

AUSTRALIAN AGENCY for INTERNATIONAL DEVELOPMENT

AGRICULTURAL SYSTEMS OF PAPUA NEW GUINEA

Working Paper No. 7

MADANG PROVINCE

TEXT SUMMARIES, MAPS, CODE LISTS AND VILLAGE IDENTIFICATION

B.J. Allen, R.L. Hide, R.M. Bourke, D. Fritsch, R. Grau, P. Hobsbawn, M.P. Levett,
I.S. Majnep, V. Mangi, T. Nen and G. Sem

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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

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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 Organisation.

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: Ted Sitapai, Michael Allen, and Balthazar Wayi (coordination and planning); Kevin Gubag, Policy and Planning Division, DAL, Konedobu (field mapping).

Division of Primary Industry, Madang Province: Lawrence Daur, Assistant Secretary (coordination and planning).

The University of Papua New Guinea Department of Geography: Malcolm Levett, Graham Sem and Vero Mangi (field mapping and data preparation).

Papua New Guinea National Research Institute: Wari Iamo (coordination and planning); Thomas Nen (field mapping).

Kaironk village: Saem Majnep (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, Deborah Stannard, Stephen Lyons (research assistance); Merv Commons (technical assistance).

Field survey

This report is based on field surveys carried out by three teams between June and December 1991. One team used a vehicle and covered the northcoast road from Madang to Bogia, inland to Joesphstaal mission and Bosmun, and Manam and Boisa Islands and the Wanuma area, the Transgogol, Bagasin, Usino, Brahman, Bundi, Kesawai and Tauta; and Saidor. A second team covered the Simbai District by foot and aircraft; the third team walked into the upper Yupna and Nankina Valleys from Morobe Province and from there to Saidor, and surveyed Karkar Island. In December 1993 a second visit was made to Teptep. In April 1994 further visits were made to the Madang District and an aerial reconnaissance was undertaken, in the company of John McAlpine (CSIRO) and Richard Croome (National Mapping Bureau) to examine the usefulness of satellite imagery in the study of land use change.

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 and Amber Pares were responsible for the production of the revised paper.

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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 Broad-scale 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 [SUSBSYSIDNO]: 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°)
2	Gentle	(2-10°)
3	Steep	(10-25°)
4	Very steep	(>25°)
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 (<i>eg. kunai</i> < 1.5 m tall)
2	Tall grass (<i>eg. Miscanthus</i> or <i>Saccharum</i> > 1.5 m tall)
3	Grass and woody regrowth (<i>dense short or tall grass and short woody regrowth</i>)
4	Short woody regrowth (<i>shrubs/trees</i> < 10 m tall)
5	Tall woody regrowth (<i>trees</i> > 10 m tall)
6	Forest (<i>no indication of previous use</i>)
7	No long fallow
8	Savanna (<i>Scattered woody growth with grass ground cover</i>)

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 (<i>Musa cvs</i>)	13	Taro (<i>Colocasia esculenta</i>)
03	Breadfruit (<i>Artocarpus altilis</i>)	14	Yam (<i>Dioscorea alata</i>)
04	Cassava (<i>Manihot esculenta</i>)	15	Yam (<i>Dioscorea esculenta</i>)
05	Chinese taro (<i>Xanthosoma sagittifolium</i>)	16	Yam (<i>Dioscorea pentaphylla</i>)
06	Coconut (<i>Cocos nucifera</i>)	17	Other
07	Corn (<i>Zea mays</i>)	18	Queensland arrowroot (<i>Canna edulis</i>)
08	Potato (<i>Solanum tuberosum</i>)		
09	Sago (<i>Metroxylon sagu</i>)	19	Taro (<i>Amorphophallus</i>)
10	Swamp taro (<i>Cyrtosperma chamissonis</i>)		(<i>Amorphophallus paeoniifolius</i>)
11	Sweet potato (<i>Ipomoea batatas</i>)	20	Yam (<i>Dioscorea bulbifera</i>)
12	Taro (<i>Alocasia macrorrhiza</i>)	21	Yam (<i>Dioscorea nummularia</i>)

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

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

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

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

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

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

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

1	Betel nut, highland (<i>Areca macrocalyx</i>)
2	Betel nut, lowland (<i>Areca catechu</i>)
3	Betel pepper, highland (<i>Piper gibbilimum</i>)
4	Betel pepper, lowland (<i>Piper betle</i>)
5	Tobacco (<i>Nicotiana tabacum</i>)
6	Kava (<i>Piper methysticum</i>)

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* [VSMBOUND]: Mounds up to 10 cm high.

