society in New Ireland. New York, W.W. Norton and Company.
Ring, A. and R. Scragg 1973 A demographic and social study of fertility in rural New Guinea. Journal of Biosocial Science 5, 89-121.
Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.
Sack, P. and D. Clark 1980 German new Guinea: The Draft Annual Report for 1913-14. Canberra, Department of Law and Research School of Social Sciences, Australian National University.
Sharrock, S.L. 1989 Report on fourth IBPGR/QDPI banana germplasm collecting mission to Papua New Guinea: 4 June to 9 July 1989. Consultant's report, Maroochy Horticultural Research Station, Nambour.
Sumbak, J.H. 1971 Progress of New Ireland fertilizer trials 1964 to 1970. Papua New Guinea Agricultural Journal 22, 2, 77-86.
Swadling, P. 1991 Garden boundaries as indicators of past land-use strategies: two case studies from coastal Melanesia. In Pawley, A. (ed), Man and a Half: Essays in Pacific Anthropology and Ethnobiology in Honour of Ralph Bulmer. Auckland, The Polynesian Society, 550-557.
Van Wijk, C.L. 1959 Reconnaissance soil survey - east coast New Ireland. Papua and New Guinea Agricultural Journal 11, 4, 95-100.
White, J.P. and J.E. Downie 1980 Excavations at Lesu, New Ireland. Asian Perspectives 23, 2, 193-220.
White, J.P., T.F. Flannery, R. O'Brien, R.V. Hancock and L. Pavlish 1991 The Balof shelters, New Ireland. In Allen, J. and C. Gosden (eds), Report of the Lapita Homeland Project. Occasional Papers in Prehistory, No. 20. Canberra, Research School of Pacific Studies, Australian National University, 46-58.
Woodhouse, S.D. n.d. DPI New Ireland Crop Survey: district breakdown of data. Unpublished report, Department of Primary Industry, Kavieng.
Young, E.A. 1977 Simbu and New Ireland migration. PhD thesis, Australian National University, Canberra.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 8	**Subsystem No.** 1 **of** 1
Districts 4 Konos	**Subsystem Extent** 100 %	**Area (sq km)** 48
Population 443	**Population density** 9 **persons/sq km**	**Population absent** 20 **%**

System Summary

Located on the Lelet Plateau in the centre of New Ireland. After long fallows of 5-10 years, a mixed fallow vegetation of tree ferns, grass and short woody regrowth is cleared, dried and burnt. Gardens are not fenced, but internal plots are defined with wooden dividers. Taro and sweet potato are the most important crops; other crops are banana, cassava and Chinese taro. A single planting of either sweet potato or taro is most common. However, a planting of sweet potato sometimes follows a taro crop and, more frequently, a first sweet potato crop. Taro and sweet potato are ideally grown in separate gardens, but a quarter of gardens may contain both where they are planted in separate sections. Sweet potato is planted in very small mounds. Household gardens are common.

Extends across provincial border to System(s) None

Altitude range (m) 750-1000 **Slope** Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	Sweet potato, Taro (Colocasia)
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sweet potato, Taro (Colocasia)
OTHER VEGETABLES	Aibika, Chinese cabbage, Choko tips, Corn, Cucumber, Ferns, Ginger, Kumu musong, Spring onion, Taro leaves
FRUITS	Malay apple, Mango, Orange, Pawpaw, Pineapple, Sugarcane
NUTS	None
NARCOTICS	Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Grass/woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	1 planting
R VALUE	9 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Very significant
CROP SEGREGATION	Minor
CROP SEQUENCES	Minor
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Significant

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	Minor

CASH EARNING ACTIVITIES

1 Fresh food	Very significant
2 Orchids	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	Minor
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	Minor
Mounding Techniques:	
VERY SMALL MOUNDS	Very significant
SMALL MOUNDS	None
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	Minor
Other Features:	
FENCES	None
STAKING OF CROPS	None
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Minor
SEASONAL SEC'DARY CROPS	None

OTHER DOCUMENTATION

Survey description

In 1974, 1975 and 1976 visits (for other purposes) of 10 days, 4 weeks and one week respectively, with walking traverses from the east coast to the west coast over the Lelet Plateau. In December 1981, and December 1984, road traverses from Boluminski Highway to the Lelet Plateau (half days). In July 1995, road traverse from Highway to Lenkamen village (quarter day).

Boundary definition

The northern boundary with System 1707 was determined by walking and vehicle traverses from the east coast to the Lelet Plateau, and extrapolated along the 750 m contour.

Notes

This is the only current system at this altitude in New Ireland. It is distinguished from System 1707, below 750 m, where banana and coconut are important crops, and the fallow vegetation is typically tall woody regrowth; and from System 1709 to the southeast, where taro is replaced by yam (D. esculenta) as a dominant staple and the fallows are short woody regrowth.

Accounts of agriculture include reports from a series of short visits over the last 20 years, and an anthropological account from 1990-91. The main change over this period was a decline in the importance of taro, and the growing significance of sweet potato. Bourke visited the Lelet Plateau four times between 1974 and 1981 (in 1974 for 10 days, 1975 for 4 weeks, 1976 for 1 week and 1981 for 1 day), noting in particular that while taro was the most important food during the 1970s, by late 1981 sweet potato had increased in importance to also become a most important food. By then it was planted after a taro crop in about half the gardens. This was noted as early as September 1978, when a four day survey by Diploma students from Vudal Agricultural College reported taro as occupying 80-90 per cent of (first year) gardens: following the harvesting of taro, gardens were usually replanted with sweet potato (Thompson and Nadile n.d., 9). In June 1981, Croyden (1981, 9-11) described taro as the first, and sometimes the second crop, followed by sweet potato. In September 1981, Bourke noted that taro was almost always the first crop. Gardens on doline slopes were planted to taro and sweet potato, those on doline bottoms to taro only (Bourke field notes 1981, 129). By 1990-91, Eves considered that sweet potato and taro were the two most important crops, with consumption of the two about equal (1994, xii, 203). Purchased rice was also by then an increasingly important staple food, and tinned fish or meat were eaten daily (Eves 1994, xii). Lelet people told Eves that taro had declined significantly in recent years (Eves 1994, 1). In part at least, the decline of taro has been due to blight, which was seen by both Croyden and Bourke in 1981 (Croyden 1981, 9-11).

In 1975, besides taro and sweet potato, taro gardens included some banana and aibika, and small plantings of cabbage and potato (Brown et al. 1975, 106). Around hamlets, oranges and banana were planted, and, in gully bottoms, there were plantings of Chinese taro and small perennial stands of Australimusa banana. In 1979, other crops included a mixture of cassava, yam, corn, banana, aibika, shallots, beans and cucumber (Thompson and Nadile n.d., 9). In September 1981, sugarcane was sometimes planted after sweet potato: other crops included aibika, Spanish onions, cucumber, a little yam (D. alata) and tobacco; and DPI gardens near Limbin village included a large range of introduced crops such as tomato, lettuce, pak choi, long beans, potato and cauliflower. In 1990-91, cassava, banana, Chinese taro and Alocasia taro were also grown (Eves 1994, xii, 174).

In 1981, Bourke recorded most gardens in the 900-1000 m range, though some were as low as 780 m. Ferns were a major feature of fallow regrowth, and fallow periods were considered to be short (Brown et al. 1975, 106). In 1984, fallow length were estimated at 5-10 years.

Croyden (1981, 9-11) reported soil retention in the form of saplings at 6-8 pace intervals along the contours. He also distinguished between a large community garden of 0.75 ha, and individual family gardens of 0.2-0.5 ha scattered at distances of up to a one hour walk from hamlets.

In the early 1990s, October to January was considered the usual period for a reduced supply of taro (Eves 1994, 1,169).

Because of altitude (too high for copra), and the lack of road access until 1979, the population on the Lelet Plateau was largely peripheral to the development of the copra dominated cash economy on the coast (Eves 1994, 32). Although market gardening for the Kavieng market began as early as the 1920s (Eves 1994, 34), and was one of the major sources of cash income in 1978 (Thompson and Nadile n.d.,10), it expanded greatly after the establishment of road

Notes continued

access in 1979. Before 1940, cash was earned by migrant labour, and by purchasing some areas of coastal land to grow the low altitude crops of coconut, betel and breadfruit. For instance, Limbin villagers bought land at Kantebu to grow these crops, though by 1990 copra was no longer being made (Eves 1994, 32). There have been unsuccessful attempts to establish coffee, cocoa, cardamom and rice as cash crops on the Plateau (Eves 1994, 35; Thompson and Nadile n.d., 10). During the 1980s, there were several projects to support and encourage vegetable production on the Plateau, with a DPI Base Camp located at Limbin. In 1995, sales of fresh food, including taro, sweet potato and a wide range of vegetables, mainly at Kavieng market, were the major source of cash income. Orchid plants were also sold at Kavieng. In addition, taro is also grown for sale to coastal people (largely the village of Pinikindu and Lamasong in System 1707, Eves 1994, 1) for use in mortuary feasts. In return, Lelet people, who keep few pigs, purchase their ceremonial requirements from coastal people (Eves 1994, 243).

National Nutrition Survey 1982/83

33 families from 3 villages were asked in October 1982 what they had eaten the previous day. 82 per cent reported eating sweet potato, 67 per cent coconut, 33 per cent taro, 18 per cent banana, 3 per cent cassava, 3 per cent yam and none Chinese taro or sago. 64 per cent reported eating rice. 9 per cent reported eating fresh fish. This is similar to the crop pattern, except for the high consumption of coconut which was presumably brought up from the coastal area, and the relatively low consumption of taro.

Main References

Eves, R. 1994 Seating the place: magic and embodiment on the Lelet Plateau, New Ireland (Papua New Guinea). PhD thesis, Australian National University, Canberra.

Other References

Bourke, R.M. 1981 Food shortages in New Ireland Province. Unpublished letter to PRDO, Division of Primary Industry, Kavieng.

Brown, A.L., R.M. Bourke and C.H.C. Shannon 1976 Lelet: report of the 1975 New Ireland speleological expedition. Niugini Caver 4, 3, 87-106.

Croyden, R. 1981 Report of trip to New Ireland. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.

Hide, R.L. 1985 Notes on subsistence agriculture (farming systems) in West New Britain and New Ireland Provinces: report of a field trip to Papua New Guinea 14 November 1984 to 14 December 1984. Unpublished report, Division of Water and Land Resources, Commonwealth Scientific and Industrial Research Organization, Canberra.

Thompson, P. and R. Nadile n.d. Community survey of the Lelet Plateau - New Ireland Province. Unpublished report by the 1978 Post Certificate Diploma Group, Vudal Agricultural College, Keravat.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 9	**Subsystem No.** 1 **of** 1
Districts 4 Konos, 5 Namatanai	**Subsystem Extent** 100 %	**Area (sq km)** 811
Population 10,220	**Population density** 13 **persons/sq km**	**Population absent** 16 **%**

System Summary

Located in central New Ireland and centred around Namatanai town. Gardens are mainly cleared from short woody regrowth, 10-15 years old, but there is some use of older, tall woody regrowth. Vegetation is cut, dried and burnt. Gardens are commonly fenced, and then divided into rectangular sections by wooden dividers. Sweet potato and yam (D. esculenta) are the most important crops; taro, banana, yam (D. alata) and coconut are important crops; other crops are cassava, Chinese taro and Alocasia taro. There is some use of separate gardens for the first planting of different crops, but more usually crops are planted in separate sections. There is only one planting of yam or taro, but a further crop of sweet potato or cassava before fallow is common. Two plantings of sweet potato or cassava before fallow are usual. Sweet potato is planted in small mounds. New gardens are usually cleared and planted between July and January. Only some yams (D. esculenta and D. alata) are staked. Household gardens are common.

Extends across provincial border to System(s) None

Altitude range (m) 0-200 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato, Yam (D. esculenta)
STAPLES SUBDOMINANT	Banana, Coconut, Taro (Colocasia), Yam (D. alata)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sweet potato, Taro (Alocasia), Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Amaranthus spp., Corn, Cucumber, Lowland pitpit, Pumpkin tips, Tulip, Valangur, Bean (snake), Taro leaves
FRUITS	Bukabuk, Malay apple, Mango, Pawpaw, Pineapple, Sugarcane, Ton, Watermelon
NUTS	Breadfruit, Galip, Java almond, Pao, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Short woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	2 plantings
R VALUE	17 (low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Minor
CROP SEGREGATION	Significant
CROP SEQUENCES	Significant
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Significant

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Coconuts	Very significant
2 Cocoa	Significant
3 Betel nut	Minor
4 Fresh food	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	None
SMALL MOUNDS	Very significant
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	Significant
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Minor

OTHER DOCUMENTATION

Survey description

In September-October 1971, vehicle traverses on roads in the Namatanai area, with garden visits on the east coast to the south (at Rasese, Namorodu and Sohun villages); on the west coast to the south and west (at Napanta, Rapontamon, Rasirik and Rapito villages); and on the east coast to the north (at Pire, Bo and Belik villages) (2 days). In December 1984, vehicle traverses on roads in the Namatanai area, with garden visits at Namorodu and Balai villages to the south on the east coast, and at Burau village on the west coast (one and a half days). In July 1995, vehicle traverses, with garden visits, on the Boluminski Highway from Dalom village to Namatanai, north on the west coast road to Kono village via Rapontamon village, west and south on the west coast to Napanta and Bom villages, and south on the east coast road via Kisela and Warangansau villages to Siar (two and a half days).

Boundary definition

The northwestern boundaries with System 1707 were determined by road traverses on the Boluminski Highway and on the west coast road between Labur and Kono villages. To the south, the east coast boundary with System 1710 was determined by a road traverse between Namatanai town and Silur station, while the west coast boundary was identified by interviews at Bakak and Bom villages on the west coast, and at Bakom village on the far southeast coast in System 1710.

Notes

This system is distinguished from System 1707 to the northwest, where yam (D. esculenta) is replaced by taro as a dominant staple, and the fallows are tall woody regrowth, more than 15 years old; from System 1708 above 750 m on the Lelet Plateau, where there are no subdominant staples, and the fallow vegetation is a regrowth of short trees, ferns and grass; from System 1710 in the southeast, where yam is replaced by taro as a dominant staple, and the fallows are tall woody regrowth, more than 15 years old; and from System 1711 on the main island of Lihir, where, although the staples are similar, the fallows are taller and older.

The rainfall regime of the Namatanai area has a relatively sharply defined dry season between May and October, which contrasts both with the even distribution of rain to the north towards Kavieng, and the reversed seasonality, with the drier season between November and March, further south (McAlpine et al. 1975; Abeyasekera 1987).

Prehistoric research shows human occupation at Matenkupkum site on the east coast as early as 33,000 years ago, with shellfish remains suggesting a broadly based, hunter-gatherer economy exploiting both marine and terrestrial resources (Allen et al. 1988; Allen et al. 1989, 551, 558-9). At Matenkupkum, fish bones in the earliest levels, and a dense shell midden at 32,000 years before present, are the earliest evidence anywhere in the world for human capture of marine fish (Allen et al. 1989, 552). Faunal evidence from these sites suggest that several animals were introduced by humans to New Ireland (Flannery and White 1991; Flannery et al. 1988). Obsidian, dated at between 12,000 and 20,000 years ago, originated from West New Britain some 350 km to the west, while later obsidian originated from Lou Island in Manus Province (Allen et al. 1989, 554-5). The full implications of this time-depth for human use of the New Ireland environment have yet to be understood.

There are descriptions of agriculture from four regional surveys (Bourke 1971; Dignan 1981 and Woodhouse n.d.; Croyden 1982; Hide 1985), and by five single village studies. Prior to the colonial period, yam (D. esculenta and D. alata) and taro were the staple crops. The major change has been the introduction and increasing importance of sweet potato and cassava. The regional surveys and single village studies indicate variation in the relative importance of the different staple crops between locations, possibly over time during the past 25 years, and also probably between observers. In 1971, Bourke (1971, 3) found that in areas away from the coast, sweet potato was generally the most important crop, with taro a second staple; yams (D. esculenta and D. alata) were present but of less importance. Near the coast around Namatanai, yam (D. esculenta) was most important, followed by yam (D. alata) and sweet potato, with taro less important. By Belik village on the east coast in the north, sweet potato was the most important crop, followed by taro, with both species of yam a poor third, although they were grown as the main crop by some villagers. Banana was a minor staple. In 1982, Croyden (1982, 1) described yam (D. esculenta), taro and banana as the main crops near Namatanai, and, for the area between Napantah village and the west coast, taro as the major crop, with some sweet potato. In late 1984, the main crops were yam (D. esculenta and D. alata) plus sweet potato and cassava (Hide 1985).

A broadly similar pattern of variation is shown by the single village studies conducted between about 1975 and 1985. At Borau village in the mid 1970s, the staples were reported as yam, sweet potato and coconut (Claydon 1978/79,

Notes continued

145). At the end of the wet season, when the study was conducted, yams were said to be in relatively short supply, taro was being planted, and winged bean and other vegetables were plentiful. Nevertheless, a five day dietary intake survey of one household showed that yam was still the most important food, with rice second, followed by cassava and sweet potato (Claydon 1978/79, 148). At Bom/Ratabu village on the west coast in 1976, the staple foods were yam, sweet potato and taro (E. Young, pers. comm. 1985). In March, sweet potato and yam were both important in Namatanai market. In 1979-81 and 1985, at Kokola village in the west coast Barok area, yam was the most common food, followed by sweet potato (George 1988, 237). For feasts, however, taro was the most prized food, although it was said not to grow well in west coast gardens, except in the vicinity of Kono village where there were richer soils (George 1988, 236). In the east coast village of Bakan in 1979, the Barok speaking villagers regarded themselves as gardeners of yams (both D. alata and D. esculenta), though sweet potato was the most commonly eaten tuber, and taro was also grown (Wagner 1986, 33). The exception appears to be Tekedan village on the far southeast coast, where in 1989-92, taro and sweet potato were described as the main foods and yam received no mention (Bolyanatz 1994, 55).

Observations of fallow type, fallow length and the number of plantings before fallowing during the last 25 years suggest that some intensification has occurred. In 1971, second plantings of sweet potato appeared to be uncommon: near Namatanai, it was only observed in parts of two gardens (Bourke 1971). Fallow periods were estimated as 10-20 years. At Bom/Ratabu village in 1976, yam and taro were only planted once (E. Young, pers. comm 1985). In 1982, in the Namatanai gardens, yam (D. esculenta) was planted first, with taro and banana interplanted 6-8 weeks later. After the first crop, a second crop of sweet potato was planted, and occasionally a third crop (Croyden 1982, 2). Taro was planted on burnt out bamboo clumps. Fallow length was an estimated 7-15 years. In 1984, some second planting of sweet potato and cassava after a first yam crop was evident; fallows were mainly tall woody regrowth, and were estimated as more than 15 years old (Hide 1985).

Staking of yam (D. esculenta and D. alata) is not the customary practise, and, where seen, usually indicates that the gardener originates from the islands of Lihir or Tanga where staking is usual. At Bakan village in 1979, most gardens were fenced, and were subdivided into sections measuring about 5 by 8 m. While sugarcane was interplanted amongst the yam, taro was sometimes planted in separate sections, and bananas were planted on the inside of the fences (Wagner 1986, 34). Traditionally, each household made a sequence of two gardens each year, the first ('a lua') being smaller and made in September, the second ('a sinam') larger in January-February (Wagner 1986, 36-42). In 1979, the largest gardens were made in late January-early February. In 1976, at Bom/Ratabu village, yams were planted in August (E. Young, pers. comm., 1985).

At Kokola village in 1979-81, customary ('gaba') feasts required extra supplies of items such as betel nut, betel pepper and coconuts, as well as foods which were produced in special major gardens scheduled in relation to feast demands (George 1988, 235, 340-341). Pigs were important, with 69 pigs killed one occasion in 1980 (George 1988, 238, 339).

Giant African snails were reported to be a problem in 1971 (Bourke 1971, 8). The 1979 DPI crop survey was told by respondents that food shortages were usual in the period September to December, when the gardens were 'empty' (Woodhouse n.d.). The same survey found that 53 per cent of gardens were fenced, and just over 50 per cent were located less than 30 minutes walk from the gardener's house. In 1982, sweet potato was suffering serious scab damage; taro yields were said to be increased by cutting off old leaves (Croyden 1982, 2).

Fruit and nut trees are an important component of subsistence and many species, besides the commonest ones listed, are grown. Peekel (1984) is an important historical and linguistic source for the ethnobotany of the Namatanai area (Pala language) in the period 1904-1911.

The population resident in this system includes considerable numbers of non-New Ireland born citizens, some of whom originally came to New Ireland as plantation labourers.

Fishing and shellfish collection provide an important part of the diet for coastal villages.

Up to the 1970s, copra was the main source of cash income, with cocoa secondary, and market sales minor (Young 1977, 363, 367). With relatively high rates of migration to work elsewhere, remittances are probably also important (Young 1977, 376, 439-443). In 1979, the DPI crop survey indicated that rice was less important in diets than further north (Dignan 1981; Woodhouse n.d.), but this was not supported by the 1982/83 NNS data shown below. In 1995, copra was still the major income source, followed by cocoa, and market sales of both fresh food and betel nut.

National Nutrition Survey 1982/83

164 families from 15 villages were asked in September or October 1982 what they had eaten the previous day. 87 per cent reported eating coconut, 56 per cent sweet potato, 29 per cent banana, 12 per cent taro, 10 per cent cassava, 10 per cent yam, 7 per cent Chinese taro and none sago. 78 per cent reported eating rice. 15 per cent reported eating fresh fish. This is similar to the crop pattern, except for the low consumption of yam.

Main References

Bourke, R.M. 1971 New Ireland food crop survey. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.

Croyden, R. 1982 Field trip to Namatanai (1-2nd Feb) and Anir Island (4-6th Feb). Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.

Hide, R.L. 1985 Notes on subsistence agriculture (farming systems) in West New Britain and New Ireland Provinces: report of a field trip to Papua New Guinea 14 November 1984 to 14 December 1984. Unpublished report, Division of Water and Land Resources, Commonwealth Scientific and Industrial Research Organization, Canberra.

Other References

Abeyasekera, S. 1987 A classification of seasonal rainfall in Papua New Guinea. Science in New Guinea 13, 1, 1-14.

Allen, J., C. Gosden, R. Jones and J.P. White 1988 Pleistocene dates for the human occupation of New Ireland, Northern Melanesia. Nature 331, 707-709.

Allen, J., C. Gosden and J.P. White 1989 Human Pleistocene adaptations in the tropical island Pacific: recent evidence from New Ireland, a Greater Australian outlier. Antiquity 63, 548-561.