54. *Small Mounds* [SMMBOUND]: 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 (*Camptosperma* 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
-------------------------------	----------------------------------	----------------------------

Districts 2 Madang, 3 Bogia
Population 7,998

Subsystem Extent 100 %
Population density 46 persons/sq km

Area (sq km) 173
Population absent 15 %

System Summary

Located on a narrow coastal terrace between Tavultae Plantation in the north and the Gogol River in the south. Short woody regrowth and tall grass fallows, less than 5 years old, are cleared and burnt. Taro and yam (*D. esculenta*) are the most important crops; coconut, Chinese taro and banana are important crops; other crops are sweet potato, cassava, sago and yam (*D. alata*). Yam is segregated from other crops. Two plantings are made before fallowing, with Chinese taro, sweet potato or cassava planted in place of the harvested yams. Planting occurs between August and November each year. Yams are grown on stakes.

Extends across provincial border to System(s) None

Altitude range (m) 0-40

Slope Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
STAPLES SUBDOMINANT	Banana, Chinese taro, Coconut
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Corn, Lowland pitpit, Nasturtium spp., Pumpkin tips, Tulip, Bean (snake)
FRUITS	Mango, Pawpaw, Pineapple, Sugarcane, Ton, Watermelon, Guava, Mon
NUTS	Breadfruit, Galip, Okari
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

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

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	Minor
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	Significant
2 Cocoa	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	None
SMALL MOUNDS	Minor
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	Minor
STAKING OF CROPS	Significant
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION**Survey description**

In April 1980, road and foot traverses along the Madang-Lae highway (1 week). In July 1991, road traverses from Madang to Bogia, Saidor and Usino with numerous traverses inland, over a period of two weeks. In April 1994, further traverses by road and foot in the Madang and Amele areas in 1993 and 1994 (4 days) and an aerial reconnaissance.

Boundary definition

The boundary with System 1302 was determined by traverses from the coast inland at the Gogol Bridge, Mis village, Rempi mission, Garup plantation and Megiar Health Centre. It is marked by a steep 30 to 40 m high coral escarpment. The northwestern boundary with System 1304 was determined from a traverse on the Madang-Bogia road. The boundary with Systems 1324 and 1325 is the Gogol River floodplain and was determined by traverses on the Madang-Lae highway and from Maraga village to the Gogol River. Other boundaries are with commercial coconut, cocoa and coffee plantations and the Madang urban area (System 1314).

Notes

This system is distinguished from nearby Systems 1302, 1304, 1324 and 1325 by the use of short or tall woody regrowth fallows in those systems, by fallows longer than in this system, and by the combination of the most important and important crops.

A distinct dry season occurs between July and November. Land is cleared and the most important crops are planted at about the same time each year. Clearing begins in July and continues to September when cut fallow material is burnt. Planting begins with greens, corn, taro, Chinese taro and tobacco. Yam is planted in October. Yam shoots are usually broken off before planting. Yam is planted in a shallow hole and 30 cm high mounds are formed over the tubers. The small sticks initially used to train the yam vines are replaced in December with 2 m tall stakes. Harvesting of corn begins in January, taro in March and April, and yam in July. It is common to plant Chinese taro, sweet potato or cassava into the holes left by the yam harvest. The density of banana is also increased as the garden ages. A minority of gardens are fenced, usually with split bamboo. The location of the Madang urban area in the middle of the system, and the large numbers of settlers who live and cultivate land around the urban boundary, has a notable influence on land use in the system.

An intensive study at Yabob village in 1948 (the village was then 6 km from the Madang urban area but is now on the town boundary) reported by Vicary in 1960 and updated by Johnston in the same year, found taro and yam of equal importance, supplemented by sweet potato, corn and banana. In 1948 the average area cultivated per person was 0.04 ha per person. This had fallen to 0.02 ha in 1960 (Vicary 1960, 191). A restudy by Spencer (nd, 8) in 1982 found a similar figure. Over this period the village grew in population from 240 to 500. At Yabob, these changes have been associated with increases in cash incomes from urban employment and market sales. At Rempi and Aronis villages, 35 km and 70 km north of Madang town respectively, in 1970, the area cultivated per adult was 0.12 ha (Moulik 1973, 40). Ninety-one households each owned an average of 350 bearing coconuts. Fresh food was sold at Madang market, but more commonly at local markets and at plantations, missions and health centres. By 1994, numerous small roadside markets had appeared to the north and south of Madang town.

A study of banana growing in the Amele area in 1986-87 which included some gardens in this system found statistically significant differences between the planting densities of crops in the adjacent System 1325 and those in this system (King et al. 1989, 27). In this system, yam (*D. esculenta*) was planted more intensively in the first year, while taro was planted more intensively in the first year in System 1325. Banana was also planted more densely in this system. In the second year, Chinese taro and sweet potato were more important in System 1325 while in this system in the second year, taro and yam (*D. esculenta*) were more important.

Urban employment, copra, cocoa, and marketed food are important sources of cash income. In 1973, Godyn (1974, 10) found the average number of cocoa trees owned by 22 families (average size 5) in the Madang District was 489 mature trees and 138 immature trees, planted on 1.36 ha. A survey of 19 smallholders along the north coast road in 1989 (Yarbro and Noble 1989, 10-11, 15, 22) found cocoa was the main cash crop for 42 per cent of the smallholders surveyed and copra for 26 per cent. The average size of 'holdings' was 2.6 ha. Forty-three per cent of the cocoa had been planted in the 1980s, but the average number of trees owned remained low at 380. Yields of dried cocoa were around 100 kg per ha and for copra 580 kg per ha. Some cash income is earned from sales of fish, artifacts, tobacco and firewood.

Notes continued

This is an area with a relatively long history of colonial contact. Considerable changes began to occur in the agriculture and the demography of the system from the 1870s. The Russian Mikloucho-Maclay, lived near Bongu village (System 1320) for a number of years from 1871, and made visits to the Alexishafen-Madang area by canoe (Mikloucho-Maclay 1975). He introduced beans, squash, pumpkin and corn. Corn is still known locally by the Russian word 'kukuris'. The German New Guinea Company established outposts at Bogia (Potsdamhafen), Hatzfeldhafen, Madang (Friedrich Wilhelmshafen), Bogadjim (Stephansort) and Bongu (Konstantinhafen) in the 1880s. The Germans established coconut and Ficus plantations and attempted to cultivate tobacco and cotton in open fields cleared from forest (Sack and Clark 1979). Some villages permanently lost land to the town and the plantations (Morauta 1974, 30). Some regained some of this land through the Plantation Redistribution Scheme in the 1970s (Tamilong 1979). Labourers from Java and China introduced smallpox in 1892, and this killed a large but unknown number of villagers along the coast and in the hinterland. However, since 1945 it is probable the resident population has doubled. Part of this increase in population results from a movement of people from System 1302 in the 1950s. The main changes in agriculture have been a shortening of fallow periods, a second planting before fallowing, and the adoption and widespread use of Chinese taro. Miklouho-Maclay (1886, 347-350) found in Astrolabe Bay that taro and coconut were the most important crops, followed by yam, sweet potato, banana, sugarcane, pitpit, breadfruit and galip nuts.

Kava was formerly grown and drunk in this system (Brunton 1989, 8-10). Contemporary use has not been recorded.

National Nutrition Survey 1982/83

58 families from 3 villages were asked in October 1982 what they had eaten the previous day. 98 per cent reported eating coconut, 84 per cent banana, 29 per cent taro, 26 per cent sweet potato, 14 per cent Chinese taro, 10 per cent yam, 5 per cent cassava and 2 per cent sago. 34 per cent reported eating rice. 12 per cent reported eating fresh fish. This differs from the crop pattern with higher consumption of banana and sweet potato and lower consumption of yam and taro.