Baseden, S.C. and P.J. Southern 1959 Evidence of potassium deficiency in coconut palms on coral-derived soils in New Ireland from analysis of nut waters, husks, fronds and soils. Papua and New Guinea Agricultural Journal 11, 4, 101-115.

Bolyanatz, A.H. 1994 Legitimacy, coercion, and leadership among the Sursurunga of southern New Ireland. Ethnology 33, 1, 53-63.

Bourke, R.M. 1981 Food shortages in New Ireland Province. Unpublished letter to PRDO, Division of Primary Industry, Kavieng.

Claydon, A. 1978-79 How important a food is winged bean in Papua New Guinea? Science in New Guinea 6, 3, 144-153.

Dignan, C. 1981 DPI Rural Survey New Ireland Province 1979/80: report on the nutrition and food garden surveys. Unpublished report, Department of Primary Industry, Kavieng.

Flannery, T.F., P. Kirch, J. Specht and M. Spriggs 1988 Holocene mammal faunas from archaeological sites in island Melanesia. Archaeology in Oceania 23, 89-94.

Flannery, T.F. and J.P. White 1991 Animal translocation. National Geographic Research and Exploration 7, 1, 96-113.

Friederici, G. 1912 Wissenschaftliche Ergebnisse einer amtlichen Forschungsreise nach dem Bismarck-Archipel im Jahre 1908. II. Beiträge zur Völker- und Sprachenkunde von Deutsch-Neuguinea. Ergänzungsheft Nr. 5, der Mitteilungen aus den Deutschen Schutzgebieten, Ernst Siegfried Mittler und Sohn, Berlin.

George, M. 1988 'A Wosak Maraluon!' the Barok pidik of hidden power, and the ritual imaging of intent and meaning. PhD thesis, University of Virginia, Charlottesville.

Gosden, C. and N. Robertson 1991 Models for Matenkupkum: interpreting a late Pleistocene site from southern New Ireland, Papua New Guinea. In Allen, J. and C. Gosden (eds), Report of the Lapita Homeland Project. Occasional Papers in Prehistory No. 20. Canberra, Research School of Pacific Studies, Australian National University, 20-45.

Manning, M. 1991 Development and performance of management agencies in Papua New Guinea agriculture. Discussion Paper No. 45, Institute of National Affairs, Port Moresby.

McAlpine, J.R., G. Keig and K. Short 1975 Climatic Tables for Papua New Guinea. Division of Land Use Research Technical Paper No. 37, Commonwealth Scientific and Industrial Research Organization, Melbourne.

Peekel, P.G. 1984 Flora of the Bismarck Archipelago for Naturalists. Lae, Office of Forests, Division of Botany.

Sharrock, S.L. 1989 Report on fourth IBPGR/QDPI banana germplasm collecting mission to Papua New Guinea: 4 June to 9 July 1989. Consultant's report, Maroochy Horticultural Research Station, Nambour.

Van Wijk, C.L. 1959 Reconnaissance soil survey - east coast New Ireland. Papua and New Guinea Agricultural Journal 11, 4, 95-100.

Wagner, R. 1986 Asiwinarong: Ethos, Image, and Social Power Among the Usen Barok of New Ireland. Princeton, Princeton University Press.

Woodhouse, S.D. n.d. DPI New Ireland Crop Survey: district breakdown of data. Unpublished report, Department of Primary Industry, Kavieng.

Young, E.A. 1977 Simbu and New Ireland migration. PhD thesis, Australian National University, Canberra.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 10	**Subsystem No.** 1 **of** 1
Districts 5 Namatanai	**Subsystem Extent** 100 %	**Area (sq km)** 483
Population 3,379	**Population density** 7 **persons/sq km**	**Population absent** 13 **%**

System Summary

Located on both east and west coasts of southern New Ireland. Gardens are typically made in tall woody regrowth, more than 15 years old. There is also minor use of short woody regrowth, 6-10 years old, and opportunistic use of recently logged primary forest. Vegetation is cut, dried and burnt. Gardens are commonly fenced, and then divided into rectangular sections by wooden dividers. The most important crops are taro and sweet potato; cassava, banana, and coconut are important crops; other crops are Chinese taro, Alocasia taro and yam (D. alata and D. esculenta). There are usually two plantings before fallow. Taro is never planted twice but may be followed by sweet potato or cassava. Some taro is planted in separate gardens, but is commonly planted in separate garden sections. Sweet potato is planted in very small mounds.

Extends across provincial border to System(s) None

Altitude range (m) 0-300 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato, Taro (Colocasia)
STAPLES SUBDOMINANT	Banana, Cassava, Coconut
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sweet potato, Taro (Alocasia), Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Corn, Ferns, Kangkong, Kumu musong, Lowland pitpit, Pumpkin fruit, Valangur, Bean (snake), Taro leaves
FRUITS	Bukabuk, Malay apple, Mango, Pawpaw, Pineapple, Sugarcane, Ton, Golden apple
NUTS	Breadfruit, Galip, Java almond, Pao, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	>15 years
CROPPING PERIOD	2 plantings
R VALUE	9 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Significant
CROP SEGREGATION	Significant
CROP SEQUENCES	Significant
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Minor

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	Minor
2 Cocoa	Minor
3 Coconuts	Minor
4 Fresh food	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	Very significant
SMALL MOUNDS	None
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	Significant
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	None

OTHER DOCUMENTATION

Survey description

In July 1995, a vehicle traverse from Namatanai south on the east coast road to Silur station; and south from Silur to Bakok village (two and a half days). The west coast, south of Bom village, was not visited but information was obtained by interview at Bom and Balok villages.

Boundary definition

In the north, the east coast boundary with System 1709 was determined by a road traverse between Namatanai town and Silur station, while the west coast boundary with System 1709 was identified by interviews at Bakak and Bom villages on the west coast, and at Bakom village in the southeast.

Notes

This system is distinguished from System 1709 to the northwest, where taro is replaced by yam (D. esculenta) as a dominant staple, and the fallows are short woody regrowth, 5-15 years old; and from Systems 1711 and 1712 in the Tanga and Anir Island groups to the east, where yam (D. esculenta) is again a dominant staple, and where, in System 1712, agriculture is considerably more intensive with shorter fallows.

The southern part of New Ireland was the last part of the region brought under colonial control by the Germans in the late 19th and early 20th Centuries (Sack and Clark 1979, 236). There was still bitter fighting between the inland and coastal people in 1902, and it was only in 1908 that the Germans discovered that 'contrary to what was assumed previously, the interior of southern (New Ireland) is unfortunately only very sparsely populated....The mountain people are dying out and it will not be long before the last man disappears' (Sack and Clark 1979, 290). People from mountain settlements were relocated to new villages on the Siar coast. As late as 1911, some isolated villages in the inland mountains had still not been brought under control (Sack and Clark 1979, 337). The large area of land mapped as very lightly used by Saunders (1993), located inland and north of the Weitim Valley, was reported by villages as unused in recent years.

There are no major descriptions of agriculture, though there is some useful information in the early (1908) account of Lamassa Island on the southwest coast by Friederici (1912, 139-143), and in Albert (1987, 1989) at Matkamlagir and Siar villages on the east coast in 1985-86. At Lamassa, Friederici (1912) noted the absence of yams, the significance of taro, the lack of coconuts, and the prevalence of galip nuts. More generally, he considered that there was no sago throughout this southern part of New Ireland, due to the lack of suitable soil and water conditions. Albert (1987, 135) noted several significant differences between the two villages he worked in: at Matkamlagir, cassava was a more important crop than at Siar where only some households had access to cassava gardens. Correspondingly, at Matkamlagir, there was greater emphasis on exchanges of cooked cassava 'bread' ('gem' or 'kom kom') between households, with each household making 20-30 packets ('pupus') some two-three times per week, and giving approximately one third away to other households (Albert 1987, 134). Although Matkamlagir villagers sold cassava and pigs to people in Siar and other villages to the south, the use of money within villages for food purchases was discouraged (Albert 1987, 136-7). At Siar, some gardens were only 20 minutes away from the village, while at Matkamlagir, all gardens were more than 45 minutes walk away (Albert 1989, 22). In Matkamlagir, all pigs were fenced in, but not in Siar (Albert 1989, 25). There were similarities and differences in labour practices: while all Lak communities used cooperative labour for clearing and planting new gardens (Albert 1987, 139-140), only some (for instance, Matkamlagir but not Siar), used non-kin labourers, paid two to five kina a day to help process copra (Albert 1987, 137; 1989, 24, 26). In both Matkamlagir and Siar villages, work to produce copra and cocoa was shared by men and women, though only men carried the heavy bags to boats and took them to Rabaul to sell (Albert 1987, 139-140).

The rainfall regime in the southern part of New Ireland is one of reversed seasonality; that is, the driest period occurs between November and March rather than June to September. This contrasts with the Namatanai area in System 1709 to the northwest, where there is a relatively sharply defined dry season between May and October (McAlpine et al. 1975; Abeyasekera 1987).

Other foods mentioned by Albert (1987, 136) included sweet potato, greens, galip and 'laka' nuts, fish, turtle and wild pig. Both fishing and hunting (wild pig in particular) are of some importance. Giant leatherback turtles breed in the sands of the Weitim estuary (Albert 1987, 139).

It is possible that yam was previously a more important food than it is currently. In November 1881, one of the survivors of the doomed Marquis de Rays expedition to establish a colony in 1880-82 in the far south of the island

Notes continued
(from Port Praslin on the west coast to the Metlik area on the east), described a journey to trade for food in the Cape Mimias area on the west coast, where they were able to buy yam, taro and other food (Biskup 1974, 56).

Some taro is grown in slowly running water. One planting seen in the vicinity of Maliom village had been made in a gravelly river bed with water 20 cm deep, with plants spaced at 80-100 cm.

Copra was still the main source of income in most of the Lak area up to the mid 1980s (Albert 1987). Unlike most of northern New Ireland, Rabaul not Kavieng has been the major economic centre, with access by sea. However, by 1990 copra was no longer being produced and sold, and remittances had become the main income source for many people, while timber royalties were growing in importance for some villages (Filer 1991a; 1991b, 72). The southeastern coast has been the site of some extensive logging recently. The Lak Timber Rights Purchase area extends from Cape Mimias to the Jau River (see Filer 1991a; 1991b). However, the operations of the logging company, Niugini Lumber (a subsidiary of Rimbunan Hijau), have been the subject of many major complaints (for example, no Environmental Plan from December 1992 to March 1994; undersized logs), and production was sporadic in 1994-95. In 1992, a report on the agricultural potential of the area for the landowner company, Metlak Development Corporation, noted that there had already been a rapid rise in the consumption of purchased food (Woodhouse 1992). Between 1994 and 1996, there was an attempt in the Lak area to establish an Integrated Conservation and Development Project (ICAD) as an alternative to unsustainable commercial logging. This project was funded by a grant from the Global Environment Facility (a fund administered by the UNDP, World Bank and UNEP), but proved unsuccessful and was withdrawn in August 1996. During the survey in 1995, only very little copra was being produced and sold. Some cocoa was being sold, and several new areas of cocoa plantings were seen. There were minor sales of fresh food and betel nut.

National Nutrition Survey 1982/83
27 families from 3 villages were asked in October 1982 what they had eaten the previous day. 93 per cent reported eating coconut, 67 per cent sweet potato, 56 per cent taro, 11 per cent banana, 11 per cent cassava and none Chinese taro, sago or yam. 22 per cent reported eating rice. 37 per cent reported eating fresh fish. This is similar to the crop pattern.

Main References
None.

Other References
Abeyasekera, S. 1987 A classification of seasonal rainfall in Papua New Guinea. Science in New Guinea 13, 1, 1-14.
Albert, S.M. 1987 The work of marriage and of death: ritual and political process among the Lak, southern New Ireland, Papua New Guinea. PhD thesis, University of Chicago, Chicago.
Albert, S. 1989 'Kastom I winim ol lo'? Development and political culture in the Lak electorate, New Ireland. Research in Melanesia 13, 19-29.
Biskup, P. 1974 The New Guinea Memoirs of Jean Baptiste Octave Mouton. Pacific History Series No. 7. Canberra, Australian National University Press.
Filer, C. 1991a Logging or conservation in southern New Ireland. Research in Melanesia 15, 1, 66-75.
Filer, C. 1991b Two shots in the dark: the first year of the Task Force on Environmental Planning in Priority Forest Areas. Research in Melanesia 15, 1, 1-48.
Friederici, G. 1912 Wissenschaftliche Ergebnisse einer amtlichen Forschungsreise nach dem Bismarck-Archipel im Jahre 1908. II. Beiträge zur Völker- und Sprachenkunde von Deutsch-Neuguinea. Ergänzungsheft Nr. 5, der Mitteilungen aus den Deutschen Schutzgebieten, Ernst Siegfried Mittler und Sohn, Berlin.
McAlpine, J.R., G. Keig and R. Falls 1983 Climate of Papua New Guinea. Canberra, Commonwealth Scientific and Industrial Research Organization in association with Australian National University Press.
McAlpine, J.R., G. Keig and K. Short 1975 Climatic Tables for Papua New Guinea. Division of Land Use Research Technical Paper No. 37, Commonwealth Scientific and Industrial Research Organization, Melbourne.
Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.
Woodhouse, S. 1992 Agricultural potential in the Lak area of New Ireland. Patrol Report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 11	**Subsystem No.** 1 **of** 1
Districts 5 Namatanai, 6 Lihir	**Subsystem Extent** 100 %	**Area (sq km)** 301
Population 5,841	**Population density** 19 **persons/sq km**	**Population absent** 9 **%**

System Summary

Located on the islands of Babase and Ambitle in the Anir group, the islands of Malendok, Lif and Tefa in the Tanga group, and the main island of Lihir. The fallow vegetation is typically tall woody regrowth, more than 15 years old, but there is some use of short woody regrowth, 5-15 years old. Tall bamboo is a preferred component of fallow. Vegetation is cut, dried and burnt. Most gardens are fenced. The cultivated area is thoroughly cleared and divided into plots. Yam (D. esculenta) and sweet potato are the most important crops; yam (D. alata), cassava and coconut are important crops; other crops are banana, taro, Chinese taro and, on Lihir only, sago. Yam is only planted once, usually followed by a planting of sweet potato, cassava or Chinese taro before fallow. Two plantings of sweet potato or cassava are made before long fallow. Root crops are planted in separate garden sections. Sweet potato is planted in very small mounds or small mounds. Yams (D. alata and D. esculenta) are staked. New yam gardens are cleared and planted between June and January. Fruit and nut tree crops are important. Fish is an important food in some locations.

Extends across provincial border to System(s) None

Altitude range (m) 0-400 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato, Yam (D. esculenta)
STAPLES SUBDOMINANT	Cassava, Coconut, Yam (D. alata)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Amaranthus spp., Corn, Kumu musong, Lowland pitpit, Pumpkin tips, Valangur, Bean (snake), Taro leaves, Kalava
FRUITS	Bukabuk, Malay apple, Mango, Pawpaw, Pineapple, Sugarcane, Ton, Golden apple
NUTS	Breadfruit, Galip, Java almond, Pao, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	>15 years
CROPPING PERIOD	2 plantings
R VALUE	9 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Minor
CROP SEGREGATION	Very significant
CROP SEQUENCES	Significant
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Minor

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	Minor
2 Cocoa	Minor
3 Coconuts	Minor
4 Fish	Minor
5 Fresh food	Minor

Water Management:

DRAINAGE	None
IRRIGATION	None

Soil Management:

PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None

Mounding Techniques:

VERY SMALL MOUNDS	Minor
SMALL MOUNDS	Significant
MOUNDS	None
LARGE MOUNDS	None

Garden Bed Techniques:

BEDS SQUARE	None
BEDS LONG	None

Other Features:

FENCES	Very significant
STAKING OF CROPS	Significant
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Minor

OTHER AGRONOMIC PRACTICES

OTHER DOCUMENTATION

Survey description

In July 1995, in the Anir group, vehicle traverses on most roads on Babase Island, with interviews and visits at Banakin and Bulam villages (1 day); by canoe from Babase to Ambitle Island, with a vehicle traverse around most of the island with garden visits and interviews at Waranbana, Balankolen and Fatkasang villages (1 day). In the Tanga group, by dinghy from Boang Island to Balanwarasau village on Malendok Island, with a walking traverse across the island to the northwest coast (half day). The small islands of Lif and Tefa were not visited; information was obtained from interviews on Boang Island. On Lihir Island, also in July 1995, a vehicle traverse from Londolovit station to Zuen village in the north, with garden visits at Kunaie and Zuen villages; a vehicle traverse from Londolovit, south to Samo village on the southwest coast, with garden visits at Lisel, Tubuapil, Komat, Pangoh and Samo villages (2 days).

Boundary definition

These islands were allocated to a separate system after visits to Babase, Anir, Malendok and Lihir Islands; and after surveys of Boang Island (System 1712), the northern islands of the Lihir group (System 1713), the Tabar group (System 1714), and the nearby coastal areas of New Ireland (Systems 1709 and 1710).

Notes

This system is similar to System 1709, in the central part of New Ireland, in terms of staple crops, but there fallow vegetation is short woody regrowth and fallow periods are shorter. It is distinguished from System 1710 on the southern half of New Ireland, where taro is one of the dominant staples, and from System 1714, on the Tabar group of islands to the north, where the most important crops are cassava and sweet potato, and fallow periods are shorter. While generally similar in terms of crops and some other features to both System 1712, on Boang Island in the Tanga group, and to System 1713, on the small islands of Mali, Masahet and Mahur to the north of Lihir Island, it is distinguished from them because in both these systems agriculture is much more intensive, fallow vegetation is short woody regrowth, and fallow periods are shorter.

This system includes both Babase and Ambitle Islands in the Anir group, and Malendok, Lif and Tefa Islands in the Tanga group, and the main island of Lihir. The overall population density is approximately five times less than that on Boang Island (System 1712) and that on the northern Lihir Islands (System 1713). Babase Island is flat, raised coral, while Ambitle and Malendok are hilly. Lihir is a volcanic island (Hughes and Sullivan 1988). On Lihir, Ambitle and Malendok, most agriculture is currently located on the coastal fringes, with landuse in the interior of the islands being considerably less intensive (Saunders 1993). Settlement patterns have changed this century: from dispersed hamlets to villages or camps during the colonial period, and, more recently, a partial return to the dispersed pattern (Foster 1995, 83). It is likely these changes have also been reflected in changes in the pattern of land use intensity. On Lihir in 1985, most food gardens were located just inland of the coconut belt, though in the south of the island there were some yam gardens inland on steep slopes (Filer and Jackson 1989, 35). On Lihir, population density is significantly higher in the south than in the north. As calculated by Filer and Jackson (1989, 37), density in the south was 41 persons/sq km and, in the north, 20 persons/sq km. It should be noted however that these density calculations exclude the mountainous interior of the island, some 7,060 ha or 33 per cent of the island total. Generally, gardens are on flat or gently sloping land near the coasts, and tend to be on steeper slopes inland.

The rainfall regime appears to vary from an even monthly pattern at Londolovit on Lihir Island, to one of reversed seasonality, with the driest period between November and March, at Malekolon on Babase Island (McAlpine et al. 1975; Abeyasekera 1987).

While there are no major studies specifically describing agriculture on these islands, there are a number of useful accounts. The two anthropological studies carried out on Boang Island in the Tanga group (System 1712), are both relevant: Bell in 1933 (Bell 1946); and Foster in 1984-85, and again in 1992 (Foster 1988; 1995). Also, in addition to briefly visiting Boang (Croyden 1982b), Croyden (1982a) made a two day visit in 1982 to both Babase and Ambitle Islands in the Anir group to collect specimens of indigenous fruits and nuts for Keravat. On Lihir, there are two descriptions of village agriculture carried out in association with the development of the Lihir goldmine (Filer and Jackson 1989; Bonnell 1992).

In the past, throughout these islands, yam (D. alata and D. esculenta) were the most important crops. In January 1832, for instance, people on Anir Island traded a large quantity of what was probably yam (D. esculenta), described as ‘bulbous roots, somewhat resembling a potato’ to a British whaling ship (Rubel and Rosman 1991, 338, citing Beale 1973, 319). In 1880, there were attempts by the German trader Eduard Hernsheim, based at Matupit Island in East

Notes continued

New Britain, to purchase yams from Lihir for feeding plantation workers and others on the Gazelle Peninsula: however, none were bought in June, and in September less than half a tonne (Hernsheim 1983, 132, 137-8). Some other New Ireland locations, however, appear to have yielded more than eight tonnes (Hernsheim 1983, 132). During the 20th Century, and particularly since 1945, sweet potato, cassava and Chinese taro have all increased in importance. In 1981, yams were still reported as the staple, though sweet potato in particular was increasing in importance (Croyden 1981, 6), even to the point of becoming the main staple, with yam and taro also of importance (S. Woodhouse, pers. comm. 1981). In the Tanga group in 1982, Croyden (1982b) described yams (D. alata and D. esculenta) as still the principal crops, with Chinese taro (not included in Bell's 1933 crop list (Bell 1946, 157)), sweet potato, taro and banana as the other major crops. On Anir, yams were also most important (Croyden 1982a, 3). On Tanga, yam planting was still focused on the period October-December. Croyden suggested that other crops were planted after yams, in the order, taro and Chinese taro, banana and sweet potato, and finally Chinese taro and pawpaw. Yams (D. esculenta) were sometimes planted separately. In yam gardens, taro and banana were usually interplanted amongst the yams several months after the latter were planted. Chinese taro appeared to be replacing taro, both as a result of taro beetle problems, and of declining soil fertility following the shortening of fallows. Taro was generally grown on old bamboo clumps. Yam dieback was increasingly affecting the cultivation of D. esculenta. On Lihir in 1985, Filer and Jackson (1989, 35-37) measured 19 gardens (ranging from 900-2800 sq m), and found that the major staple was yam (D. esculenta), with D. alata also important, followed by cassava (which they thought had replaced taro), and then a mixture of taro, sweet potato and banana. The proportion of yams in gardens increased with distance from settlements, and most gardens were fenced with bamboo due to large numbers of pigs. There was usually only one planting before fallow, the fallow period was about 7-10 years, and the planting time was around December. Typically, each household made two food gardens of about 2000 sq m each.

In 1995, the importance of some crops varied between islands. Cassava was more important on Anir than Tanga or Lihir; Chinese taro was more significant on Tanga than elsewhere. Sweet potato was generally planted without mounds, or on only very small mounds, on Anir and Tanga; on Lihir, small mounds up to 20 cm high were common. Yams were staked everywhere, but the height of stakes differed between the islands: 2-3 m on Anir and Tanga, up to 4 m on Lihir. Other vegetable crops grown included winged bean and karakap on Lihir. In 1982, on Babase Island in the Anir group, Croyden (1982a) reported a wide range of green vegetables eaten: the most popular being kalava, but also including the leaves of other trees and shrubs (tulip, kumu musong, valangur and one known locally as 'kosik'), as well as taro leaves, the unfurled leaves of a wild aroid known as 'don' (Alocasia lansifolia), and others. Household gardens were more common on Anir and Tanga than Lihir, and gardens were more frequently fenced.

Arboriculture is of special importance (Bell 1946, 242-7; Croyden 1982a; 1982b). Besides a wide range of fruit and nut trees, the following species are especially significant. Ordinary sago is apparently only grown on Lihir: elsewhere it is Solomons' sago (Metroxylon solomonense), which French (1986, 27) described as restricted to the North Solomons Province. On Tanga, it is now widely cultivated on dry land sites. On Anir, it appears to be less common and is grown on both dry and wet sites. However, it is not used as a source of starch but as the main source of leaves for roofing. In 1933, it seems that the distribution of this species was restricted in the Tanga group to the small island of Tefa, which exported its leaves for thatching to other islands in return for shell payments (Bell 1949, 336-7). Lihir Island is gradually undergoing uplift from the east, and thus causing slow inundation of the western coastline (Sullivan 1990): this coast provides most of the island's sago, which grows in swamps in the coastal reaches of almost all streams. While sago starch is used only as a very occasional food (no sago was reported eaten in the 1982 National Nutrition Survey - see below), sago leaves are widely used for roofing and window shutters (Filer and Jackson 1989, 35). Sullivan (1990) suggested that this resource will be threatened by a 1 m rise in sea levels. In the north of Lihir, sago is very limited - the largest areas are at Matakues, Lienbil and Lakunbut near Kunaie. Lakunbut provides sago leaf material for islanders from Mali and Masahet (Filer and Jackson 1989, 35).

Bamboo, which is important throughout New Ireland in regrowth vegetation as a species used for fencing, construction and many other purposes, is especially important here. In System 1712 on Boang Island, bamboo is increasingly restricted to protected groves, whereas it appeared to be more common in regrowth on Malekolon Island. On Lihir, bamboo was also described by Filer and Jackson (1989, 34) as cultivated. Some bamboo from the northern part of the island (near Suen and Kunaie villages, and Kapit Creek) is exported to the offshore islands of Masahet and Mali (Filer and Jackson 1989, 34). Terminalia megalocarpa, known as 'andakon', is grown on both Tanga and Anir, and both the fruit, and the seeds after extensive processing, are eaten (Croyden 1982a; 1982b). Currently, this tree is not common

Notes continued

on Boang, unlike its distribution on some of the islands in Milne Bay Province (see System 0512, 0514-18, 0524-27 in Hide et al. 1994). Other species not included in the fruit and nut listings are the vine Omphalea gageana, the fruit tree Corynocarpus cribbianus, the nut trees Cordia subcordata and Pangium edule, and the Indian mulberry fruit tree, Morinda citrifolia (Croyden 1982a; 1982b).

Islanders have been involved, if only peripherally, in wider monetised economies since the last century when labour migration began to take many men away, some as far as Queensland (Foster 1995, 36-50). Coconut plantations were established on the coastal fringes of all the major islands, with some still being worked in the early 1980s (Croyden 1982a). Islanders themselves began to sell copra in about the 1930s (in the Tanga group). Although smallholder planting began at this time, it expanded most rapidly after World War II. Copra has remained the major income source for Tanga and Anir islanders, and would warrant significant status on these islands. On Lihir, however, where in 1980, 42 per cent of households claimed copra sales, the advent of mining exploration during the 1980s relegated copra to a relatively minor role. In 1985, copra sales perhaps totalled K100,000, declining to K30,000 in 1988 (Filer and Jackson 1989, 81, 84). As early as 1987, export tree crops were estimated to provide only about one sixth of total Lihir incomes, or some K125 per household, with mining associated activity already accounting for roughly half of total cash income (Filer and Jackson 1989, 90-91). Although some copra was still being made on Lihir during the current survey in 1995, by February 1996 it was reported as no longer being made on Lihir (The Independent Newspaper, 16 February 1996, p. 5). Cocoa was planted quite widely in villages in the south of Lihir (in 1980, 43 per cent of households claimed cocoa sales), and between 1985-87, a further 104 ha were planted (Filer and Jackson 1989, 81, 88). In 1985, there were six cocoa fermentaries operating in southern villages, with none in the north (Filer and Jackson 1989, 92-93). During the late 1980s, there were experimental plantings of rubber and pepper but no recent sales are recorded (Filer and Jackson 1989, 88).

Fresh food, betel nut and fish are sold locally at small produce markets (e.g. at Sasa (coastal) and Ansawe (inland) villages in the Tanga group). On Lihir, despite the mining activity, local food sales have remained limited. Organised long distance inter-island trade had ended by the early 1980s (Foster 1995, 33; for pigs from Anir to Tanga, see Parkinson 1907). However, some individuals still travelled from Lihir to Tanga to trade for pigs using shell disc valuables, and some betel nut was imported from Anir to Tanga (Foster 1995, 33). In recent years, Anir islanders have been making significant sales of betel nut to mainland New Ireland. Generally, Rabaul has remained more important than Namatanai as the economic centre for Anir and Tanga (Foster 1995, 33), and, to a less extent, Lihir. Since the 1980s, however, the economic relationships, and fortunes, of Lihir have changed dramatically.

The Louise Caldera on the east coast of Lihir between the villages of Kapit and Putput is now the site of a major new goldmine, one of the world's largest gold deposits with reserve estimates of nearly 15 million ounces. It is scheduled to start production by oxide ore processing in May 1997, with sulphide processing five or six months later. By April 1996, some 20 per cent of construction, and 80 per cent of engineering work, had been completed. The mine will consist of two pits, eventually merging into one, covering an area of some 2 sq km, and involves the relocation of two villages, Putput No. 1 and Kapit. The mine is expected to produce gold for 36 years. Hughes and Sullivan (1988, 53-54) suggested that the mine would require less than 400 ha (or less than 3 per cent of all land), and thus have very little effect on the overall availability of agricultural land. It would, however, directly affect some specific resources such as wild fowl (megapode) nesting grounds located in the mine area. In gross terms, the development of the mine has fundamentally altered the economy of Lihir people. The mining company, Lihir Gold, has agreed to pay K32 million to those villagers (numbering about 180) whose land is directly affected by mining, and annual compensation and other payments of K1.3 million. Annual royalties of K4 million will also be paid to major landowners. Some 180 villagers have been relocated to modern houses costing some K60,000 each. In addition, the Lihir population owns just under half of the PNG Government's stake of 17 per cent in Lihir Gold. Experience from other mines in Papua New Guinea would suggest that major impacts on village agriculture are likely.

National Nutrition Survey 1982/83

78 families from 7 villages were asked in September or October 1982 what they had eaten the previous day. 62 per cent reported eating coconut, 58 per cent sweet potato, 46 per cent yam, 28 per cent cassava, 17 per cent banana, 6 per cent taro, 3 per cent Chinese taro and none sago. 18 per cent reported eating rice. 33 per cent reported eating fresh fish. This is similar to the crop pattern.

Main References

Bonnell, S. 1992 Lihir food garden survey: 28 September to 28 October 1992. Unpublished report, Lihir Management Company.
Filer, C.S. and R.T. Jackson 1989 The social and economic impact of a gold mine in Lihir: revised and expanded. Consultants report, Lihir Liaison Committee, Port Moresby.

Other References

Abeyasekera, S. 1987 A classification of seasonal rainfall in Papua New Guinea. Science in New Guinea 13, 1, 1-14.
Beale, T. 1973 (originally 1839) The Natural History of the Sperm Whale ... to Which is added a Sketch of a South Sea Whaling Voyage. London, The Holland Press.
Bell, F.L.S. 1946 The place of food in the social life of the Tanga (Part 1: The culture of the garden). Oceania 17, 2, 139-172.
Bell, F.L.S. 1949 The industrial arts in Tanga (Part 2: The building of houses). Oceania 19, 4, 320-348.
Croyden, R. 1981 Report of trip to New Ireland. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.
Croyden, R. 1982a Field visit to Anir Island 11-13 May 1982. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.
Croyden, R. 1982b Tanga Island. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.
Croyden, R. 1983 Horticulture extension and development. In, Lowland Agricultural Experiment Station, Keravat, East New Britain Province, Papua New Guinea: Annual Report for 1982. Port Moresby, Department of Primary Industry.
Foster, R.J. 1988 Social reproduction and value in a New Ireland Society, Tanga Islands, Papua New Guinea. PhD thesis, University of Chicago, Chicago.
Foster, R.J. 1995 Social Reproduction and History in Melanesia: Mortuary Ritual, Gift Exchange, and Custom in the Tanga Islands. Cambridge, Cambridge University Press.
French, B.R. 1986 Food Plants of Papua New Guinea: A Compendium. Sheffield, Tasmania, Privately published.
Hernsheim, E. 1983 South Sea Merchant. Port Moresby, Institute of Papua New Guinea Studies (edited and translated by P. Sack and D. Clark).
Hide, R.L., R.M. Bourke, B.J. Allen, T. Betitis, D. Fritsch, R. Grau, L. Kurika, E. Lowes, D.K. Mitchell, S.S. Rangai, M. Sakiasi, G. Sem and B. Suma 1994 Milne Bay Province: text summaries, maps, code lists and village identification. Agricultural Systems of Papua New Guinea Working Paper No. 6, Department of Human Geography, Research School of Pacific and Asian Studies, Australian National University, Canberra.
Hughes, P.J. and M.E. Sullivan 1988 Population, land use and goldmining in Papua New Guinea. Yagl-Ambu 15, 2, 40-62.
McAlpine, J.R., G. Keig and K. Short 1975 Climatic Tables for Papua New Guinea. Division of Land Use Research Technical Paper No. 37, Commonwealth Scientific and Industrial Research Organization, Melbourne.
O'Sullivan, D.F. 1973 Observations on the coconut spathe bug Axiagastus cambelli Distant (Hemiptera: Pentatomidae) and its parasites and predators in Papua New Guinea. Papua New Guinea Agricultural Journal 24, 3, 79-86.
Parkinson, R. 1907 Dreissig Jahre in der Südsee. Land und Leute, Sitten und Gebräuche im Bismarckarchipel und auf den Deutschen Salomoinseln. (Thirty Years in the South Seas. The Bismarck Archipelago: Land, Natives and Customs - English translation by N.C. Barry). Stuttgart, Berlag von Strecker and Schröder.
Rubel, P.G. and A. Rosman 1991 From ceremonial exchange to capitalist exchange: how the New Irelanders coped with the establishment of trading stations. In Pawley, A. (ed), Man and a Half: Essays in Pacific Anthropology and Ethnobiology in Honour of Ralph Bulmer. Auckland, The Polynesian Society, 336-343.
Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.
Sullivan, M. 1990 The effect of sea level rise on raised coral and high islands. In Pernetta, J.C. and P.J. Hughes (eds), Implications of Expected Climate Changes in the South Pacific Region: An Overview. UNEP Regional Seas Reports and Studies 128. Nairobi, United Nations Environment Program, 218-223.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 12	**Subsystem No.** 1 **of** 1
Districts 5 Namatanai	**Subsystem Extent** 100 %	**Area (sq km)** 27
Population 2,511	**Population density** 93 **persons/sq km**	**Population absent** 9 **%**

System Summary

Located on Boang Island in the Tanga group. Gardens are typically made from short woody regrowth, after fallows of 3-6 years. There is also use of regrowth, more than 15 years old, cleared amidst old coconut plantings. Vegetation is cut, dried and burnt. The cultivated area is thoroughly cleared and divided into plots. Yam (D. esculenta) and sweet potato are the most important crops; yam (D. alata), Chinese taro, banana and coconut are important crops; other crops are taro and cassava. Separate new gardens are usually made for yam and other root crops; within gardens root crops are planted in separate sections. There is a single main planting of yam (sometimes followed by a supplementary second planting), which is usually followed by a planting of sweet potato, Chinese taro or cassava. Two plantings of sweet potato are made before long fallow. Sweet potato and yams are planted in very small mounds. Yam (D. alata and D. esculenta) are staked to 2-3 m. New yam gardens are cleared and planted between August and January. Fruit and nut tree crops are important. The importance of fish in the diet varies by location.

Extends across provincial border to System(s) None

Altitude range (m) 0-150 **Slope** Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	Sweet potato, Yam (D. esculenta)
STAPLES SUBDOMINANT	Banana, Chinese taro, Coconut, Yam (D. alata)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sweet potato, Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Corn, Pumpkin tips, Bean (snake), Kalava
FRUITS	Bukabuk, Malay apple, Mango, Pawpaw, Pineapple, Sugarcane, Ton, Golden apple
NUTS	Breadfruit, Galip, Java almond, Pao
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Short woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	2 plantings
R VALUE	17 (low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Significant
CROP SEGREGATION	Significant
CROP SEQUENCES	Significant
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	None

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Coconuts	Significant
2 Betel nut	Minor
3 Fish	Minor
4 Fresh food	Minor

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	Very significant
SMALL MOUNDS	None
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	Significant
STAKING OF CROPS	Significant
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Minor

OTHER AGRONOMIC PRACTICES

OTHER DOCUMENTATION

Survey description

In July 1995, a vehicle traverse of most roads on Boang Island, and a walking traverse across the centre of the island to the Buel area on the north coast (one and a half days).

Boundary definition

This island was allocated to a separate system after a visit there; and after surveys of the islands of Babase, Anir, Malendok and Lihir (System 1711), the northern islands of the Lihir group (System 1713), the Tabar group (System 1714), and the nearby coastal areas of New Ireland (Systems 1709 and 1710).

Notes

This system is sharply different from System 1710 on the southern half of New Ireland, where taro is one of the dominant staples, the fallow vegetation is tall woody regrowth, and fallow periods are longer. It is similar to System 1711 on the neighbouring island of Malendok in the Tanga group (and the Anir group and Lihir Island), but distinguished because there agriculture is less intensive, with longer fallows, and fallow vegetation is tall woody regrowth. It is more similar to System 1713 on the small island offshore from Lihir Island where agriculture is also intensive, but where there is a different crop pattern, and fallow periods are somewhat shorter.

This system includes only the one island of Boang in the Tanga group with a population density, in 1990, of 154 persons/sq km, which is 6 times higher than that on the neighbouring island of Malendok in System 1711.

Two major anthropological studies have been made on Boang Island in the Tanga group, both including substantial information on agriculture: Bell, for 6 months in 1933, (Bell 1934; 1946; and many other papers); and Foster in 1984-85, and again in 1992 (Foster 1988; 1995). In addition, Croyden (1982a) made a 2 day visit in 1982 to collect specimens of indigenous fruits and nuts for Keravat.

Agricultural change on Boang Island has been most influenced in the last 75 years by two major factors: an almost fourfold increase in population from 1000 people in 1923 to 3750 in 1990, and a massive expansion of coconut planting to the point where most of the island is now under coconuts (Foster 1995, 34-35, 63; Saunders 1993). In 1933, in contrast, there was no shortage of agricultural land, and villagers rarely returned to reuse the same plot of land (Bell 1946, 144). Trees on uncleared land had girths of 8 m (Bell 1934, 292). Since the 1970s, arable land has been scarce, fallow periods have been substantially reduced, and there is a major reliance on purchased foods (Foster 1995, 34, 63-4). By the 1980s, there has been a virtual ban on planting new coconut trees because of land shortage (Foster 1995, 89). However, despite this recent pressure on resources, no obvious nutritional deterioration has yet occurred. For instance, a quick check in 1995 on birthweights recorded at the Tanga Health Centre indicated that average birthweights were relatively high for New Ireland. In 1987, the Tanga average was 3.098 kg (n=134), and in 1994, 3.094 kg (n=189). These compare with figures from the early 1980s, recorded by the National Nutrition Survey (n.d.), of 3.003 kg (n=175) for Namatanai District, and 2.974 kg (n=538) for the whole of New Ireland. Further investigation of Tangan agro-economic responses to such rapid environmental and agricultural change would be most worthwhile.

In 1933, the main staple crops were described as yam (D. alata and D. esculenta), with taro also eaten on most days (Bell 1934, 295). (Bell's use of the term 'kau-kau' (or 'kaukau') both in this paper and elsewhere (i.e. Bell 1946, 145, 157; Bell 1977, 31, 36, 151) is problematic: it is understood to refer primarily to D. esculenta yam rather than to sweet potato - he may have been misled by the fact that D. esculenta yam is known as 'kaukau' in the Pala language of the Namatanai area (Peekel 1984, 95), and either 'inen' or 'kaukau' in the Tanga language (Foster 1995, 114)). Although Bell (1934, 294) initially noted only a single planting of yam before land was fallowed, he later reported that, after the first harvest (and further work repairing fences), there was an immediate replanting of yams, although such second crops were never good, and were never stored (Bell 1946, 151, 171). Land was plentiful to the point where people 'rarely, if ever, use the same plot of land again for gardening purposes' (Bell 1946, 144) and most of the island was covered in substantial forest (Bell 1934, 292). Severe depopulation in the previous 25 years (Bell 1934, 292) may have contributed to this situation. Most garden preparation occurred between August and December, with planting between November and January (Bell 1946, 141-143, 146). Most households made three gardens in a year, one 'principal', and other 'supplementary' ones. Gardens for specific social or ceremonial purposes were also made. All gardens were fenced against pigs, commonly with bamboo which was partly grown in special groves (Bell 1946, 153), but also with other timber and, apparently in the past, with walls made of coral outcrop. Bell (1946, 154) also referred, somewhat ambiguously, to the extensive planting of a plant called 'gogo' in fallow land 'in order to make the land heavy with

Notes continued

food', implying a concern with fertility maintenance (this was not confirmed in the 1995 survey). Arboriculture was of major importance (Bell 1948a, 242-7); pig husbandry very significant, with between one and two pigs per person (Bell 1947b, 37); hunting of minor importance; and fishing and collecting significant (Bell 1947a, 311; 1947b, 37).

In 1981, yams were still reported as the staple on Tanga (as well as the other eastern islands of Anir and Lihir), though sweet potato was of increasing importance (Croyden 1981, 6). The following year, Croyden described yams (D. alata and D. esculenta) as still the principal crops, with Chinese taro, sweet potato, taro and banana as the other major crops. In 1933, Chinese taro was not included in the crop list reported by Bell (1946, 157). In 1982, yam planting was still focused on the period October-December. Croyden (1981) suggested that other crops were planted after yams, in the order, taro and Chinese taro, banana and sweet potato, and finally Chinese taro and pawpaw. Yams (D. esculenta) were sometimes planted separately. In yam gardens, taro and banana were usually interplanted amongst the yams several months after the latter were planted. Chinese taro appeared to be replacing taro, both as a result of taro beetle problems, and of declining soil fertility following the shortening of fallows. Taro was generally grown on old bamboo clumps. Yam dieback was increasingly affecting the cultivation of yam (D. esculenta).

In the mid 1980s, Foster (1988, 167-8) distinguished between primary gardens of mainly yam and some taro, and secondary gardens of Chinese taro and sweet potato. The primary gardens were usually begun between September and February. Each spouse held a separate supply of seed tubers, grew their tubers in separate plots and stored their harvested tubers separately (Foster 1995, 113-4). In contrast to the practice on mainland New Ireland, yams were usually staked up to 3 m high (Foster 1995, 258). Yam remained the food required for feasting (Foster 1995, 114). As described by Bell in 1933, after the harvest of the main yam crop, a second smaller crop was immediately planted using some of the smaller yams just harvested. This was often followed by a planting of sweet potato (Foster 1988, 168). The secondary gardens of sweet potato and Chinese taro were made throughout the year. Such gardens were commonly located at the borders of primary gardens, and did not reveal the same orderly layout (Foster 1995, 114). Ten years was regarded as the ideal fallow period between cultivations (Foster 1988, 168). From the time of the first yam harvest in late April until January, the availability of yams provided the basis for much ceremonial feasting centred on ceremonies for first fruits, men's houses and mortuary occasions (Foster 1995, 113-4). Special gardens were made for part of the mortuary feasts.

Settlement patterns have changed this century: from dispersed hamlets to villages or camps during the colonial period, with a more recent return to the dispersed pattern (Foster 1995, 83).

Arboriculture is of special importance (Bell 1948a, 242-7; Croyden 1982a), and would be well worth detailed study. Besides a wide range of fruit and nut trees, several species are especially significant. Ordinary sago is not grown on the island, but Solomons' sago (Metroxylon solomonense), which French (1986, 27) described as restricted to the North Solomons Province, is widely cultivated here on dry land sites. However, it is not grown as a source of starch but as the main source of leaves for roofing. Interestingly, in 1933, sago was unobtainable on Boang, and all leaves for thatch were imported from the small island of Tefa in return for shell payments (Bell 1949, 336-7). This implies that the current plantings on Boang are only recent. Bamboo, which is important throughout New Ireland in regrowth vegetation as a species used for fencing, construction and many other purposes, is especially important here. As a consequence of the reduction of fallow land due to coconut planting and population increase, bamboo is increasingly restricted to protected groves. Foster (1995, 259) reported that the use of bamboo for building had declined by the early 1980s as a result of severe bamboo shortage. Several species of wood (including 'patma', 'mo', 'sel' and 'binun'), which are used for yam stakes 2-4 m high, sprout after serving their immediate purpose and become rapid growing woody components of new fallows - approximating a planted tree fallow. At least two indigenous leguminous tree species ('lapse' and 'galen') are common in fallows. Terminalia megalocarpa, known as 'andakon', is grown on both Tanga and Anir, and both the fruit, and the seeds after extensive processing, are eaten (Croyden 1982a; 1982b). Currently, this tree is not common on Boang, unlike its distribution on some of the islands in Milne Bay Province (see System 0512, 0514-18, 0524-27 in Hide et al. 1994). Other species not included in the fruit and nut listings are the vine Omphalea gageana, the fruit tree Corynocarpus cribbianus, the nut trees Cordia subcordata and Pangium edule, and the Indian mulberry fruit tree, Morinda citrifolia (Croyden 1982a).

Pig husbandry has remained important since at least the 1930s, with significant demand for pork in customary ('kastam') exchanges. Live pigs are rarely exchanged, and Tangans do not buy live pigs with cash for use in exchanges (Foster 1995, 177-8). Pig production, however, has changed significantly: in the 1930s pigs were mostly fed on

Notes continued

cooked root crop tubers (and thus largely the responsibility of women); in the 1980s coconut meat (coconuts being largely a male responsibility) was their main food (Foster 1995, 178, 266, 271). In 1995, pigs were excluded from gardens by two means: in the west of the island they are excluded from a large area by fencing and walling, while to the east individual gardens are fenced.