Main References

King, G.A., J. Banag, R.N. Kambuou, K. Ovia, A. Ovia, P.F. Heywood and R.L. Hide 1989 Production of bananas by the Amele in Madang Province and in the Vanapa River and Kabadi areas of Central Province Papua New Guinea. Research Bulletin No. 44, Department of Agriculture and Livestock, Port Moresby.
 Spencer, T. n.d. Field report on Yabob. Unpublished report, Papua New Guinea Institute of Medical Research, Madang.
 Vicary, J.R. 1960 Agricultural year at Yabob village. Papua and New Guinea Agricultural Journal 12, 4, 180-191.

Other References

Brunton, R. 1989 The Abandoned Narcotic: Kava and Cultural Instability in Melanesia. Cambridge, Cambridge University Press.
 Croome, R. 1989 The potential for satellite remote sensing to monitor coffee, tea, cocoa and coconut plantings in Papua New Guinea. Designing Monitoring Systems for Smallholder Agriculture in Papua New Guinea, Working Paper No. 2, Australian Centre for International Agricultural Research, Canberra.
 Fahey, S. 1985 Producers or consumers? Women's entry into the cash economy in Madang, Papua New Guinea. In, Women in Development in the South Pacific: Barriers and Opportunities. Canberra, Development Studies Centre, Australian National University, 137-155.
 Fahey, S. 1986 Rural differentiation in Papua New Guinea. Pacific Viewpoint 27, 2, 144-164.
 Godyn, D.L. 1974 An economic survey of cocoa in Papua New Guinea. Part III: Village cocoa. Unpublished report, Department of Agriculture, Stock and Fisheries, Port Moresby.
 Mikloucho-Maclay, N.N. 1975 New Guinea Diaries: 1871-1883 (translated by C.L. Sentinella). Madang, Kristen Pres.
 Miklouho-Maclay, N. 1886 List of plants in use by the natives of the Maclay-Coast, New Guinea. Linnean Society of New South Wales, Proceedings 10, 346-358.
 Morauta, L. 1974 Beyond the Village: Local Politics in Madang, Papua New Guinea. London, Athlone Press.
 Moulik, T.K. 1973 Money, motivation and cash cropping. New Guinea Research Bulletin No. 53, Australian National University, Port Moresby and Canberra.
 Robbins, R.G., H.A. Haantjens, J.A. Mabbutt, R. Pullen, E. Reiner, J.C. Saunders and K. Short 1976 Lands of the Ramu-Madang Area, Papua New Guinea. Land Research Series No. 37, Commonwealth Scientific and Industrial Research Organization, Melbourne.
 Rural Statistics Section 1992 Report on Food Crop Market Survey 1988: Madang Main Market. Port Moresby, Department of Agriculture and Livestock.
 Sack, P. and D. Clark 1979 German New Guinea: The Annual Reports. Canberra, Australian National University Press.
 Tamilong, M. 1979 The Plantation Redistribution Scheme: A Case-study of Matupi Plantation in the Madang Province. Discussion Paper No. 28. Institute of Applied Social and Economic Research, Port Moresby.

Other References continued

Yarbro, S. and S. Noble 1989 Smallholder production, processing and marketing of cocoa and copra in Papua New Guinea: a baseline survey. Designing Monitoring Systems for Smallholder Agriculture in Papua New Guinea, Working Paper No. 10, Australian Centre for International Agricultural Research, Canberra.

Districts 2 Madang
Population 7,375

Subsystem Extent 100 %
Population density 10 persons/sq km

Area (sq km) 764
Population absent 18 %

System Summary

Located in the coastal foothills of the Adelbert Ranges, inland of a narrow plain in closely dissected, sharp crested hills and v-shaped valleys, from near Tokain Agricultural Station in the north to Madang town in the south, below about 350 m altitude. Short woody regrowth, about 10 years old, is cleared and burnt. Taro and Chinese taro are the most important crops; sweet potato, banana and coconut are important crops; other crops are yams (mainly *D. alata* with some *D. esculenta*), cassava and sago. Yams are segregated from other crops, particularly from taro. Gardens are planted each year from August to December. Only one planting is made before fallowing. Following a number of cultivation-fallow cycles within a restricted area (after about 30 to 40 years), another area of older, taller woody regrowth is selected. The more intensive cultivation-fallow cycle is begun in the tall woody regrowth and the previously used area left to a long fallow of over 30 years. Villages may also move as part of this cycle of shorter fallows within long fallows.

Extends across provincial border to System(s) None

Altitude range (m) 40-350 **Slope** Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	Chinese taro, Taro (<i>Colocasia</i>)
STAPLES SUBDOMINANT	Banana, Coconut, Sweet potato
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (winged), Corn, Lowland pitpit, Nasturtium spp., Pumpkin tips, Tulip, Bean (snake)
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane, Ton, Guava, Mon
NUTS	Breadfruit, Galip, Okari
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	1 planting
R VALUE	9 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	None
CROP SEGREGATION	Significant
CROP SEQUENCES	None
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 Cocoa	Significant
2 Coconuts	Significant
3 Betel nut	Minor
4 Firewood	Minor
5 Fresh food	Minor
6 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	Minor
Mounding Techniques:	
VERY SMALL MOUNDS	None
SMALL MOUNDS	Minor
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	Significant

OTHER DOCUMENTATION**Survey description**

In July 1991, numerous traverses inland from the Madang-Lae and Madang-Bogia highway, at the Megiar Health Centre, Walog Plantation and Hatzfeldhafen Health Centre, and from Madang to Silibob and Kamba villages, Barahaim school and Nobanob mission, over a period of two weeks. In April 1994, ground and aerial observations in the Amele and inland Gum River area (2 days).

Boundary definition

The boundary with System 1301 was determined by traverses from the coast inland at the Gogol Bridge, Mis village, Rempi mission, Garup plantation and Megiar Health Centre. It is marked by a steep 30 to 40 m high coral escarpment. The boundary with System 1303 is based on the boundaries of Saunders (1993) land use intensity classes 2 and 3. The boundary with System 1325 is the Gum River floodplain and was determined by traverses on the Madang-Lae highway and between Dolonu village and Barahaim school.

Notes

This system is distinguished from System 1301 where fallow vegetation is short woody regrowth and tall grass, less than 5 years old; from System 1303 where fallow vegetation is tall woody regrowth, more than 15 years old; and from System 1325 where two plantings are made before fallowing.

One of the most important crops, Chinese taro, was introduced within the last 100 years. It is cultivated around the edges of gardens on steeper slopes, with taro in the centre of the garden. Yam is relatively unimportant and yam (*D. alata*) is the main species grown. Yam (*D. esculenta*) is said to grow poorly here. Thin poles laid along the contour are said to be plot markers, but they also function as soil retention barriers. They are not seen in all gardens.

The fallow cycle is complex. A large area of land is selected and all gardens are cleared within this area for up to 40 years. Fallows within the selected area average around 10 years. Many of the trees cut during clearing for cultivation regrow. Trees in fallows commonly show evidence of this in the form of multiple thin stems growing from a larger stump. After some time, probably between 30 and 40 years, a new area of land which has not been cultivated for up to 40 years is selected and all the gardening activity is transferred to this area, and the previously used area reverts to a long fallow. There is evidence from air photographs taken in 1943 that the area of tall woody regrowth in this system has been substantially reduced (Allied Geographical Section 1943) and replaced with short woody regrowth. Bowman et al. (1990) provide floristic and structural descriptions of vegetation and soil chemistry in fallows of given ages at Baiteta village. Kava was formerly grown and drunk in this system (Brunton 1989, 8-10). Contemporary use has not been recorded.