Cash incomes were initially earned by labour migration as early as the 1880s (Foster 1995, 36-50). The sale of copra began in the 1930s, when a small plantation was established at Amfar (Foster 1995, 51-2). While smallholder planting also began at this time, it expanded most rapidly in the period 1950-70, a period during which individual households replaced cooperative societies as the most significant units of production (Foster 1988, 53-58). As early as 1970, it was reported that most land had been planted to coconuts, and that some people were beginning to plant food crops under the coconut palms (Foster 1995, 63). Most income was said to be used to purchase food. By the mid 1980s, the main income sources were copra, remittances and wage labour, and major amounts of imported food were purchased: in 1984 the mission store alone sold 50 tonnes of rice (Foster 1995, 63, 90). Foster argued that this food dependence resulted from the shortage of arable land following coconut planting, with consequent shorter fallows and reduced soil fertility. This is supported by the evidence of 1982, when, despite a fall in the price of copra, production expanded to meet a major drought-related fall in subsistence food production (Foster 1995, 63-4). By 1985, when the price of copra was reasonable, there was marked economic differentiation among households in terms of incomes. Foster surveyed 16 households in 1985 and found incomes ranging from 0-437 kina per half year, with an average of 80 kina/person/year. By 1992, however, the copra market had 'collapsed', and remittances had become the most important source of income (Foster 1995, 253). This source also declined following the return of workers as a result of civil war on Bougainville. Copra improved later: in the 12 months from August 1993 to July 1994, 470 tonnes of copra were sold to the Copra Marketing Board Depot on Boang (at K267/tonne, yielding K127,000 or K32 per person). However, in 1994, at least 150 tonnes of rice, costing approximately K150,000, was purchased on Boang; this is the equivalent of about 0.7 kg of rice per person per week. In 1994, trochus shell worth at least K6100 was sold.

In the past, there was some exchange of products between parts of Boang Island, for example mature coconuts from Taonsip village were bartered for leafy greens (tulip) from Fonli (Foster 1995, 145). Currently there are two small produce market sites on Boang, at Sasa on the beach near Amfar and inland at Senabel. By 1984, there was no longer any organised inter-island trade (Foster 1995, 33; for pigs from Anir, see Parkinson 1907), though some individuals still travelled from Lihir to Tanga to trade for pigs using shell disc valuables. Some betel nut was imported from Anir (Foster 1995, 33). Generally, Rabaul has remained more important than Namatanai as the economic centre (Foster 1995, 33).

National Nutrition Survey 1982/83

84 families from 4 villages were asked in September or October 1982, or January 1983 what they had eaten the previous day. 88 per cent reported eating coconut, 63 per cent sweet potato, 37 per cent Chinese taro, 15 per cent yam, 13 per cent banana, 5 per cent taro and none cassava or sago. 23 per cent reported eating rice. 7 per cent reported eating fresh fish. This is similar to the crop pattern, except for the low yam consumption and the high Chinese taro consumption. The consumption of rice is also lower than expected.

Main References

Bell, F.L.S. 1946 The place of food in the social life of the Tanga (Part 1: The culture of the garden). Oceania 17, 2, 139-172.

Croyden, R. 1982a Tanga Island. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.

Foster, R.J. 1988 Social reproduction and value in a New Ireland Society, Tanga Islands, Papua New Guinea. PhD thesis, University of Chicago, Chicago.

Other References

Barrett, C. 1954 Isles of the Sun. Melbourne, William Heinemann.
Bell, F.L.S. 1934 Report on field work in Tanga. Oceania 4, 3, 290-309.
Bell, F.L.S. 1947a The place of food in the social life of the Tanga (Part 2: The art of fishing). Oceania 17, 4, 310-326.
Bell, F.L.S. 1947b The place of food in the social life of the Tanga (Part 3: The raising of pigs). Oceania 18, 1, 36-59.
Bell, F.L.S. 1948a The place of food in the social life of the Tanga (Part 4: Hunting and collecting). Oceania 18, 3, 233-247.
Bell, F.L.S. 1948b The place of food in the social life of the Tanga (Part 5: Feasting and feeding). Oceania 19, 1, 51-74.
Bell, F.L.S. 1949 The industrial arts in Tanga (Part 2: The building of houses). Oceania 19, 4, 320-348.
Bell, F.L.S. 1977 Tanga-English English-Tanga Dictionary. Oceania Linguistic Monographs No. 21, University of Sydney, Sydney.
Croyden, R. 1981 Report of trip to New Ireland. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.
Croyden, R. 1982b Field visit to Anir Island 11-13 May 1982. Unpublished report, Lowlands Agricultural Experiment Station, Department of Primary Industry, Keravat.
Croyden, R. 1983 Horticulture extension and development. In, Lowland Agricultural Experiment Station, Keravat, East New Britain Province, Papua New Guinea: Annual Report for 1982. Port Moresby, Department of Primary Industry.
Foster, R.J. 1993 Dangerous circulation and revelatory display: exchange practices in a New Ireland society. In Fajans, J. (ed), Exchanging Products: Producing Exchange. Sydney, University of Sydney, 15-31.
Foster, R.J. 1995 Social Reproduction and History in Melanesia: Mortuary Ritual, Gift Exchange, and Custom in the Tanga Islands. Cambridge, Cambridge University Press.
French, B.R. 1986 Food Plants of Papua New Guinea: A Compendium. Sheffield, Tasmania, Privately published.
Hide, R.L., R.M. Bourke, B.J. Allen, T. Betitis, D. Fritsch, R. Grau, L. Kurika, E. Lowes, D.K. Mitchell, S.S. Rangai, M. Sakiasi, G. Sem and B. Suma 1994 Milne Bay Province: text summaries, maps, code lists and village identification. Agricultural Systems of Papua New Guinea Working Paper No. 6, Department of Human Geography, Research School of Pacific and Asian Studies, Australian National University, Canberra.
National Nutrition Survey n.d. Provincial Tabulations, Manus and New Ireland Provinces. 1982/3 National Nutrition Survey, Papua New Guinea Institute of Medical Research and Nutrition Section, National Department of Health, Goroka and Port Moresby.
Parkinson, R. 1907 Dreissig Jahre in der Südsee. Land und Leute, Sitten und Gebräuche im Bismarckarchipel und auf den Deutschen Salomoinseln. (Thirty Years in the South Seas. The Bismarck Archipelago: Land, Natives and Customs - English translation by N.C. Barry). Stuttgart, Berlag von Strecker and Schröder.
Peekel, P.G. 1984 Flora of the Bismarck Archipelago for Naturalists. Lae, Office of Forests, Division of Botany.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 13	**Subsystem No.** 1 **of** 1
Districts 6 Lihir	**Subsystem Extent** 100 %	**Area (sq km)** 16
Population 1,732	**Population density** 108 **persons/sq km**	**Population absent** 12 **%**

System Summary

Located on the three small northern Lihir Islands of Mali, Masahet and Mahur. The fallow vegetation is short woody regrowth, generally less than 5 years old, though there is some use of older vegetation. Vegetation is cut, dried and burnt. Fencing is general, though stone walls are used in a wider enclosure system on the central plateau of Masahet Island. Sweet potato, cassava, yam (D. esculenta and D. alata) and coconut are important crops; other crops are banana, taro and Chinese taro. Two plantings are made before fallow. Yam is only planted once, but may be followed by sweet potato or cassava. Sweet potato is planted twice before fallow. Yam is usually planted in separate gardens from sweet potato and cassava; within gardens, root crops occupy separate sections. Sweet potato is planted in small mounds. Yam gardens are cleared and planted between May and November. Yams are staked to 4 m.

Extends across provincial border to System(s) None

Altitude range (m) 0-200 **Slope** Flat (<2 degrees)

CROPS

STAPLES DOMINANT	None
STAPLES SUBDOMINANT	Cassava, Sweet potato, Yam (D. alata), Yam (D. esculenta), Coconut
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sweet potato, Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Amaranthus spp., Chinese cabbage, Corn, Ginger, Kumu musong, Pumpkin tips, Valangur, Bean (snake), Karakap
FRUITS	Bukabuk, Mango, Pawpaw, Pineapple, Sugarcane, Ton, Watermelon, Pomelo
NUTS	Breadfruit, Galip, Java almond, Pao, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Short woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	1-4 years
CROPPING PERIOD	2 plantings
R VALUE	40 (medium)

GARDEN SEGREGATION

GARDEN SEGREGATION	Significant
CROP SEGREGATION	Significant
CROP SEQUENCES	Significant
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Minor

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Coconuts	Minor
2 Fish	Minor
3 Fresh food	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	Minor
SMALL MOUNDS	Very significant
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	Significant
STAKING OF CROPS	Significant
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Minor

OTHER DOCUMENTATION

Survey description

In July 1995, by dinghy from Lihir Island to Masahet and Mali Islands; interviews and garden visits at Ton village on Masahet Island, and at Mali village on Mali (1 day). Mahur Island was not visited.

Boundary definition

These islands were allocated to a separate system after visits to Mali and Masahet Islands; and after surveys of the islands of Babase, Ambitle, Malendok and Lihir (System 1711), Boang Island (System 1712), the Tabar group (System 1714), and the nearby coastal areas of New Ireland (Systems 1707 and 1709).

Notes

This system, which is restricted to the three small islands to the north of Lihir Island, is similar to System 1711 on the main island of Lihir. Here, however, as a consequence of severe land shortage, agriculture is much more intensive. The main trends of intensification are shorter fallow periods and simplification of the fallow vegetation. The system is also distinguished from System 1709 in the central part of New Ireland around Namatanai, where yam and sweet potato are the most important crops, and fallow periods are longer. It is more similar to System 1712 on Boang Island where agriculture is also intensive, but sweet potato and yam are most important crops, and fallows are longer. It differs from System 1714 on Tabar Island, to the north, where the most important crops are cassava and sweet potato, and fallow periods are longer.

There is no major study of agriculture on these islands, but there are two useful studies carried out in association with the development of the Lihir goldmine (Filer and Jackson 1989; Bonnell 1992). The former provides major information on population densities and incomes, with most specific information for Masahet and Mali; the latter gives crop counts for gardens on Masahet.

In 1985, population densities on the three islands were 120 persons/sq km on Mali, 104 on Masahet and 80 on Mahur; that is, two to six times higher than the densities on Lihir Island (Filer and Jackson 1989, 37). Filer and Jackson (1989, 38-39) considered that people on Masahet and Mali were already short of land by 1985, were actively converting coconut plantings to garden land and were intensifying their agricultural practices. On Mali, yam gardens were still the main garden type, but fallow periods were less than four years, and gardens were cultivated for up to four years (Filer and Jackson 1989, 39-40). On Masahet, they measured eight gardens on the central plateau finding a range in size from 440-700 sq m, with a household typically making three or four of these (Filer and Jackson 1989, 39). Sweet potato and cassava were the major staples in the small gardens. In addition, separate yam gardens were made on the coastal strip. Stone walls were constructed of stones removed from cultivated land. Some villagers also had access to land on the north of Lihir Island between Sali and Kunaie for food gardens, and near Suen for growing coconuts (Filer and Jackson 1989, 40).

Fallow periods are now typically less than five years. When gardens are made specifically for production for customary purposes, longer periods are possible. On Masahet, yam stakes ('mangas'), more than 4 m high, sprout and are left to provide the woody regrowth fallow. On both Masahet and Mali, some bamboo poles, imported from the northern part of Lihir Island, are also used (Filer and Jackson 1989, 34).

On the plateau on Masahet Island, there is an elaborate system of stone walls (one to one and half metres high), which creates a large enclosed area within which individual gardens are not fenced. This use of stone walls may be the same as that referred to by Riesenfeld (1950, 254), who cited an early unpublished report describing Lihir banana plantings fenced in by low stone walls as a protection from pigs.

Building materials such as bamboo and sago leaves for roofing are imported from the main island of Lihir (Hughes and Sullivan 1988, 51). Mahur Island has some sago, but Mali and Masahet obtain sago leaves from the Lakunbut area near Kunaie village. They also acquire bamboo, for yam poles and other purposes, from the northern part of Lihir Island (Filer and Jackson 1989, 34-35). Trade with other islands supplies pigs from Tanga and Tabar, and sago from Tabar.

Fishing is more important than on the main island of Lihir, but is not as significant as might be expected (Filer and Jackson 1989, 32). On Mali Island, fishing from the reef was a daily occupation in the mid 1980s, with fresh fish, large crayfish and lobsters regularly consumed.

Notes continued

In the past, the main sources of cash income have been the production of shell money (known as 'mis', and estimated as worth K50,000/year in the mid 1980s), copra (significant for Mahur only, very limited for Mali and Masahet), chillies and very limited sales of fish and food (Filer and Jackson 1989, 81, 86). By 1995, mining related income was probably the most important income source: very little copra was being made, but shell money was still being produced (an armspan of which was worth K30 at Namatanai and Kavieng). Since the local shell supply had been worked out, unprocessed shell was imported from the Tigak Islands. Small amounts of food crops and fish are marketed.

National Nutrition Survey 1982/83

31 families from 2 villages were asked in September 1982 what they had eaten the previous day. 94 per cent reported eating sweet potato, 81 per cent coconut, 58 per cent yam, 39 per cent cassava, 6 per cent banana and none Chinese taro, sago or taro. 27 per cent reported eating rice. 13 per cent reported eating fresh fish. This is similar to the crop pattern.

Main References

Bonnell, S. 1992 Lihir food garden survey: 28 September to 28 October 1992. Unpublished report, Lihir Management Company.

Filer, C.S. and R.T. Jackson 1989 The social and economic impact of a gold mine in Lihir: revised and expanded. Consultants report, Lihir Liaison Committee, Port Moresby.

Other References

Hughes, P.J. and M.E. Sullivan 1988 Population, land use and goldmining in Papua New Guinea. Yagl-Ambu 15, 2, 40-62.

O'Sullivan, D.F. 1973 Observations on the coconut spathe bug Axiagastus cambelli Distant (Hemiptera: Pentatomidae) and its parasites and predators in Papua New Guinea. Papua New Guinea Agricultural Journal 24, 3, 79-86.

Riesenfeld, A. 1950 The Megalithic Culture of Melanesia. Leiden, E.J. Brill.

PROVINCE 17 New Ireland	**AGRICULTURAL SYSTEM No.** 14	**Subsystem No.** 1 **of** 1
Districts 4 Konos	**Subsystem Extent** 100 %	**Area (sq km)** 248
Population 2,077	**Population density** 8 **persons/sq km**	**Population absent** 12 **%**

System Summary

Located on the three islands of the Tabar group. Typically, short woody regrowth, 5-15 years old, is cleared, dried and burnt. There is also some use of taller, older regrowth. Sweet potato and cassava are the most important crops; banana and coconut are important crops; other crops are yam (D. esculenta and D. alata), taro, sago and Chinese taro. Sweet potato and cassava are mostly planted in separate garden sections. There are two plantings before fallow. Sweet potato is planted in very small mounds. All gardens are fenced. Household gardens are common. Fish is usually an important food.

Extends across provincial border to System(s) None

Altitude range (m) 0-200 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Cassava, Sweet potato
STAPLES SUBDOMINANT	Banana, Coconut
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (Colocasia), Yam (D. alata), Yam (D. esculenta)
OTHER VEGETABLES	Aibika, Amaranthus spp., Corn, Ferns, Lowland pitpit, Pumpkin tips, Valangur, Bean (snake), Taro leaves, Karakap
FRUITS	Bukabuk, Malay apple, Mango, Pawpaw, Pineapple, Sugarcane, Ton, Watermelon
NUTS	Breadfruit, Galip, Java almond, Pao, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Short woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	2 plantings
R VALUE	17 (low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Minor
CROP SEGREGATION	Significant
CROP SEQUENCES	None
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Significant

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	None
PLANTED TREE FALLOW	None
COMPOST	None
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	Minor
2 Coconuts	Minor
3 Fresh food	Minor
4 Marine products	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	Significant
SMALL MOUNDS	None
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	Very significant
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Minor
SEASONAL SEC'DARY CROPS	Minor

OTHER DOCUMENTATION

Survey description

In July 1995, on Tatau Island, by dinghy from Mapua station to Tatau village; to Bueri, Napekur and Simberi villages on Simberi Island; and to the west and south coasts of Tatau Island (2 days). Tabar Island was not visited, but information was obtained from interviews with Tabar islanders at Mapua.

Boundary definition

These islands were allocated to a separate system after a visit there; and after surveys of the Lihir, Tanga and Anir Island groups (System 1711, 1712 and 1713), and of the nearby coastal areas of New Ireland (System 1707).

Notes

This system is distinguished from System 1707 on the neighbouring part of northern New Ireland, where taro is still a dominant staple and cassava is not important; and from Systems 1711 and 1713 in the Lihir Group, where yam (mainly D. esculenta but also D. alata), is a major crop, and in the case of System 1713, land use is much more intensive.

In addition to the early 1908 observations of Friederici (1912, 140-141), there are two anthropological accounts (Fergie 1985; 1989; Groves 1934-35), each of which gives a minor, but useful, description of some aspects of agriculture.

As early as 1908, according to Friederici (1912), the main crop taro was already being displaced by sweet potato, due to a particular pest. This was probably taro beetle, which was the subject of special entomological investigation in the late 1940s or early 1950s (see Barrett 1954, 141, 148-9). Friederici (1912) noted that sago was used, as had been noted previously by Tasman, and that breadfruit was more common here than in most part of Melanesia: it was the only place in Melanesia that he ate the seedless type of breadfruit. There were large numbers of coconut palms. Twenty-five years later, in the latter half of 1933, Groves (1934-35) worked on Tatau Island. By this time, inland settlements, whose sites were still marked by coconut trees, had been relocated on the coast (Groves 1934-35, 230). Agriculture was practised where possible on level, dry lowland areas adjacent to the coast, but mostly in valleys between the lower slopes of hills immediately behind the coastal villages; cultivable area was limited by the occurrence of mangrove swamps around the islands (Groves 1934-35, 228-230). Groves implied that yams and taro were the main crops, with sago as both a reserve and feast food; sweet potato was also regularly grown (Groves 1934-35, 229-230, 348). Gardens were fenced. There was a more or less regular system of food exchanges between villages, associated with all phases of the ceremonial calendar (Groves 1934-35, 230). There was a lack of pawpaw and banana, apparently due to damage by parrots. All work associated with sago production was said to be done by men; as was fishing, though women collected shellfish and land crabs (Groves 1934-35, 349). Introduced vegetables such as tomatoes, pumpkin, beans and cucumber were already grown (Groves 1934-35, 349). There was some preservation of food: hollowed-out taro tubers were roasted and the resulting taro 'biscuit' was placed in baskets or leaf packages and kept as a reserve in case of drought (Groves 1934-35, 349, 353). Pigs were of central importance for feasts, with every family owning pigs: additional live pigs were traded to Tabar by Lihir people for shell currency while Tabar people sold their pigs to the mainland (Groves 1934-35, 349-351).

Fergie (1985; 1989) studied ritual on Tabar in 1979-80 and 1986. By this time, the colonial pattern of hamlets aggregated to form coastal villages, which had been established earlier in the century, had changed with a return to smaller decentralised settlements (Fergie 1989, 114). By 1980, the crop pattern had also changed: instead of taro and yam, the main crops were sweet potato and cassava, supplemented by some taro, yam and banana, with aibika and tobacco also grown. Under good management, there were three plantings of the main tubers before fallowing (Fergie 1985, 4-6). Cassava was usually eaten grated (Fergie 1985, 84). Sago starch was still made for feasts, and for use when food was short; sago leaves were used for thatching (Fergie 1985, 69, 83). Gardens were fenced; cooperative work was employed for clearing and fencing (Fergie 1985, 81-82). Malangan ceremonials made heavy requirements on food production, with a full malangan sequence requiring sponsors to put on between five and 20 feasts: special gardens were made for such purposes (Fergie 1985, 68-69).

During the 1995 survey, the change in crop pattern was confirmed. However, instead of three plantings of sweet potato and cassava before fallowing as reported by Fergie (1985, 4-6), two appeared to be more typical. There was some variation in fallow periods, with the shortest reported at Tatau village. Tatau villagers said that gardens made specifically for malangan ceremonies were cut in older fallows.

Notes continued
Malangan rituals were not performed between about 1940 and the early 1960s, and Fergie (1985, 27) related this to demographic and technical aspects of subsistence and cash crop production. There was massive depopulation between 1914 and 1951: the population declined from 3483 in 1914, to 2769 in 1921, and finally to 1461 in 1951; by 1971, it had recovered to 2094, and reached 2682 in 1990 (Fergie 1985, 46; 1989, 109). In Fergie's view, the combination of a declining population and a shortage of women in the productive age-groups, resulted in an inability to produce the food surpluses required for the ceremonials (Fergie 1985, 67-70).

As early as 1913 under German rule, some 513 ha had been planted to coconuts in six plantations (Sack and Clark 1980, 44). By 1980, four had been abandoned and none were viable (Fergie 1989, 101). Village smallholder coconut plantings were encouraged by government before the 1930s, but in 1933, due to low prices, most villagers exchanged either copra or coconuts to storekeepers for goods (Groves 1934-35, 231). Trochus and green snail shell were also collected for sale (Groves 1934-35, 149).

In the early 1980s, the main sources of income were copra, cocoa and green snail shell (Fergie 1985, 11). Copra production was generally low with peaks before payments of tax and school fees (Fergie 1985, 27). Few Tabar islanders relied on cash for their primary subsistence: gardening and fishing were still of primary importance in 1980 (Fergie 1989, 104). Since 1986, new potential sources of income have appeared in the form of timber royalties and mineral exploration primarily but not exclusively on Simberi Island (Fergie 1989, 116; Anon 1994). By 1995, it was believed the Simberi prospect, mostly on the eastern side of the island, could produce 35,000 - 40,000 ounces of gold a year for a mine life of 5-7 years, and Nord Pacific Ltd. announced that it was applying for a mining lease to develop the site (Anon 1996, 18). During the survey in 1995, there were still minor sales of copra. Small amounts of fresh food and betel nut were sold locally, and some at Konos on the main island of New Ireland. There were also minor sales of trochus and other marine products, as well as artefacts.

National Nutrition Survey 1982/83
39 families from 5 villages were asked in May 1983 what they had eaten the previous day. 100 per cent reported eating coconut, 87 per cent sweet potato, 36 per cent cassava, 23 per cent sago, 10 per cent banana, 5 per cent yam and none Chinese taro or taro. 21 per cent reported eating rice. 49 per cent reported eating fresh fish. This is similar to the crop pattern, except for the relatively high consumption of sago. This may have been due to the 1982 drought.