In 1973, Godyn (1974, 10) found the average number of cocoa trees owned by 22 families (average size 5) in the Madang District was 489 mature trees and 138 immature trees, planted on 1.36 ha. A survey of 19 smallholders along the north coast road in 1989 (Yarbro and Noble 1989, 10-11, 15, 22) found cocoa was the main cash crop for 42 per cent and copra for 26 per cent. The average size of 'holdings' was 2.6 ha. Forty-three per cent of the cocoa had been planted in the 1980s, but the average number of trees owned remained low at 380. Yields of dried cocoa were around 100 kg per ha and for copra 580 kg per ha.

The system has relatively good access to the coast road and to Madang town. Substantial village owned coconut/cocoa plantations occur and cocoa fermentaries and copra driers are common. A number of people from this system are employed in the Madang urban area. Sales of betel nut, fresh food, firewood and tobacco provides some income.

National Nutrition Survey 1982/83

41 families from 2 villages were asked in October or December 1982 what they had eaten the previous day. 76 per cent reported eating coconut, 54 per cent banana, 44 per cent sweet potato, 41 per cent taro, 24 per cent Chinese taro, 15 per cent yam, 5 per cent sago and none cassava. 44 per cent reported eating rice. 15 per cent reported eating fresh fish. This is similar to the crop pattern, except for the lower than expected consumption of Chinese taro.

Main References

None.

Other References

- Allied Geographical Section 1943 Local Study of Madang. Southwest Pacific Area: Terrain Study No. 69.
- Bowman, D.M.J.S., J.C.Z. Woinarski, D.P.A. Sands, A. Wells and V.J. McShane 1990 Slash-and-burn agriculture in the wet coastal lowlands of Papua New Guinea: responses of birds, butterflies and reptiles. *Journal of Biogeography* 17, 227-239.
- Brunton, R. 1989 *The Abandoned Narcotic: Kava and Cultural Instability in Melanesia*. Cambridge, Cambridge University Press.
- Godyn, D.L. 1974 An economic survey of cocoa in Papua New Guinea. Part III: Village cocoa. Unpublished report, Department of Agriculture, Stock and Fisheries, Port Moresby.
- Mikloucho-Maclay, N.N. 1975 *New Guinea Diaries: 1871-1883* (translated by C.L. Sentinella). Madang, Kristen Pres.
- Mikloucho-Maclay, N. 1886 List of plants in use by the natives of the Maclay-Coast, New Guinea. *Linnean Society of New South Wales, Proceedings* 10, 346-358.
- Morauta, L. 1974 *Beyond the Village: Local Politics in Madang, Papua New Guinea*. London, Athlone Press.
- Robbins, R.G., H.A. Haantjens, J.A. Mabbutt, R. Pullen, E. Reiner, J.C. Saunders and K. Short 1976 *Lands of the Ramu-Madang Area, Papua New Guinea*. Land Research Series 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.
- Yarbro, S. and S. Noble 1989 Smallholder production, processing and marketing of cocoa and copra in Papua New Guinea: a baseline survey. *Designing Monitoring Systems for Smallholder Agriculture in Papua New Guinea*, Working Paper No. 10, Australian Centre for International Agricultural Research, Canberra.

PROVINCE 13 Madang		AGRICULTURAL SYSTEM No. 3	Subsystem No. 1 of 1
Districts 2 Madang, 3 Bogia, 4 Middle Ramu, 5 Upper Ramu	Subsystem Extent 100 %	Area (sq km) 6226	
Population 19,077	Population density 3 persons/sq km	Population absent 17 %	

System Summary

Located on both sides of the Adelbert Range in very steep mountains, and on the middle Ramu River plain. Tall woody regrowth, more than 15 years old, is cleared and burnt. Sweet potato and taro are the most important crops; banana and Chinese taro are important crops; other crops are cassava, sago, and yam (*D. alata* and *D. esculenta*). Only one planting is made before fallowing. After a number of cultivation-fallow cycles within a restricted area (for about 30 to 40 years), another area of older, taller woody regrowth is selected. The more intensive cultivation-fallow cycle is begun here and the previously used area left to a long fallow of over 30 years. Villages may also move as part of this cycle of short fallows within long fallows. Gardens are planted between July and December. Sweet potato is planted in small mounds.