Main References
None.

Other References
Anon 1994 Tabar mining development potential being studied. PNG Resources April-June, 26-30.
Anon 1996 Nord wants to fast track Simberi development. PNG Resources October-December, 18-20.
Barrett, C. 1954 Isles of the Sun. Melbourne, William Heinemann.
Fergie, D.J. 1985 Being and becoming: ritual and reproduction in an island Melanesian society. PhD thesis, University of Adelaide, Adelaide.
Fergie, D. 1989 Limits of commitment: the resilience of a ritual system in island Melanesia. Canberra Anthropology 12, 1-2, 99-119.
Friederici, G. 1912 Wissenschaftliche Ergebnisse einer amtlichen Forschungsreise nach dem Bismarck-Archipel im Jahre 1908. II. Beiträge zur Völker- und Sprachenkunde von Deutsch-Neuguinea. Ergänzungsheft Nr. 5, der Mitteilungen aus den Deutschen Schutzgebieten, Ernst Siegfried Mittler und Sohn, Berlin.
Greenfield, H. 1975 The energy needs for pregnancy and lactation. Unpublished paper presented at 10th International Congress of Nutrition, Tokyo, Japan, August 3-9, 1975.
Groves, W.C. 1934-35 Tabar to-day: a study of a Melanesian community in contact with alien non-primitive cultural forces. Oceania 5, 2, 224-240;, 5, 3, 346-360.
Groves, W.C. 1935 Tabar to-day. Part II: Present day conditions in Tatau village. Oceania 6, 2, 147-157.
Ring, A. and R. Scragg 1973 A demographic and social study of fertility in rural New Guinea. Journal of Biosocial Science 5, 89-121.
Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.
Sack, P. and D. Clark 1980 German new Guinea: The Draft Annual Report for 1913-14. Canberra, Department of Law and Research School of Social Sciences, Australian National University.

4. AGRICULTURAL SYSTEMS: MAPS

The maps show the location of the Agricultural Systems identified in the Province and selected important characteristics of the systems. Where subsystems exist within an Agricultural System, the maps display information from the first subsystem only. Subsequent subsystem information is not displayed, but it is available in the text summaries. For crop combinations, cash income activities, population density and population absent, the maps show information for the entire system. A note in the key on the Agricultural Systems map lists the systems in which subsystems occur. Maps can be produced from computer files at any scale down to 1:500 000.

The following notes explain the classes used on the maps.

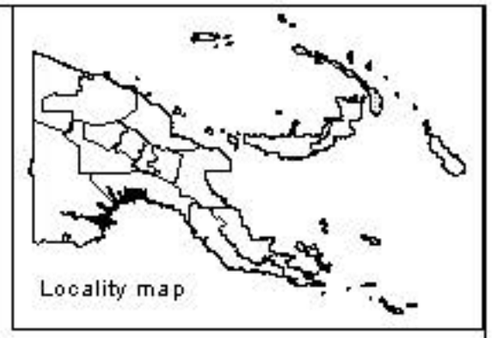
Map title	Notes
1. Agricultural Systems	Boundaries and identification numbers (eg. 1 = System 1401). See key for subsystem occurrences.
2. Fallow vegetation	The vegetation cleared from garden sites at the beginning of a new period of cultivation (8 classes).
3. Long fallow period	An estimate of the length of time land is left fallow before it is cultivated again (4 classes).
4. Number of plantings before fallow	The number of times staple crops are planted in the main gardens before those gardens are returned to a long fallow (5 classes).
5. Intensity of land use	Ratio of the cropping period (estimated from the number of plantings) to the length of the complete cultivation cycle, ie. cropping period plus fallow period (4 classes based on Ruthenberg's R factor)[1]. Very low: (R < 10) Low: (R = 10 - 32) Medium: (R = 33 - 66) High: (R > 66).
6. Crop combinations	Combinations of the most important (dominant staple) and important (subdominant staple) crops in this Province.

[1] R = (Number of years of cultivation x 100) / (Number of years of cultivation + Number of years of long fallow), (Ruthenberg 1980, 15)

Map title	Notes
7. Garden and crop segregation	Separation of crops into different gardens or into different plots within a garden (4 classes). A combination of Fields 28 and 29. For both fields, 'nil' and 'minor or insignificant' are defined as 'absent'; and 'significant' and 'very significant' as 'present'. Classes are: both absent = 'No segregation'; garden segregation present only = 'Garden segregation'; crop segregation present only = 'Crop segregation'; both present = 'Garden and crop segregation'.
8. Soil fertility maintenance	The presence or absence of the following: legume rotation, planted tree fallow, composting and mulching. For all features, 'nil' and 'minor or insignificant' are defined as 'absent'; and 'significant' and 'very significant' as 'present'.
9. Soil tillage	The use of tillage in the preparation of land for cultivation (4 classes).
10. Fallow clearing practices	A combination of the practices of burning fallow vegetation before planting, and cutting down fallows onto crops after planting. For both features, 'none' and 'minor or insignificant' are defined as 'absent'; and 'significant' and 'very significant' as 'present' (3 classes).
11. Soil mounds and beds	A combination of measures of significance for mounds and beds: Medium and large mounds are classed together as 'large mounds'. Square and long beds are classed together as 'beds'. Very small mounds are excluded. Absent = 'none' and 'minor or insignificant' for all mounds and beds. Present = 'significant' and 'very significant' for all mounds and beds (6 classes).
12. Water management techniques	The presence or absence of the following: drainage, irrigation and soil retention barriers. For all features, 'nil' and 'minor or insignificant' are defined as 'absent'; and 'significant' and 'very significant' as 'present' (4 classes).

Map title	Notes
13. Cash income activities	Combinations of cash earning activities specific to this province. For all activities, 'nil' and 'minor or insignificant' are defined as 'absent'; and 'significant' and 'very significant' as 'present'.
14. Seasonality of the main food crops	Whether the dominant staple (most important) crops and the subdominant staple (important) are planted at about the same time each year. 'Nil' and 'minor or insignificant' are defined as 'absent'; and 'significant' and 'very significant' as 'present' (2 classes).
15. Population density	Persons per square kilometre, based on the 1980 National Population Census and the area occupied by the System (6 classes). 'Not applicable' refers to Systems where there are no census points.
16. Population absent	The proportion of the 'total' population listed in the 1979 Provincial Data System Rural Community Register as being 'absent 6 months or more' from the Census Unit (5 classes). 'Not applicable' refers to Systems where either there are no census points, or where the PDS data do not distinguish between the 'total' and 'resident' populations.

NEW IRELAND PROVINCE
Agricultural systems



Lavongai (New Hanover) I
Taskul
Kavieng
Tingwon I
Tabar I
Dyaul I
Konos
Uhlir I
Poeklaka
Tanga Is
Namatanai
Anir (Feni) I
Saint Matthias Group
Emira I
Mussau I
Tench I

30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Fallow vegetation

- Long fallow not used
- Grass and woody regrowth
- Short woody regrowth
- Tall woody regrowth

30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Long fallow period

- Greater than 15 years
- 5-15 years
- 1-4 years

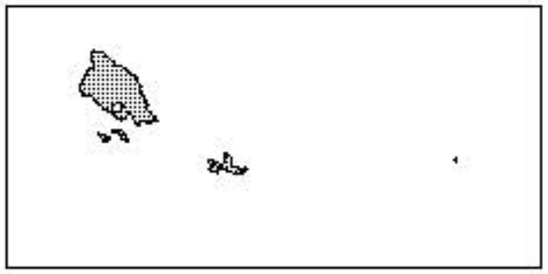
30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Number of plantings before fallow

- 1 planting only
- 2 plantings



30 0 30 60 Kilometers

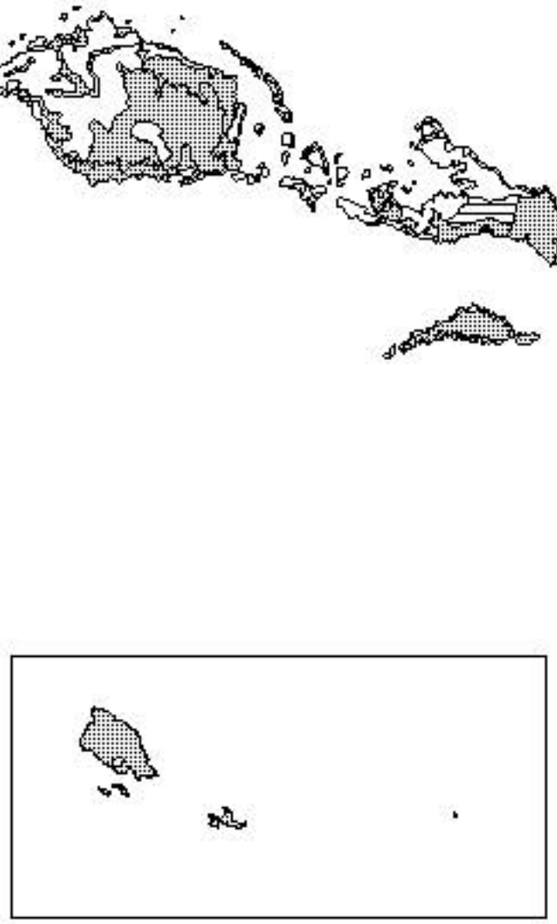
Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Intensity of land use

Ratio of cropping period to fallow period

- Very low
- Low
- Medium



30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

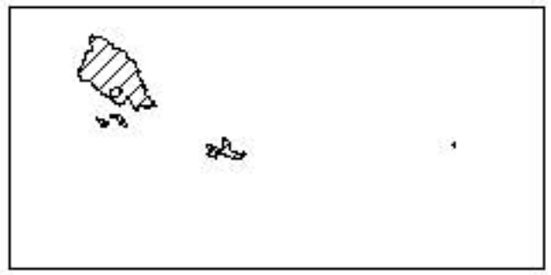
NEW IRELAND PROVINCE
Crop combinations

Most important crops	Important crops
None	Banana/Cassava/Coconut/Sago/Sweet potato
None	Cassava/Sweet potato/Yam (D. alata and D.esculenta)/Coconut
Cassava/Sweet potato	Coconut/Taro
Cassava/Sweet potato	Banana/Coconut
Cassava/Sweet potato	Banana/Coconut/Taro
Sago	Banana/Cassava/Coconut/Sweet potato
Sago/Sweet potato	Banana/Cassava/Coconut/Taro
Sweet potato/Taro	None
Sweet potato/Taro	Banana/Coconut
Sweet potato/Taro	Banana/Cassava/Coconut
Sweet potato/Taro	Cassava/Coconut
Sweet potato/Yam (D. esculenta)	Banana/Chinese taro/Coconut/Yam (D. alata)
Sweet potato/Yam (D. esculenta)	Banana/Coconut/Taro/Yam (D. alata)
Sweet potato/Yam (D. esculenta)	Cassava/Coconut/Yam (D. alata)

NEW IRELAND PROVINCE

Crop combinations

Legend on facing page



30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Garden and crop segregation

- No segregation
- Garden segregation
- Crop segregation
- Garden and crop segregation

30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Soil fertility maintenance

Long fallow only

30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Soil tillage

None

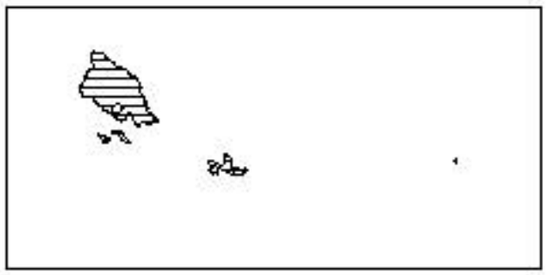
30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Fallow clearing practices

Fallow cut and burnt



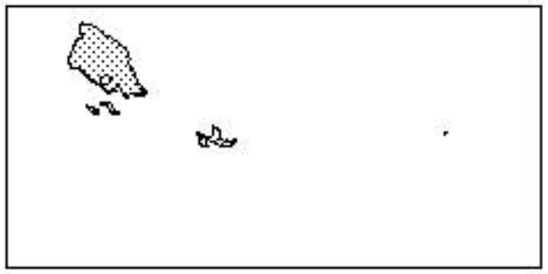
30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Soil mounds and beds

- Mounds and beds absent
- Small mounds present and beds absent



30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

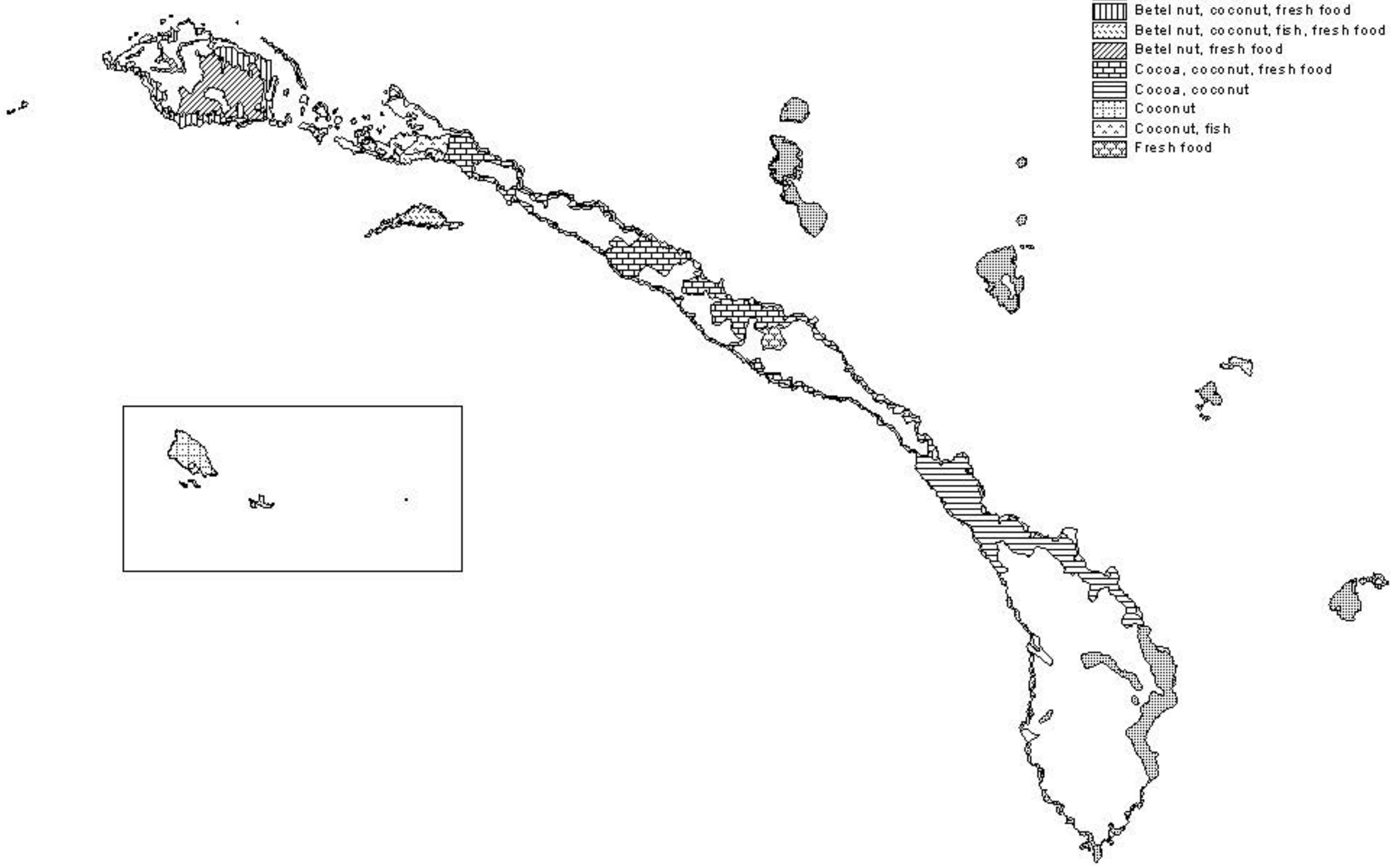
Water management techniques

No water control

30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE



Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Seasonality of main crops

No seasonal planting
Planted seasonally

30 0 30 60 Kilometers

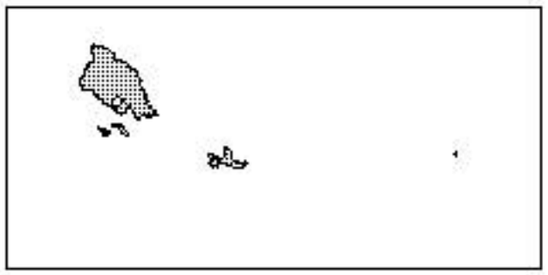
Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE

Population density

Persons per square kilometre

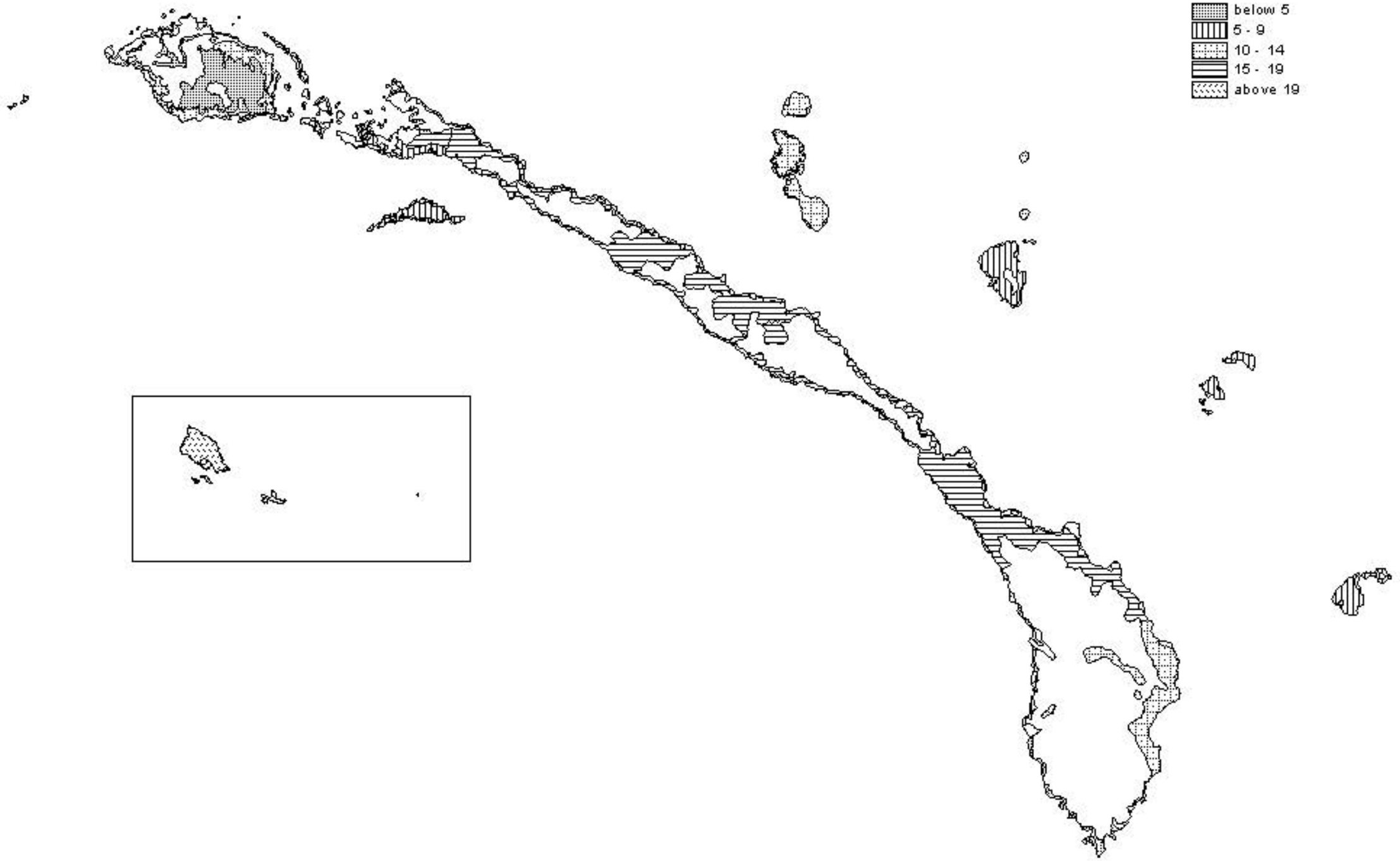
- below 10
- 10 - 24
- 25 - 49
- 50 - 74
- 75 - 99
- above 99



30 0 30 60 Kilometers

Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

NEW IRELAND PROVINCE



Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

5. AGRICULTURAL SYSTEMS: DATA LISTING BY CODES

The following tables list all of the information contained within the database in coded form. The codes are contained in Section 2, Database Structure, Definitions and Codes.

AGRICULTURAL SYSTEM DATA LISTING - CODES Province: 17 New Ireland

System	Sub sys	No. of subsys	Subsys extent	Same sys oth prov	Districts	Census Divisions
1701	1	1	4		1	01
1702	1	1	4		2	02-03
1703	1	1	4		2	02-03-04
1704	1	1	4		2	03-04
1705	1	1	4		3	05-07
1706	1	1	4		3	05
1707	1	1	4		3-4	05-06-07-08-09
1708	1	1	4		4	08
1709	1	1	4		4-5	08-09-11-12-13
1710	1	1	4		5	13-14-15
1711	1	1	4		5-6	16-17-18
1712	1	1	4		5	17
1713	1	1	4		6	16
1714	1	1	4		4	10

KEY

Subsys	Subsystem
Same sys oth prov	Same system in other province

AGRICULTURAL SYSTEM DATA LISTING - CODES Province: 17 New Ireland

System	Sub sys	Area km^2	Population			Altitude range m		Slope	Fallows		
			Total	Abs	Den	Low	High		Veg	Sht	Per
1701	1	380	2687	31	7	0	200	5	4	0	2
1702	1	23	1668	26	73	0	15	1	4	0	2
1703	1	300	7150	15	24	0	100	5	5	0	3
1704	1	396	961	5	2	100	200	5	5	0	3
1705	1	179	2260	6	13	0	150	5	5	0	3
1706	1	70	891	15	13	0	150	2	4	0	2
1707	1	904	11714	19	13	0	750	5	5	0	3
1708	1	48	443	20	9	750	1000	2	3	0	2
1709	1	811	10220	16	13	0	200	5	4	0	2
1710	1	483	3379	13	7	0	300	5	5	0	3
1711	1	301	5841	9	19	0	400	5	5	0	3
1712	1	27	2511	9	93	0	150	2	4	0	2
1713	1	16	1732	12	108	0	200	1	4	0	1
1714	1	248	2077	12	8	0	200	5	4	0	2

KEY

Subsys	Subsystem
Area km^2	Area of System
Population	
Total	Resident population 1980
Abs	Absent population (%)
Den	Population density (persons/km^2)
Fallows	
Veg	Type of Fallow vegetation
Sht	Short fallows
Per	Long fallow period

AGRICULTURAL SYSTEM DATA LISTING - CODES Province: 17 New Ireland

System	Sub sys	Staple crops			Narcotic crops
		Most import	Important	Present	
1701	1	11-13	04-06	02-04-05-06-09-10-11-12-13	00
1702	1	04-11	06-13	02-04-05-06-11-13-14-15	5
1703	1	09-11	02-04-06-13	02-04-05-06-09-11-13-14-15	2-4-5
1704	1	04-11	02-06-13	02-04-05-06-09-11-13-14-15	2-4-5
1705	1	09	02-04-06-11	02-04-05-06-09-11-12-13-14-15	2-4-5
1706	1	00	02-04-06-09-11	02-04-05-06-09-11-12-13-14-15	2-4-5
1707	1	11-13	02-06	02-04-05-06-09-11-13-14-15	2-4-5
1708	1	11-13	00	02-04-05-11-13	5
1709	1	11-15	02-06-13-14	02-04-05-06-11-12-13-14-15	2-4-5
1710	1	11-13	02-04-06	02-04-05-06-11-12-13-14-15	2-4-5
1711	1	11-15	04-06-14	02-04-05-06-09-11-13-14-15	2-4-5
1712	1	11-15	02-05-06-14	02-04-05-06-11-13-14-15	2-4-5
1713	1	00	04-11-14-15-06	02-04-05-06-11-13-14-15	2-4-5
1714	1	04-11	02-06	02-04-05-06-09-11-13-14-15	2-4-5

KEY

Subsys Subsystem

AGRICULTURAL SYSTEM DATA LISTING - CODES Province: 17 New Ireland

System	Sub sys	Vegetable crops	Fruit crops	Nut crops
1701	1	01-02-09-11-15-21-27-28-30	03-04-12-15-16-20-24-32	01-06-07-12-15
1702	1	01-02-07-09-10-20-21-27	04-05-12-15-16-17	01-07-12
1703	1	01-02-10-11-16-20-21-27-30	07-12-13-15-16	01-06-07-12-15
1704	1	01-02-09-10-11-16-20-21-27	05-07-12-13-15-16	01-06-12-15
1705	1	01-09-14-16-20-21-27	07-12-13-15-16	01-06-07-12-15
1706	1	01-09-14-16-20-21-27	07-12-15-16	01-07-12
1707	1	01-02-09-11-15-16-21-27-30	07-12-13-15-16-17-27-32	01-06-07-12-15
1708	1	01-07-08-09-10-11-12-15-28-30	05-07-09-12-13-15	00
1709	1	01-02-09-10-16-21-23-24-27-30	03-05-07-12-13-15-16-17	01-06-07-12-15
1710	1	01-09-11-14-15-16-20-24-27-30	03-05-07-12-13-15-16-20	01-06-07-12-15
1711	1	01-02-09-15-16-21-24-27-30-36	03-05-07-12-13-15-16-20	01-06-07-12-15
1712	1	01-09-21-27-36	03-05-07-12-13-15-16-20	01-06-07-12
1713	1	01-02-07-09-12-15-21-24-27-37	03-07-12-13-15-16-17-27	01-06-07-12-15
1714	1	01-02-09-11-16-21-24-27-30-37	03-05-07-12-13-15-16-17	01-06-07-12-15

KEY

Subsys Subsystem

AGRICULTURAL SYSTEM DATA LISTING - CODES Province: 17 New Ireland

System	Sub	Segregation		Crop	Gard types		Soil fertility maintenance techniques						
	sys	Gar	Crp	Seq	Mix	H'ld	Leg	Tre	Com	Man	Isl	Sil	Fer
1701	1	3	1	1	0	0	0	0	0	0	0	0	0
1702	1	2	2	2	0	0	0	0	0	0	0	0	0
1703	1	1	2	2	0	0	0	0	0	0	0	0	0
1704	1	0	3	1	0	1	0	0	0	0	0	0	0
1705	1	1	1	1	0	1	0	0	0	0	0	0	0
1706	1	0	3	2	0	0	1	0	0	0	0	0	0
1707	1	3	1	1	0	2	0	0	0	0	0	0	0
1708	1	3	1	1	0	2	0	0	0	0	0	0	1
1709	1	1	2	2	0	2	0	0	0	0	0	0	0
1710	1	2	2	2	0	1	0	0	0	0	0	0	0
1711	1	1	3	2	0	1	0	0	0	0	0	0	0
1712	1	2	2	2	0	0	0	0	0	0	0	0	0
1713	1	2	2	2	0	1	0	0	0	0	0	0	0
1714	1	1	2	0	0	2	0	0	0	0	0	0	0

KEY

Subsys Subsystem

Segregation

Gar Garden

Crp Crop

Crop seq Crop sequences

Gard types **Garden types**

Mix Mixed vegetable gardens

H'ld Household gardens

Soil fertility maintenance techniques

Leg Legume rotation

Tre Planted tree fallow

Com Compost

Man Animal manure

Isl Island bed

Sil Silt from floods

Fer Inorganic fertilizer

AGRICULTURAL SYSTEM DATA LISTING - CODES **Province: 17 New Ireland**

System	Sub sys	Management techniques											
		Water		Soil						Fallow		Other	
		Irr	Drn	Pig	Till	Hol	Bar	Mul	Mec	Brn	Cut	Fen	Stk
1701	1	0	0	0	0	0	0	0	0	3	0	3	0
1702	1	0	0	0	0	0	0	0	0	3	0	0	1
1703	1	0	0	0	0	0	0	0	0	3	0	0	1
1704	1	0	0	0	0	0	0	0	0	3	0	0	1
1705	1	0	0	0	0	0	0	0	0	3	0	0	1
1706	1	0	0	0	0	0	0	0	0	3	0	0	1
1707	1	0	0	0	0	0	0	0	0	3	0	3	1
1708	1	0	1	0	0	0	1	0	0	3	0	0	0
1709	1	0	0	0	0	0	0	0	0	3	0	2	1
1710	1	0	0	0	0	0	0	0	0	3	0	2	1
1711	1	0	0	0	0	0	0	0	0	3	0	3	2
1712	1	0	0	0	0	0	0	0	0	3	0	2	2
1713	1	0	0	0	0	0	0	0	0	3	0	2	2
1714	1	0	0	0	0	0	0	0	0	3	0	3	1

KEY

Subsys Subsystem

Management techniques

Water management

Irr Irrigation

Drn Drainage

Soil management

Pig Pigs placed in gardens

Till Tillage

Hol Deep holing (for yams)

Bar Soil retention

Mul Mulching

Mec Mechanized soil tillage

Fallow management

Brn Burning of cut vegetation

Cut Fallow cut onto crops

Other

Fen Fencing

Stk Staking of crops

AGRICULTURAL SYSTEM DATA LISTING - CODES **Province: 17 New Ireland**

System	Sub sys	Management techniques						Crop planting seasonality		Cropping intensity	R value
		Soil mounds				Garden beds					
		Vsm	Sm	Md	Lge	Sq	Lg	Maj	Min		
1701	1	3	0	0	0	0	0	0	0	1	9
1702	1	0	2	0	0	0	0	0	0	2	17
1703	1	3	1	0	0	0	0	0	0	2	9
1704	1	3	1	0	0	0	0	0	0	1	5
1705	1	3	1	0	0	0	0	0	0	2	9
1706	1	1	3	0	0	0	0	0	0	2	17
1707	1	3	1	0	0	0	0	0	0	1	5
1708	1	3	0	0	0	0	1	1	0	1	9
1709	1	0	3	0	0	0	0	2	1	2	17
1710	1	3	0	0	0	0	0	0	0	2	9
1711	1	1	2	0	0	0	0	2	1	2	9
1712	1	3	0	0	0	0	0	2	1	2	17
1713	1	1	3	0	0	0	0	2	1	2	40
1714	1	2	0	0	0	0	0	1	1	2	17

KEY

Subsys Subsystem

Management techniques

Soil mounds

Vsm Very small
Sm Small
Md Medium
Lge Large

Garden beds

Sq Square
Lg Long

Crop planting seasonality

Maj Dominant
Min Other crops

AGRICULTURAL SYSTEM DATA LISTING - CODES Province: 17 New Ireland

System	Sub	Cash income sources											
	sys	An	Bet	Crd	Cat	Chi	Coc	Cnt	CfA	CfR	Crc	Fwd	Fsh
1701	1	0	0	0	0	0	0	2	0	0	0	0	1
1702	1	0	1	0	0	0	0	3	0	0	0	0	2
1703	1	0	2	0	0	0	1	2	0	0	0	0	1
1704	1	0	2	0	0	0	0	0	0	0	0	0	0
1705	1	0	2	0	0	0	0	2	0	0	0	0	3
1706	1	0	1	0	0	0	1	3	0	0	0	0	2
1707	1	0	1	0	0	0	2	3	0	0	0	0	1
1708	1	0	0	0	0	0	0	0	0	0	0	0	0
1709	1	0	1	0	0	0	2	3	0	0	0	0	0
1710	1	0	1	0	0	0	1	1	0	0	0	0	0
1711	1	0	1	0	0	0	1	1	0	0	0	0	1
1712	1	0	1	0	0	0	0	2	0	0	0	0	1
1713	1	0	0	0	0	0	0	1	0	0	0	0	1
1714	1	0	1	0	0	0	0	1	0	0	0	0	0

KEY

Subsys Subsystem

Cash Income Sources

An	Animal skins	Chi	Chillie	CfR	Coffee Robusta
Bet	Betel nut	Coc	Cocoa	Crc	Crocodile
Crd	Cardamom	Cnt	Coconut	Fwd	Firewood
Cat	Cattle	CfA	Coffee Arabica	Fsh	Fish

AGRICULTURAL SYSTEM DATA LISTING - CODES
Province: 17 New Ireland

System	Sub	Cash income sources										
	sys	Fod	Op	Pot	Pyr	Ric	Rub	Shp	Tea	Tob	Ot1	Ot2
1701	1	1	0	0	0	0	1	0	0	0	0	0
1702	1	0	0	0	0	0	0	0	0	0	1	0
1703	1	2	0	0	0	0	0	0	0	0	0	0
1704	1	2	0	0	0	0	0	0	0	1	0	0
1705	1	2	0	0	0	0	0	0	0	0	0	0
1706	1	1	0	0	0	0	0	0	0	0	0	0
1707	1	2	1	0	0	0	0	0	0	0	0	0
1708	1	3	0	0	0	0	0	0	0	0	1	0
1709	1	1	0	0	0	0	0	0	0	0	0	0
1710	1	1	0	0	0	0	0	0	0	0	0	0
1711	1	1	0	0	0	0	0	0	0	0	0	0
1712	1	1	0	0	0	0	0	0	0	0	0	0
1713	1	1	0	0	0	0	0	0	0	0	0	0
1714	1	1	0	0	0	0	0	0	0	0	1	0

KEY

Subsys Subsystem

Cash Income Sources

Fod	Fresh food	Ric	Rice	Tob	Tobacco
Op	Oil Palm	Rub	Rubber	Ot1	Other 1
Pot	Potato	Shp	Sheep	Ot2	Other 2
Pyr	Pyrethrum	Tea	Tea		

AGRICULTURAL SYSTEM DATA LISTING - CODES **Province: 17 New Ireland**

System	Sub sys	Survey 1				Survey 2				Survey 3			
		Date mth yr	Period yrs	Sv tp	Sv in	Date mth yr	Period yrs	Sv tp	Sv in	Date mth yr	Period yrs	Sv tp	Sv in
1701	1	06 95	-	3	HKM	- -	-	-		- -	-	-	
1702	1	07 95	-	2	HKM	- -	-	-		- -	-	-	
1703	1	07 95	-	3	HKM	- -	-	-		- -	-	-	
1704	1	07 95	-	3	HKM	- -	-	-		- -	-	-	
1705	1	07 95	-	2	HKM	- -	-	-		- -	-	-	
1706	1	09 71	-	2	RMB	12 84	-	2	RLH	07 95	-	2	HKM
1707	1	- -	1971-81	4	RMB	12 84	-	3	RLH	07 95	-	3	HKM
1708	1	- -	1974-81	5	RMB	12 84	-	2	RLH	07 95	-	2	HKM
1709	1	09 71	-	3	RMB	12 84	-	3	RLH	07 95	-	3	AIH
1710	1	07 95	-	3	AIH	- -	-	-		- -	-	-	
1711	1	07 95	-	3	AIH	- -	-	-		- -	-	-	
1712	1	07 95	-	3	RLH	- -	-	-		- -	-	-	
1713	1	07 95	-	2	A/I	- -	-	-		- -	-	-	
1714	1	07 95	-	3	A/I	- -	-	-		- -	-	-	

KEY

Subsys	Subsystem
Sv tp	Survey type
Sv in	Surveyor initials

A/I	W. Akus/P. Igua
AIH	W. Akus/P. Igua/R.L. Hide
HKM	R.L. Hide/R. Kameata/N. Miskaram
RLH	R.L. Hide
RMB	R.M. Bourke

6. LISTINGS OF RURAL VILLAGES (CENSUS UNITS) INDEXED TO AGRICULTURAL SYSTEMS

All rural village Census Units in the 1980 National Population Census which are locatable on either the 1980 or 1990 Census Maps are assigned to an Agricultural System. The village name, National Population Census identification codes (Province, District, Census Division, Census Unit), population and Agricultural System number for each village is held as a single record in a population database (AGPOP). District and Census Division codes for this Province are listed in Appendix A.2.

This section provides three different listings from that database of rural villages indexed by Agricultural Systems:

6.1 Rural villages listed in census order (District, Census Division).

6.2 Rural villages listed in alphabetical order.

6.3 Rural villages listed by Agricultural System number (alphabetically within agricultural systems) with PNGRIS Resource Mapping Unit (RMU) numbers.

Abbreviations used are:

Dist	District name and number (see Appendix A.2)
Div	Census Division number (see Appendix A.2)
Population	1980 National Population Census count of population in a Unit
RMU	Provincial Resource Mapping Unit number (PNGRIS)
System	Agricultural System number
Village	Census Unit name
Unit	Census Unit number

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER

Province: 17 New Ireland

	Village	Population	System
DISTRICT	1 Palakau		
Division	1 Mussau Emira		
1	BAI	83	1701
2	ELEONUSA	32	1701
3	BULIALE	39	1701
4	ELEOA	126	1701
5	EMANANUSA	82	1701
6	KATELUSAE	193	1701
7	LAMAKUNAURU	189	1701
8	LAMUSMUS	32	1701
9	LAVORANG	96	1701
10	LOLIANG	158	1701
11	MAGIEN	158	1701
12	MALAKAT	89	1701
13	MAROI	48	1701
14	NAI	81	1701
15	PAKENA	53	1701
16	ROITAN	89	1701
17	TABILU	100	1701
18	TABOLO	110	1701
19	TANALIU	130	1701
20	TANGAITUTUI - PALAKA	242	1701
21	TANGATUNUTA	172	1701
22	TASINGINA	97	1701
23	TASITEL	267	1701
24	TENCH	21	1701
DISTRICT	2 Lavongai		
Division	2 West Lavongai		
1	AO	128	1703
2	BAUNGUNG	215	1703
3	BELEWAIA/KONE	72	1703
4	BUTELUNG	145	1703
5	KUNG/TUNUNG	122	1702
6	METEMULAI	61	1703
7	METERANKASING	126	1703
8	NEIKONOMON	104	1703
9	NEITAB	79	1702
10	NOIPUAS	158	1703
11	SOSSON	55	1702
12	TABUT	76	1703
13	TINGWON/NUSAMANI	208	1702
14	TUKULIOTONGO	88	1703
15	TUTUILA	121	1703
16	UNGALABU	33	1702
17	UMBUKUL	341	1703
Division	3 North Lavongai		
1	KAVULIKAU	110	1702
2	KITING	74	1704
3	KONEMATALIK	157	1703
4	KULIBANG	170	1702
5	KULPETAU/ATLA	249	1703
6	LUKUS	90	1702
7	MAMION	133	1702
8	METIAI	71	1703
9	METEMIN	54	1703
10	MIN	70	1704
11	MOSUANG/UNUSA	186	1703
12	NUSLIK	80	1702
13	PATIAGAGA	334	1703
14	PATIPAI	139	1703
15	POTPOTINGAN	87	1703
16	PUAS	118	1703
17	SUNGANG	172	1703
18	TSOILIK	108	1702
19	UNGAKUM	117	1702
20	UNGALIK	230	1702
21	VAISAMUAM	268	1704
Division	4 South Lavongai		
1	BAIKEP	173	1703
2	BOLPUA	210	1703
3	KULINGEI	166	1703
4	KULUNGAT	157	1703
5	LAVONGAI	296	1703
6	MAGAM	88	1704
7	MATANIU	126	1703
8	METEKAVIL	168	1703
9	MELEMANA	160	1703
10	METERAN	225	1703
11	METERANGKANG	179	1703
12	METEWOI	255	1703
13	NARIMLAVA	254	1703
14	NEIKAPUTUK	100	1703
15	NEILA	55	1703
16	NEINGANG	109	1703
17	NUSANTAUMATAI	183	1703
18	NUSAWONG	251	1703
19	PATERINA	153	1704
20	SAULA	213	1703
21	TIOPUTUK	159	1703
22	UNGAT	162	1703
23	PATIVUNG	174	1703
24	BAUE	114	1704
25	NGELIAVA	194	1704
26	PATINODO	101	1703
27	KULAPUAS	72	1703
DISTRICT	3 Kavieng		
Division	5 Tigak		
2	BAGATERE	25	1707
3	BANGATAN	73	1705
4	BUTEI	130	1705
5	ENANG	98	1705
6	ENUK	123	1705
7	KABIEN	108	1705
8	KAPLAMAN	115	1706
9	KASELOK	100	1706
10	KAUT	119	1705
12	KULANGIT	126	1706
13	LOKONO	101	1705
14	MAIOM	168	1706
15	MONGOL	86	1706
16	NONOVAUL	97	1705
17	NASAILAS	93	1705
18	NUSALIK	49	1705
19	OMO	93	1706
20	PABLIANG	31	1706
21	PANAPAI	48	1706
22	PUTPUT	100	1706
23	SALAPIU	86	1705
24	TOME	24	1706

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER

Province: 17 New Ireland

	Village	Population	System
25	TUGALOP	62	1705
26	UPUAS	138	1705
Division	6 East Coast Kara Nalik		
1	BOL	117	1707
2	BURA	53	1707
3	FANGALAWA	198	1707
4	FISSOA	175	1707
5	KAFKAF	116	1707
6	KAMA	63	1707
7	FATMILAK	205	1707
8	LAKURUMAU	328	1707
9	LAMALAVA	107	1707
10	LEMEKOT	232	1707
11	LARASLABA	168	1707
12	LAUAN	85	1707
13	LIVITUA	171	1707
14	LAVONGAI	141	1707
15	LAVONGARARUM	96	1707
16	LOSSUK	130	1707
17	LUAPUL	186	1707
18	LUBURUA	195	1707
19	LUGAGON	103	1707
20	MADINA	275	1707
21	MANGGAI	162	1707
22	MUNAWAI	143	1707
23	NGAVALUS	196	1707
24	NONOPAI	165	1707
25	NONO	96	1707
26	PANAFAU	49	1707
27	LAKAROL	17	1707
28	PANAMANA	108	1707
29	PARUAI	87	1707
30	SALI	104	1707
31	TOFABE	55	1707
Division	7 West Coast Kara		
1	BELIFU 1 & 2	153	1707
2	KARIA	195	1705
3	LAEFU	120	1707
4	LAPAI	217	1705
5	LAVOLAI	117	1707
6	LEION	64	1705
7	LEMUSMUS 1	276	1707
8	LEMUSMUS 2	182	1707
9	NAIAMA	77	1707
10	NAMASALANG	76	1707
11	PANAMAFEI	170	1707
12	PANAMEKO	156	1707
13	PANANGAI	153	1707
14	PANGEIFUA	140	1707
15	PANTEGOM	120	1705
16	PILIWA	221	1705
17	SUMUNA	166	1705
18	USIL	93	1707
DISTRICT	4 Konos		
Division	8 East Coast Central		
1	AMBA	155	1707
2	BULU	80	1707
3	BUNGBUWE	52	1707
4	DABINOT	56	1707
6	KABIL	233	1707
7	KADAN	47	1707
8	KALUAN	110	1708
9	KANAMBU	131	1707
10	KANAM	109	1709
11	KANTEBU/DAMON	95	1707
12	KARU	133	1709
13	KATANGAN	72	1707
14	KATENDAN	98	1707
15	KONOBIN	54	1707
16	KONONGUSNGUS	82	1707
17	KONOS	184	1707
18	LAMASONG	198	1707
19	LAMBUSO	133	1707
20	LANGGAMUT	19	1707
21	LANGENIA	215	1707
22	LASIGI	149	1707
23	LAVATBURA	69	1707
24	LAVATKANA 1&2	157	1708
25	LENKAMEN	88	1708
27	LEMERIS	64	1707
28	LIANDAN	92	1707
29	LIBBA	135	1707
30	LIMBIN 1&2	88	1708
32	LIVINKO	78	1707
33	LOKON	191	1709
34	LOSSU 1&2	391	1707
36	MALOM	212	1707
37	PINATGIN	195	1707
38	PINIKIDU	241	1707
39	SILOM	51	1707
40	TANDIS	142	1707
Division	9 West Coast Central		
1	BI'MUN	95	1707
2	DAMPIT	122	1707
3	DANU	125	1707
4	KALAGUNAN	47	1707
5	KANAMARANDAN	115	1707
6	KOKOLA	139	1709
7	KOMALABU	122	1707
8	KOMALU	109	1709
9	KONO	219	1707
10	KONOGOGO	149	1709
11	KONTU	170	1707
12	LAMBU	99	1707
13	LEMAU	85	1707
14	MAMBO	32	1707
15	MESS 1 AND 2	235	1707
16	NEIRUARAN	100	1707
17	PANARAS	103	1707
18	PATLANGAT	79	1707
19	TEMBIN	109	1707
20	UGANA	70	1707
Division	10 Tabar		
1	BANESA	78	1714
2	BUERI	54	1714
3	DATAVA	95	1714
4	KOKO	98	1714
5	KORUMBO	18	1714
6	KOWAMARARA	28	1714
7	LAWA	123	1714
8	MANG-GAWUR	46	1714

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER

Province: 17 New Ireland

	Village	Population	System
9	MAPUA	71	1714
10	MARAGAT	27	1714
11	MARAGON	86	1714
12	MARAI	62	1714
13	MATLIK	122	1714
14	MONUN	37	1714
15	MORAI	67	1714
16	NAPEKUR	157	1714
17	PEKINBERIU	99	1714
18	RAKUBO	59	1714
19	SAMBUARI	60	1714
20	SANAPARI	72	1714
21	SIMBERI	120	1714
22	SOS	54	1714
23	TATAU	135	1714
24	TIRIPATS	19	1714
25	TOKARA	102	1714
26	TUGITUG	26	1714
27	WANG	100	1714
28	TUMUDAR	62	1714
DISTRICT	5 Namatanai		
Division	11 East Coast Namatanai		
1	BAKAN	118	1709
2	BELIK	106	1709
3	BISAPU	184	1709
4	BO	155	1709
5	KANAPIT	95	1709
6	KISELA	155	1709
7	KOLONOBOI	128	1709
8	LOLOBA	127	1709
9	MATANANGAS	137	1709
10	MATANDIDUK	123	1709
11	NABUMAI	127	1709
12	NAMARODU	133	1709
13	NAMATANAI	278	1709
14	NAPANTAH	192	1709
15	PIRE	211	1709
16	PUNAM	215	1709
17	RAMAT	82	1709
18	RASESE	201	1709
19	RATAVIS	119	1709
20	SALIMUN	230	1709
21	SOHUN 1&2	250	1709
23	SOPAU	122	1709
24	WANAWANA	63	1709
Division	12 West Coast Namatanai		
1	BOM	176	1709
2	BURAU	213	1709
3	HUNABORE	112	1709
4	KABANUT	270	1709
5	KALIL	209	1709
6	KURUMUT	103	1709
7	LABUR	160	1709
8	MATAKAN	133	1709
9	PAKINSELA	148	1709
10	PALABONG	145	1709
11	RAPITO	179	1709
12	RAPUNTEMON	240	1709
13	RASIRIK	147	1709
14	RATABU	133	1709
15	REBEHEN 1 (KALIL)	103	1709
16	REBEHEN 2 (LABUR)	243	1709
17	UMUDU	116	1709
Division	13 Susurunga		
1	BALAI	171	1709
2	DANFU	79	1710
3	HIBALING	148	1709
4	HILALON	171	1709
5	HIMAU	204	1709
6	HIMAU'UL	89	1709
7	HIPAGAT	104	1709
8	HURIS	129	1709
9	KAMBIRARA	45	1709
10	KAPSEL	152	1709
11	KAPSIPAU	48	1710
12	KEMBENG	96	1709
13	KUDUKUDU	147	1709
14	IASU	74	1710
15	LIKAS	110	1709
16	MULIAMA	248	1709
17	NOKON	101	1709
18	PORABUNBUN	98	1709
19	PORONBUS	126	1709
20	PULPULU	31	1709
21	PURUNKUM	77	1710
22	REI	83	1710
23	RUKALIKLIK	100	1709
24	SAMO	201	1709
25	SENA	181	1709
26	SUMSUM	86	1710
28	TEKEDAN	68	1709
29	WARANGANSAU	157	1709
30	WEILO	132	1709
Division	14 Kandas		
1	HITUNG	98	1710
2	KABAMAN	140	1710
3	KAIT	141	1710
4	KING	178	1710
5	LAMASSA	283	1710
6	NASKO	87	1710
7	SEMALU	116	1710
8	SIAMAN	142	1710
9	SURALIL	26	1710
10	WATPI	142	1710
11	TAMPAKAR	24	1710
Division	15 Lak		
1	BAKOK	99	1710
2	BAKUM	142	1710
3	BERIOTA	100	1710
4	KAMBILAL	80	1710
5	KAMIANG	52	1710
6	LAMBOM	403	1710
7	LAMORAN	65	1710
8	LENAI	80	1710
9	MALIOM	31	1710
10	MATKAMLAGIR	64	1710
11	MIMIAS	56	1710
12	MORUKON	115	1710
14	SIAR	169	1710
15	KUMPARUM	99	1710

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER

Province: 17 New Ireland

	Village	Population	System
Division	17 Tanga		
1	AMBABA	169	1712
2	AMBISUME	100	1712
3	AMFA	187	1712
4	ANSAWE	214	1712
5	BALANWARANSAU	123	1711
6	BALAMFAL	105	1711
7	BIL	77	1712
8	FANGMEL	85	1711
9	FONLI	304	1712
10	GARGARIS	131	1711
11	KITKITA	107	1711
12	KOMINASAFO	135	1712
13	LUANKE	168	1712
14	PUT	181	1711
15	SASA	268	1712
16	SINAUNDO	72	1711
17	SUNKIN	164	1712
18	TAUBIE	171	1712
19	TAUNSIP	422	1712
20	TEFA	145	1711
21	TIRIWAN	132	1712
Division	18 Anir		
1	BALANGIT	86	1711
2	BALANKOLEN	111	1711
3	BANAKIN	42	1711
4	BASAKALA	37	1711
5	BULAM	86	1711
6	FARANGOT	87	1711
7	GALUSU	137	1711
8	KUMGOT	123	1711
9	NALIU	89	1711
10	NATONG	132	1711
11	TUBULAM	110	1711
13	WARANTABAN	92	1711
14	WARABANA	75	1711
15	FATKASANG	46	1711

	Village	Population	System
DISTRICT	6 Lihir		
Division	16 Lihir		
1	BANAM	158	1711
2	BILAMI	157	1713
3	HUNIHO	19	1711
4	KOMAT	263	1711
5	KUELAM	243	1713
6	LAMBOAR	244	1711
7	LATAUL	245	1711
8	LIBUKO	110	1711
9	LIENBIL	75	1711
10	LINMEL	28	1711
11	LISEL	153	1711
12	LONDOLOVIT/KAPIT	236	1711
13	MALAL	144	1713
14	MALI	109	1713
15	MATAKUES	277	1711
16	MATATUKUEN	158	1713
17	MUSOI	119	1713
18	PANGO	216	1711
19	PENAPEDIK	156	1713
20	PUTPUT 1	259	1711
22	SALI	75	1711
23	SAMO 1	281	1711
25	SIANUS	111	1711
26	SUEN	163	1711
27	TALIS	126	1711
28	TERITERI 1 2	383	1713
30	TOMBAVIL	91	1711
31	TON	263	1713
32	WURTOL	156	1711
33	KUNAIE	353	1711

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER

Province: 17 New Ireland

Village	Dist	Div	Unit	System
AMBA	4	8	1	1707
AMBABA	5	17	1	1712
AMBISUME	5	17	2	1712
AMFA	5	17	3	1712
ANSAWE	5	17	4	1712
AO	2	2	1	1703
BAGATERE	3	5	2	1707
BAI	1	1	1	1701
BAIKEP	2	4	1	1703
BAKAN	5	11	1	1709
BAKOK	5	15	1	1710
BAKUM	5	15	2	1710
BALAI	5	13	1	1709
BALAMFAL	5	17	6	1711
BALANGIT	5	18	1	1711
BALANKOLEN	5	18	2	1711
BALANWARANSAU	5	17	5	1711
BANAKIN	5	18	3	1711
BANAM	6	16	1	1711
BANESA	4	10	1	1714
BANGATAN	3	5	3	1705
BASAKALA	5	18	4	1711
BAUE	2	4	24	1704
BAUNGUNG	2	2	2	1703
BELEWAIA/KONE	2	2	3	1703
BELIFU 1 & 2	3	7	1	1707
BELIK	5	11	2	1709
BERIOTA	5	15	3	1710
BI'MUN	4	9	1	1707
BIL	5	17	7	1712
BILAMI	6	16	2	1713
BISAPU	5	11	3	1709
BO	5	11	4	1709
BOL	3	6	1	1707
BOLPUA	2	4	2	1703
BOM	5	12	1	1709
BUERI	4	10	2	1714
BULAM	5	18	5	1711
BULIALE	1	1	3	1701
BULU	4	8	2	1707
BUNGBUWE	4	8	3	1707
BURA	3	6	2	1707
BURAU	5	12	2	1709
BUTEI	3	5	4	1705
BUTELUNG	2	2	4	1703
DABINOT	4	8	4	1707
DAMPIT	4	9	2	1707
DANFU	5	13	2	1710
DANU	4	9	3	1707
DATAVA	4	10	3	1714
ELEOA	1	1	4	1701
ELEONUSA	1	1	2	1701
EMANANUSA	1	1	5	1701
ENANG	3	5	5	1705
ENUK	3	5	6	1705
FANGALAWA	3	6	3	1707
FANGMEL	5	17	8	1711
FARANGOT	5	18	6	1711
FATKASANG	5	18	15	1711
FATMILAK	3	6	7	1707
FISSOA	3	6	4	1707
FONLI	5	17	9	1712
GALUSU	5	18	7	1711
GARGARIS	5	17	10	1711
HIBALING	5	13	3	1709
HILALON	5	13	4	1709
HIMAU	5	13	5	1709
HIMAU'UL	5	13	6	1709
HIPAGAT	5	13	7	1709
HITUNG	5	14	1	1710
HUNABORE	5	12	3	1709
HUNIHO	6	16	3	1711
HURIS	5	13	8	1709
IASU	5	13	14	1710
KABAMAN	5	14	2	1710
KABANUT	5	12	4	1709
KABIEN	3	5	7	1705
KABIL	4	8	6	1707
KADAN	4	8	7	1707
KAFKAF	3	6	5	1707
KAIT	5	14	3	1710
KALAGUNAN	4	9	4	1707
KALIL	5	12	5	1709
KALUAN	4	8	8	1708
KAMA	3	6	6	1707
KAMBILAL	5	15	4	1710
KAMBIRARA	5	13	9	1709
KAMIANG	5	15	5	1710
KANAM	4	8	10	1709
KANAMARANDAN	4	9	5	1707
KANAMBU	4	8	9	1707
KANAPIT	5	11	5	1709
KANTEBU/DAMON	4	8	11	1707
KAPLAMAN	3	5	8	1706
KAPSEL	5	13	10	1709
KAPSIPAU	5	13	11	1710
KARIA	3	7	2	1705
KARU	4	8	12	1709
KASELOK	3	5	9	1706
KATANGAN	4	8	13	1707
KATELUSAE	1	1	6	1701
KATENDAN	4	8	14	1707
KAUT	3	5	10	1705
KAVULIKAU	2	3	1	1702
KEMBENG	5	13	12	1709
KING	5	14	4	1710
KISELA	5	11	6	1709
KITING	2	3	2	1704
KITKITA	5	17	11	1711
KOKO	4	10	4	1714
KOKOLA	4	9	6	1709
KOLONOBOI	5	11	7	1709
KOMALABU	4	9	7	1707
KOMALU	4	9	8	1709
KOMAT	6	16	4	1711

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER

Province: 17 New Ireland

Village	Dist	Div	Unit	System
KOMINASAFO	5	17	12	1712
KONEMATALIK	2	3	3	1703
KONO	4	9	9	1707
KONOBIN	4	8	15	1707
KONOGOGO	4	9	10	1709
KONONGUSNGUS	4	8	16	1707
KONOS	4	8	17	1707
KONTU	4	9	11	1707
KORUMBO	4	10	5	1714
KOWAMARARA	4	10	6	1714
KUDUKUDU	5	13	13	1709
KUELAM	6	16	5	1713
KULANGIT	3	5	12	1706
KULAPUAS	2	4	27	1703
KULIBANG	2	3	4	1702
KULINGEI	2	4	3	1703
KULPETAU/ATLA	2	3	5	1703
KULUNGAT	2	4	4	1703
KUMGOT	5	18	8	1711
KUMPARUM	5	15	15	1710
KUNAIE	6	16	33	1711
KUNG/TUNUNG	2	2	5	1702
KURUMUT	5	12	6	1709
LABUR	5	12	7	1709
LAEFU	3	7	3	1707
LAKAROL	3	6	27	1707
LAKURUMAU	3	6	8	1707
LAMAKUNAURU	1	1	7	1701
LAMALAVA	3	6	9	1707
LAMASONG	4	8	18	1707
LAMASSA	5	14	5	1710
LAMBOAR	6	16	6	1711
LAMBOM	5	15	6	1710
LAMBU	4	9	12	1707
LAMBUSO	4	8	19	1707
LAMORAN	5	15	7	1710
LAMUSMUS	1	1	8	1701
LANGENIA	4	8	21	1707
LANGGAMUT	4	8	20	1707
LAPAI	3	7	4	1705
LARASLABA	3	6	11	1707
LASIGI	4	8	22	1707
LATAUL	6	16	7	1711
LAUAN	3	6	12	1707
LAVATBURA	4	8	23	1707
LAVATKANA 1&2	4	8	24	1708
LAVOLAI	3	7	5	1707
LAVONGAI	2	4	5	1703
LAVONGAI	3	6	14	1707
LAVONGARARUM	3	6	15	1707
LAVORANG	1	1	9	1701
LAWA	4	10	7	1714
LEION	3	7	6	1705
LEMAU	4	9	13	1707
LEMEKOT	3	6	10	1707
LEMERIS	4	8	27	1707
LEMUSMUS 1	3	7	7	1707
LEMUSMUS 2	3	7	8	1707
LENAI	5	15	8	1710
LENKAMEN	4	8	25	1708
LIANDAN	4	8	28	1707
LIBBA	4	8	29	1707
LIBUKO	6	16	8	1711
LIENBIL	6	16	9	1711
LIKAS	5	13	15	1709
LIMBIN 1&2	4	8	30	1708
LINMEL	6	16	10	1711
LISEL	6	16	11	1711
LIVINKO	4	8	32	1707
LIVITUA	3	6	13	1707
LOKON	4	8	33	1709
LOKONO	3	5	13	1705
LOLIANG	1	1	10	1701
LOLOBA	5	11	8	1709
LONDOLOVIT/KAPIT	6	16	12	1711
LOSSU 1&2	4	8	34	1707
LOSSUK	3	6	16	1707
LUANKE	5	17	13	1712
LUAPUL	3	6	17	1707
LUBURUA	3	6	18	1707
LUGAGON	3	6	19	1707
LUKUS	2	3	6	1702
MADINA	3	6	20	1707
MAGAM	2	4	6	1704
MAGIEN	1	1	11	1701
MAIOM	3	5	14	1706
MALAKAT	1	1	12	1701
MALAL	6	16	13	1713
MALI	6	16	14	1713
MALIOM	5	15	9	1710
MALOM	4	8	36	1707
MAMBO	4	9	14	1707
MAMION	2	3	7	1702
MANG-GAWUR	4	10	8	1714
MANGGAI	3	6	21	1707
MAPUA	4	10	9	1714
MARAGAT	4	10	10	1714
MARAGON	4	10	11	1714
MARAI	4	10	12	1714
MAROI	1	1	13	1701
MATAKAN	5	12	8	1709
MATAKUES	6	16	15	1711
MATANANGAS	5	11	9	1709
MATANDIDUK	5	11	10	1709
MATANIU	2	4	7	1703
MATATUKUEN	6	16	16	1713
MATKAMLAGIR	5	15	10	1710
MATLIK	4	10	13	1714
MELEMANA	2	4	9	1703
MESS 1 AND 2	4	9	15	1707
METEKAVIL	2	4	8	1703
METEMIN	2	3	9	1703
METEMULAI	2	2	6	1703
METERAN	2	4	10	1703
METERANGKANG	2	4	11	1703
METERANKASING	2	2	7	1703
METEWOI	2	4	12	1703
METIAI	2	3	8	1703
MIMIAS	5	15	11	1710
MIN	2	3	10	1704

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER

Province: 17 New Ireland

Village	Dist	Div	Unit	System
MONGOL	3	5	15	1706
MONUN	4	10	14	1714
MORAI	4	10	15	1714
MORUKON	5	15	12	1710
MOSUANG/UNUSA	2	3	11	1703
MULIAMA	5	13	16	1709
MUNAWAI	3	6	22	1707
MUSOI	6	16	17	1713
NABUMAI	5	11	11	1709
NAI	1	1	14	1701
NAIAMA	3	7	9	1707
NALIU	5	18	9	1711
NAMARODU	5	11	12	1709
NAMASALANG	3	7	10	1707
NAMATANAI	5	11	13	1709
NAPANTAH	5	11	14	1709
NAPEKUR	4	10	16	1714
NARIMLAVA	2	4	13	1703
NASAILAS	3	5	17	1705
NASKO	5	14	6	1710
NATONG	5	18	10	1711
NEIKAPUTUK	2	4	14	1703
NEIKONOMON	2	2	8	1703
NEILA	2	4	15	1703
NEINGANG	2	4	16	1703
NEIRUARAN	4	9	16	1707
NEITAB	2	2	9	1702
NGAVALUS	3	6	23	1707
NGELIAVA	2	4	25	1704
NOIPUAS	2	2	10	1703
NOKON	5	13	17	1709
NONO	3	6	25	1707
NONOPAI	3	6	24	1707
NONOVAUL	3	5	16	1705
NUSALIK	3	5	18	1705
NUSANTAUMATAI	2	4	17	1703
NUSAWONG	2	4	18	1703
NUSLIK	2	3	12	1702
OMO	3	5	19	1706
PABLIANG	3	5	20	1706
PAKENA	1	1	15	1701
PAKINSELA	5	12	9	1709
PALABONG	5	12	10	1709
PANAFAU	3	6	26	1707
PANAMAFEI	3	7	11	1707
PANAMANA	3	6	28	1707
PANAMEKO	3	7	12	1707
PANANGAI	3	7	13	1707
PANAPAI	3	5	21	1706
PANARAS	4	9	17	1707
PANGEIFUA	3	7	14	1707
PANGO	6	16	18	1711
PANTEGOM	3	7	15	1705
PARUAI	3	6	29	1707
PATERINA	2	4	19	1704
PATIAGAGA	2	3	13	1703
PATINODO	2	4	26	1703
PATIPAI	2	3	14	1703
PATIVUNG	2	4	23	1703
PATLANGAT	4	9	18	1707
PEKINBERIU	4	10	17	1714
PENAPEDIK	6	16	19	1713
PILIWA	3	7	16	1705
PINATGIN	4	8	37	1707
PINIKIDU	4	8	38	1707
PIRE	5	11	15	1709
PORABUNBUN	5	13	18	1709
PORONBUS	5	13	19	1709
POTPOTINGAN	2	3	15	1703
PUAS	2	3	16	1703
PULPULU	5	13	20	1709
PUNAM	5	11	16	1709
PURUNKUM	5	13	21	1710
PUT	5	17	14	1711
PUTPUT	3	5	22	1706
PUTPUT 1	6	16	20	1711
RAKUBO	4	10	18	1714
RAMAT	5	11	17	1709
RAPITO	5	12	11	1709
RAPUNTEMON	5	12	12	1709
RASESE	5	11	18	1709
RASIRIK	5	12	13	1709
RATABU	5	12	14	1709
RATAVIS	5	11	19	1709
REBEHEN 1 (KALIL)	5	12	15	1709
REBEHEN 2 (LABUR)	5	12	16	1709
REI	5	13	22	1710
ROITAN	1	1	16	1701
RUKALIKLIK	5	13	23	1709
SALAPIU	3	5	23	1705
SALI	3	6	30	1707
SALI	6	16	22	1711
SALIMUN	5	11	20	1709
SAMBUARI	4	10	19	1714
SAMO	5	13	24	1709
SAMO 1	6	16	23	1711
SANAPARI	4	10	20	1714
SASA	5	17	15	1712
SAULA	2	4	20	1703
SEMALU	5	14	7	1710
SENA	5	13	25	1709
SIAMAN	5	14	8	1710
SIANUS	6	16	25	1711
SIAR	5	15	14	1710
SILOM	4	8	39	1707
SIMBERI	4	10	21	1714
SINAUNDO	5	17	16	1711
SOHUN 1&2	5	11	21	1709
SOPAU	5	11	23	1709
SOS	4	10	22	1714
SOSSON	2	2	11	1702
SUEN	6	16	26	1711
SUMSUM	5	13	26	1710
SUMUNA	3	7	17	1705
SUNGANG	2	3	17	1703
SUNKIN	5	17	17	1712
SURALIL	5	14	9	1710

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER

Province: 17 New Ireland

Village	Dist	Div	Unit	System	Village	Dist	Div	Unit	System
TABILU	1	1	17	1701	TSOILIK	2	3	18	1702
TABOLO	1	1	18	1701	TUBULAM	5	18	11	1711
TABUT	2	2	12	1703	TUGALOP	3	5	25	1705
TALIS	6	16	27	1711	TUGITUG	4	10	26	1714
TAMPAKAR	5	14	11	1710	TUKULIOTONGO	2	2	14	1703
TANALIU	1	1	19	1701	TUMUDAR	4	10	28	1714
TANDIS	4	8	40	1707	TUTUILA	2	2	15	1703
TANGAITUTUI - PALAKA	1	1	20	1701	UGANA	4	9	20	1707
TANGATUNUTA	1	1	21	1701	UMBUKUL	2	2	17	1703
TASINGINA	1	1	22	1701	UMUDU	5	12	17	1709
TASITEL	1	1	23	1701	UNGAKUM	2	3	19	1702
TATAU	4	10	23	1714	UNGALABU	2	2	16	1702
TAUBIE	5	17	18	1712	UNGALIK	2	3	20	1702
TAUNSIP	5	17	19	1712	UNGAT	2	4	22	1703
TEFA	5	17	20	1711	UPUAS	3	5	26	1705
TEKEDAN	5	13	28	1709	USIL	3	7	18	1707
TEMBIN	4	9	19	1707					
TENCH	1	1	24	1701	VAISAMUAM	2	3	21	1704
TERITERI 1 2	6	16	28	1713					
TINGWON/NUSAMANI	2	2	13	1702	WANAWANA	5	11	24	1709
TIOPUTUK	2	4	21	1703	WANG	4	10	27	1714
TIRIPATS	4	10	24	1714	WARABANA	5	18	14	1711
TIRIWAN	5	17	21	1712	WARANGANSAU	5	13	29	1709
TOFABE	3	6	31	1707	WARANTABAN	5	18	13	1711
TOKARA	4	10	25	1714	WATPI	5	14	10	1710
TOMBAVIL	6	16	30	1711	WEILO	5	13	30	1709
TOME	3	5	24	1706	WURTOL	6	16	32	1711
TON	6	16	31	1713					

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM Province: 17 New Ireland

Village	Dist	Div	Unit	RMU
SYSTEM 1701				
BAI	1	1	1	134
BULIALE	1	1	3	121
ELEOA	1	1	4	121
ELEONUSA	1	1	2	121
EMANANUSA	1	1	5	124
KATELUSAE	1	1	6	89
LAMAKUNAURU	1	1	7	89
LAMUSMUS	1	1	8	134
LAVORANG	1	1	9	134
LOLIANG	1	1	10	89
MAGIEN	1	1	11	134
MALAKAT	1	1	12	89
MAROI	1	1	13	89
NAI	1	1	14	89
PAKENA	1	1	15	121
ROITAN	1	1	16	89
TABILU	1	1	17	121
TABOLO	1	1	18	123
TANALIU	1	1	19	134
TANGAITUTUI - PALAKA	1	1	20	89
TANGATUNUTA	1	1	21	124
TASINGINA	1	1	22	121
TASITEL	1	1	23	89
TENCH	1	1	24	122
SYSTEM 1702				
KAVULIKAU	2	3	1	9
KULIBANG	2	3	4	9
KUNG/TUNUNG	2	2	5	112
LUKUS	2	3	6	22
MAMION	2	3	7	9
NEITAB	2	2	9	111
NUSLIK	2	3	12	22
SOSSON	2	2	11	114
TINGWON/NUSAMANI	2	2	13	119
TSOILIK	2	3	18	9
UNGAKUM	2	3	19	9
UNGALABU	2	2	16	113
UNGALIK	2	3	20	116
SYSTEM 1703				
AO	2	2	1	2
BAIKEP	2	4	1	7
BAUNGUNG	2	2	2	6
BELEWAIA/KONE	2	2	3	3
BOLPUA	2	4	2	6
BUTELUNG	2	2	4	6
KONEMATALIK	2	3	3	8
KULAPUAS	2	4	27	8
KULINGEI	2	4	3	8
KULPETAU/ATLA	2	3	5	8
KULUNGAT	2	4	4	6
LAVONGAI	2	4	5	6
MATANIU	2	4	7	8
MELEMANA	2	4	9	7
METEKAVIL	2	4	8	7
METEMIN	2	3	9	4
METEMULAI	2	2	6	3
METERAN	2	4	10	7
METERANGKANG	2	4	11	6
METERANKASING	2	2	7	3
METEWOI	2	4	12	7
METIAI	2	3	8	8
MOSUANG/UNUSA	2	3	11	4
NARIMLAVA	2	4	13	8
NEIKAPUTUK	2	4	14	8
NEIKONOMON	2	2	8	5
NEILA	2	4	15	8
NEINGANG	2	4	16	6
NOIPUAS	2	2	10	3
NUSANTAUMATAI	2	4	17	8
NUSAWONG	2	4	18	6
PATIAGAGA	2	3	13	5
PATINODO	2	4	26	7
PATIPAI	2	3	14	8
PATIVUNG	2	4	23	7
POTPOTINGAN	2	3	15	5
PUAS	2	3	16	4
SAULA	2	4	20	6
SUNGANG	2	3	17	8
TABUT	2	2	12	3
TIOPUTUK	2	4	21	7
TUKULIOTONGO	2	2	14	6
TUTUILA	2	2	15	6
UMBUKUL	2	2	17	2
UNGAT	2	4	22	7
SYSTEM 1704				
BAUE	2	4	24	7
KITING	2	3	2	5
MAGAM	2	4	6	8
MIN	2	3	10	5
NGELIAVA	2	4	25	6
PATERINA	2	4	19	6
VAISAMUAM	2	3	21	5
SYSTEM 1705				
BANGATAN	3	5	3	13
BUTEI	3	5	4	15
ENANG	3	5	5	12
ENUK	3	5	6	15
KABIEN	3	5	7	18
KARIA	3	7	2	31
KAUT	3	5	10	29
LAPAI	3	7	4	31
LEION	3	7	6	31
LOKONO	3	5	13	18
NASAILAS	3	5	17	15
NONOVAUL	3	5	16	15
NUSALIK	3	5	18	21
PANTEGOM	3	7	15	31
PILIWA	3	7	16	31
SALAPIU	3	5	23	14
SUMUNA	3	7	17	31
TUGALOP	3	5	25	115
UPUAS	3	5	26	14
SYSTEM 1706				
KAPLAMAN	3	5	8	23
KASELOK	3	5	9	23

Village	Dist	Div	Unit	RMU
KULANGIT	3	5	12	23
MAIOM	3	5	14	23
MONGOL	3	5	15	23
OMO	3	5	19	23
PABLIANG	3	5	20	23
PANAPAI	3	5	21	23
PUTPUT	3	5	22	23
TOME	3	5	24	20
SYSTEM 1707				
AMBA	4	8	1	37
BAGATERE	3	5	2	32
BELIFU 1 & 2	3	7	1	32
BI'MUN	4	9	1	40
BOL	3	6	1	37
BULU	4	8	2	44
BUNGBUWE	4	8	3	44
BURA	3	6	2	37
DABINOT	4	8	4	44
DAMPIT	4	9	2	40
DANU	4	9	3	40
FANGALAWA	3	6	3	27
FATMILAK	3	6	7	37
FISSOA	3	6	4	37
KABIL	4	8	6	37
KADAN	4	8	7	44
KAFKAF	3	6	5	37
KALAGUNAN	4	9	4	40
KAMA	3	6	6	37
KANAMARANDAN	4	9	5	40
KANAMBU	4	8	9	43
KANTEBU/DAMON	4	8	11	44
KATANGAN	4	8	13	44
KATENDAN	4	8	14	37
KOMALABU	4	9	7	40
KONO	4	9	9	40
KONOBIN	4	8	15	37
KONONGUSNGUS	4	8	16	37
KONOS	4	8	17	37
KONTU	4	9	11	40
LAEFU	3	7	3	32
LAKAROL	3	6	27	27
LAKURUMAU	3	6	8	27
LAMALAVA	3	6	9	37
LAMASONG	4	8	18	37
LAMBU	4	9	12	40
LAMBUSO	4	8	19	37
LANGENIA	4	8	21	37
LANGGAMUT	4	8	20	44
LARASLABA	3	6	11	27
LASIGI	4	8	22	37
LAUAN	3	6	12	27
LAVATBURA	4	8	23	37
LAVOLAI	3	7	5	32
LAVONGAI	3	6	14	27
LAVONGARARUM	3	6	15	27
LEMAU	4	9	13	40
LEMEKOT	3	6	10	27
LEMERIS	4	8	27	44
LEMUSMUS 1	3	7	7	32
LEMUSMUS 2	3	7	8	32
LIANDAN	4	8	28	37
LIBBA	4	8	29	37
LIVINKO	4	8	32	44
LIVITUA	3	6	13	27
LOSSU 1&2	4	8	34	37
LOSSUK	3	6	16	27
LUAPUL	3	6	17	27
LUBURUA	3	6	18	27
LUGAGON	3	6	19	37
MADINA	3	6	20	27
MALOM	4	8	36	37
MAMBO	4	9	14	40
MANGGAI	3	6	21	27
MESS 1 AND 2	4	9	15	40
MUNAWAI	3	6	22	27
NAIAMA	3	7	9	32
NAMASALANG	3	7	10	32
NEIRUARAN	4	9	16	40
NGAVALUS	3	6	23	27
NONO	3	6	25	27
NONOPAI	3	6	24	27
PANAFAU	3	6	26	27
PANAMAFEI	3	7	11	32
PANAMANA	3	6	28	27
PANAMEKO	3	7	12	32
PANANGAI	3	7	13	32
PANARAS	4	9	17	32
PANGEIFUA	3	7	14	32
PARUAI	3	6	29	27
PATLANGAT	4	9	18	40
PINATGIN	4	8	37	44
PINIKIDU	4	8	38	37
SALI	3	6	30	27
SILOM	4	8	39	44
TANDIS	4	8	40	37
TEMBIN	4	9	19	40
TOFABE	3	6	31	27
UGANA	4	9	20	40
USIL	3	7	18	32
SYSTEM 1708				
KALUAN	4	8	8	45
LAVATKANA 1&2	4	8	24	45
LENKAMEN	4	8	25	45
LIMBIN 1&2	4	8	30	45
SYSTEM 1709				
BAKAN	5	11	1	48
BALAI	5	13	1	132
BELIK	5	11	2	48
BISAPU	5	11	3	51
BO	5	11	4	128
BOM	5	12	1	53
BURAU	5	12	2	53
HIBALING	5	13	3	132
HILALON	5	13	4	132
HIMAU	5	13	5	132
HIMAU'UL	5	13	6	132
HIPAGAT	5	13	7	132
HUNABORE	5	12	3	53
HURIS	5	13	8	132

Village	Dist	Div	Unit	RMU
KABANUT	5	12	4	53
KALIL	5	12	5	53
KAMBIRARA	5	13	9	132
KANAM	4	8	10	48
KANAPIT	5	11	5	48
KAPSEL	5	13	10	132
KARU	4	8	12	48
KEMBENG	5	13	12	132
KISELA	5	11	6	51
KOKOLA	4	9	6	127
KOLONOBOI	5	11	7	48
KOMALU	4	9	8	127
KONOGOGO	4	9	10	127
KUDUKUDU	5	13	13	132
KURUMUT	5	12	6	50
LABUR	5	12	7	50
LIKAS	5	13	15	132
LOKON	4	8	33	48
LOLOBA	5	11	8	48
MATAKAN	5	12	8	53
MATANANGAS	5	11	9	51
MATANDIDUK	5	11	10	51
MULIAMA	5	13	16	61
NABUMAI	5	11	11	52
NAMARODU	5	11	12	51
NAMATANAI	5	11	13	51
NAPANTAH	5	11	14	52
NOKON	5	13	17	132
PAKINSELA	5	12	9	53
PALABONG	5	12	10	56
PIRE	5	11	15	51
PORABUNBUN	5	13	18	132
PORONBUS	5	13	19	132
PULPULU	5	13	20	132
PUNAM	5	11	16	51
RAMAT	5	11	17	49
RAPITO	5	12	11	128
RAPUNTEMON	5	12	12	50
RASESE	5	11	18	51
RASIRIK	5	12	13	128
RATABU	5	12	14	53
RATAVIS	5	11	19	51
REBEHEN 1 (KALIL)	5	12	15	53
REBEHEN 2 (LABUR)	5	12	16	53
RUKALIKLIK	5	13	23	132
SALIMUN	5	11	20	51
SAMO	5	13	24	132
SENA	5	13	25	132
SOHUN 1&2	5	11	21	51
SOPAU	5	11	23	51
TEKEDAN	5	13	28	132
UMUDU	5	12	17	53
WANAWANA	5	11	24	51
WARANGANSAU	5	13	29	132
WEILO	5	13	30	66
SYSTEM 1710				
BAKOK	5	15	1	91
BAKUM	5	15	2	86
BERIOTA	5	15	3	92
DANFU	5	13	2	66
HITUNG	5	14	1	56
IASU	5	13	14	67
KABAMAN	5	14	2	82
KAIT	5	14	3	80
KAMBILAL	5	15	4	68
KAMIANG	5	15	5	68
KAPSIPAU	5	13	11	68
KING	5	14	4	80
KUMPARUM	5	15	15	68
LAMASSA	5	14	5	118
LAMBOM	5	15	6	117
LAMORAN	5	15	7	68
LENAI	5	15	8	68
MALIOM	5	15	9	85
MATKAMLAGIR	5	15	10	87
MIMIAS	5	15	11	68
MORUKON	5	15	12	68
NASKO	5	14	6	79
PURUNKUM	5	13	21	67
REI	5	13	22	68
SEMALU	5	14	7	78
SIAMAN	5	14	8	76
SIAR	5	15	14	86
SUMSUM	5	13	26	68
SURALIL	5	14	9	55
TAMPAKAR	5	14	11	76
WATPI	5	14	10	79
SYSTEM 1711				
BALAMFAL	5	17	6	106
BALANGIT	5	18	1	109
BALANKOLEN	5	18	2	110
BALANWARANSAU	5	17	5	105
BANAKIN	5	18	3	73
BANAM	6	16	1	103
BASAKALA	5	18	4	110
BULAM	5	18	5	73
FANGMEL	5	17	8	105
FARANGOT	5	18	6	108
FATKASANG	5	18	15	110
GALUSU	5	18	7	73
GARGARIS	5	17	10	105
HUNIHO	6	16	3	103
KITKITA	5	17	11	106
KOMAT	6	16	4	126
KUMGOT	5	18	8	73
KUNAIE	6	16	33	126
LAMBOAR	6	16	6	103
LATAUL	6	16	7	126
LIBUKO	6	16	8	126
LIENBIL	6	16	9	126
LINMEL	6	16	10	126
LISEL	6	16	11	126
LONDOLOVIT/KAPIT	6	16	12	126
MATAKUES	6	16	15	126
NALIU	5	18	9	73
NATONG	5	18	10	110
PANGO	6	16	18	126
PUT	5	17	14	105
PUTPUT 1	6	16	20	126
SALI	6	16	22	126

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM Province: 17 New Ireland

Village	Dist	Div	Unit	RMU
SAMO 1	6	16	23	126
SIANUS	6	16	25	126
SINAUNDO	5	17	16	105
SUEN	6	16	26	126
TALIS	6	16	27	126
TEFA	5	17	20	107
TOMBAVIL	6	16	30	126
TUBULAM	5	18	11	110
WARABANA	5	18	14	110
WARANTABAN	5	18	13	108
WURTOL	6	16	32	126
SYSTEM 1712				
AMBABA	5	17	1	104
AMBISUME	5	17	2	104
AMFA	5	17	3	104
ANSAWE	5	17	4	104
BIL	5	17	7	104
FONLI	5	17	9	104
KOMINASAFO	5	17	12	104
LUANKE	5	17	13	104
SASA	5	17	15	104
SUNKIN	5	17	17	104
TAUBIE	5	17	18	104
TAUNSIP	5	17	19	104
TIRIWAN	5	17	21	104
SYSTEM 1713				
BILAMI	6	16	2	101
KUELAM	6	16	5	100
MALAL	6	16	13	101
MALI	6	16	14	102
MATATUKUEN	6	16	16	101
MUSOI	6	16	17	101
PENAPEDIK	6	16	19	102
TERITERI 1 2	6	16	28	100
TON	6	16	31	101

Village	Dist	Div	Unit	RMU
SYSTEM 1714				
BANESA	4	10	1	99
BUERI	4	10	2	94
DATAVA	4	10	3	98
KOKO	4	10	4	98
KORUMBO	4	10	5	95
KOWAMARARA	4	10	6	97
LAWA	4	10	7	95
MANG-GAWUR	4	10	8	95
MAPUA	4	10	9	95
MARAGAT	4	10	10	96
MARAGON	4	10	11	94
MARAI	4	10	12	96
MATLIK	4	10	13	99
MONUN	4	10	14	93
MORAI	4	10	15	99
NAPEKUR	4	10	16	94
PEKINBERIU	4	10	17	95
RAKUBO	4	10	18	97
SAMBUARI	4	10	19	96
SANAPARI	4	10	20	95
SIMBERI	4	10	21	94
SOS	4	10	22	95
TATAU	4	10	23	95
TIRIPATS	4	10	24	97
TOKARA	4	10	25	95
TUGITUG	4	10	26	95
TUMUDAR	4	10	28	98
WANG	4	10	27	99

APPENDIX A.1

NATIONAL POPULATION CENSUS PROVINCIAL CODES

Province	Abbreviation	Code
Western	WES	01
Gulf	GUL	02
Central	CEN	03
National Capital District	NCD	04
Milne Bay	MBP	05
Oro (Northern)	ORO	06
Southern Highlands	SHP	07
Enga	ENG	08
Western Highlands	WHP	09
Simbu (Chimbu)	SIM	10
Eastern Highlands	EHP	11
Morobe	MOR	12
Madang	MAD	13
East Sepik	ESP	14
West Sepik (Sandaun)	WSP	15
Manus	MAN	16
New Ireland	NIP	17
East New Britain	ENB	18
West New Britain	WNB	19
Bougainville	NSP	20

APPENDIX A.2

NATIONAL POPULATION CENSUS CODES FOR DISTRICTS AND CENSUS DIVISIONS, NEW IRELAND PROVINCE[1]

Code	Division	Code	Division
01	PALAKAU	05	NAMATANAI
01	MUSSAU EMIRA	11	EAST COAST NAMATANAI
		12	WEST COAST NAMATANAI
02	LAVONGAI	13	SUSURUNGA
02	WEST LAVONGAI	14	KANDAS
03	NORTH LAVONGAI	15	LAK
04	SOUTH LAVONGAI	17	TANGA
		18	ANIR
03	KAVIENG		
05	TIGAK	06	LIHIR
06	EAST COAST KARA NALIK	16	LIHIR
07	WEST COAST KARA		
04	KONOS		
08	EAST COAST CENTRAL		
09	WEST COAST CENTRAL		
10	TABAR		

[1] The Census Division names and codes are from the 1980 National Population Census. However, because the district definitions in some provinces changed between the 1980 and 1990 censuses, and because districts are important for provincial administrative purposes, the district names and codes are from the 1990 National Population Census. Some provinces have further changed district definitions since 1990 but these are not shown.

Agricultural Systems of Papua New Guinea Working Papers

1. Bourke, R.M., B.J. Allen, P. Hobsbawn and J. Conway (1998) Papua New Guinea: Text Summaries (two volumes).
2. Allen, B.J., R.L. Hide, R.M. Bourke, D. Fritsch, R. Grau, E. Lowes, T. Nen, E. Nirsie, J. Risimeri and M. Woruba (2002) East Sepik Province: Text Summaries, Maps, Code Lists and Village Identification.
3. Bourke, R.M., B.J. Allen, R.L. Hide, D. Fritsch, R. Grau, E. Lowes, T. Nen, E. Nirsie, J. Risimeri and M. Woruba (2002) West Sepik Province: Text Summaries, Maps, Code Lists and Village Identification.
4. Allen, B.J., R.L. Hide, R.M. Bourke, W. Akus, D. Fritsch, R. Grau, G. Ling and E. Lowes (2002) Western Province: Text Summaries, Maps, Code Lists and Village Identification.
5. Hide, R.L., R.M. Bourke, B.J. Allen, N. Fereday, D. Fritsch, R. Grau, E. Lowes and M. Woruba (2002) Gulf Province: Text Summaries, Maps, Code Lists and Village Identification.
6. Hide, R.L., R.M. Bourke, B.J. Allen, T. Betitis, D. Fritsch, R. Grau, L. Kurika, E. Lowes, D.K. Mitchell, S.S. Rangai, M. Sakiasi, G. Sem and B. Suma (2002) Milne Bay Province: Text Summaries, Maps, Code Lists and Village Identification.
7. Allen, B.J., R.L. Hide, R.M. Bourke, D. Fritsch, R. Grau, P. Hobsbawn, M.P. Levett, I.S. Majnep, V. Mangai, T. Nen and G. Sem (2002) Madang Province: Text Summaries, Maps, Code Lists and Village Identification.
8. Bourke R.M., B.J. Allen, R.L. Hide, D. Fritsch, R. Grau, P. Hobsbawn, E. Lowes and D. Stannard (2002) Eastern Highlands Province: Text Summaries, Maps, Code Lists and Village Identification.
9. Allen, B.J., R.L. Hide, R.M. Bourke, C. Ballard, D. Fritsch, R. Grau, P. Hobsbawn, G.S. Humphreys and D. Kandasan (2002) Enga Province: Text Summaries, Maps, Code Lists and Village Identification.
10. Hide, R.L., R.M. Bourke, B.J. Allen, D. Fritsch, R. Grau, P. Hobsbawn and S. Lyon (2002) Western Highlands Province: Text Summaries, Maps, Code Lists and Village Identification.
11. Bourke, R.M., B.J. Allen, R.L. Hide, D. Fritsch, R. Grau, P. Hobsbawn, B. Konabe, M.P. Levett, S. Lyon and A. Varvaliu (2002) Southern Highlands Province: Text Summaries, Maps, Code Lists and Village Identification.
12. Hide, R.L., R.M. Bourke, B.J. Allen, D. Fritsch, R. Grau, P. Hobsbawn and S. Lyon (2002) Chimbu Province: Text Summaries, Maps, Code Lists and Village Identification.
13. Bourke, R.M., R.L. Hide, B.J. Allen, D. Fritsch, R. Grau, P. Hobsbawn, M. Levett, S. Lyon, L. Nama and T. Nen (2002) West New Britain Province: Text Summaries, Maps,Code Lists and Village Identification.
14. Bourke, R.M., B.J. Allen, R.L. Hide, D. Fritsch, T. Geob, R. Grau, S. Heai, P. Hobsbawn, G. Ling, S. Lyon and M. Poienou (2002) East New Britain Province: Text Summaries, Maps,Code Lists and Village Identification.
15. Allen, B.J., T. Nen, R.M. Bourke, R.L. Hide, D. Fritsch, R. Grau, P. Hobsbawn and S. Lyon (2002) Central Province: Text Summaries, Maps,Code Lists and Village Identification.
16. Allen, B.J., T. Nen, R.L. Hide, R.M. Bourke, D. Fritsch, R. Grau, P. Hobsbawn, S. Lyon and G. Sem (2002) Northern Province: Text Summaries, Maps, Code Lists and Village Identification.
17. Hide, R.L., R.M. Bourke, B.J. Allen, W. Akus, D. Frisch, R. Grau, P. Hobsbawn, P. Igua, R. Kameata, S. Lyon and N. Miskaram (2002) New Ireland Province: Text Summaries, Maps, Code Lists and Village Identification.
18. Hide, R.L., B.J. Allen, R.M. Bourke, D. Frisch, R. Grau, J.L. Helepet, P. Hobsbawn, S. Lyon, M. Poienou, S. Pondrilei, K. Pouru, G. Sem and B. Tewi (2002) Manus Province: Text Summaries, Maps, Code Lists and Village Identification.
19. Bourke, R.M., B.J. Allen, R.L. Hide, N. Fereday, D. Fritsch, B. Gaupu, R. Grau, P. Hobsbawn, M.P. Levett, S. Lyon, V. Mangi and G. Sem (2002) Morobe Province: Text Summaries, Maps, Code Lists and Village Identification.
20. Bourke, R.M., M. Woruba, B.J. Allen, M. Allen, R. Grau and P. Hobsbawn (2002) Bougainville Province: Text Summaries, Maps, Code Lists and Village Identification.
21. Hobsbawn, P., D. Fritsch, R. Grau, B.J. Allen, R.L. Hide and R.M. Bourke (1997) Technical Information and Methods.
22. Hobsbawn, P. and J. Conway (1998) Bibliography.
23. Stuckings, N.E., R.L. Hide, R.M. Bourke, B.J. Allen, P. Hobsbawn and J. Conway (1997) Papua New Guinea Agriculture Literature Database.

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