Extends across provincial border to System(s) None

Altitude range (m) 350-1000 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato, Taro (<i>Colocasia</i>)
STAPLES SUBDOMINANT	Banana, Chinese taro
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (common), Bean (winged), Corn, Lowland pitpit, Pumpkin tips, Tulip, Bean (snake)
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane, Watermelon, Guava, Mon
NUTS	Breadfruit, Coconut, Galip
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	Minor
CROP SEQUENCES	None
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	Minor
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	Minor
2 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	Minor
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	Significant
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION**Survey description**

Except for the Ramu plain, this description is based largely on observations on the fringes of the system. On the floodplain, two road traverses with two three-hour foot traverses were made along a track running south from Usino to the Ramu River, and along the Walium station to Braham station road from the Madang-Lae road to the Ramu River. In July 1991, road traverses to Dolonu, Kamba, Kauris and Nobanob villages, Utu mission, the Yoro Cocoa Scheme and Josephstaal mission were made; and in October 1991, to Usino and Ono villages and Walium and Braham stations. In October 1991, helicopter visit to Arimatau village near Wanuma mission and associated aerial reconnaissance. In April 1994, aerial reconnaissance between Bagasin and Utu mission.

Boundary definition

The boundary with System 1301 was determined by traverses from the coast inland at Hatzfeldhafen. It is marked by a steep 30 to 40 m high coral escarpment. The boundaries with System 1302, 1324, 1325 and 1326 are based on Saunders (1993) land use intensity map between land use intensity classes 2 and 3 (Systems 1302, 1324, 1325, 1326) and classes 4, 5 and 6 (this system), and the borders of the Gogol timber project. The Wanuma area, which Saunders classes as land use intensity 3, is an exception and is included in this system. The boundary with System 1304 is based on ground traverses near the coast and inland from Malala high school. The boundary with System 1307 and 1308 was determined by traverses at Josephstaal and south of Wadaginam village east on new logging tracks and extrapolated. It is based on the 40 m contour, which is the approximate boundary between the lower hill country (this system) and the upper margins of the Ramu plain (System 1308).

Notes

This system is distinguished from System 1301 where fallow vegetation is short woody regrowth and tall grass, less than 5 years old; from Systems 1302, 1324 and 1325 where fallow vegetation is short woody regrowth, 5-15 years old; from Systems 1304 and 1326 by different combinations of the most important and important crops; and from Systems 1307 and 1308 where sago is the most important food.

This system covers a large area of the Madang Province from the steeplands of the Adelbert mountains to the almost flat Ramu floodplain. Population densities are very low over the whole system.

The description of the system in the mountains is based on one short visit to Arimatau village near Wanuma mission, and on accounts of the system by people in neighbouring systems. Very little published material exists. Lawrence (1984) describes the Garia, who occupy the hills between Bagasin and Usino (on the boundary with System 1326) in 1953. Except that sweet potato was not important then, his description (*ibid*, 16) agrees generally with what was observed at Wanuma in 1991. The descriptions and the observations at Wanuma suggest that the main differences between System 1302 and this system are the longer fallows, greater use of sweet potato and greater importance of fencing in this system.

In the Wanuma area, gardens are cleared and planted each year during the drier period from July to December. Yams (almost all *D. alata*) are strictly segregated from taro. Chinese taro is planted on the outer edges of gardens and on steeper slopes. Sweet potato is sometimes planted as a first and only crop. Small mounds are used for cultivating sweet potato and yam. All gardens are heavily fenced against pigs. Fences are constructed with heavy timber along the top of ditches, lean out over the ditch at about a 35 degree angle and are supported by props. It is the failure of the fence and the entry of pigs which is said to be the reason for planting only one crop before fallowing. Poles laid along the contour are used to prevent soil loss. Coconuts are not grown at Wanuma, but have been introduced elsewhere (Lawrence 1984, 17). Galip nut is grown but bears poorly in the mountains. Small areas of Robusta coffee have been planted but were not being harvested in 1991. A small vegetable growing project exists at Wanuma mission, but the airstrip is closed frequently due to the slippery surface. Marita pandanus is said to be a seasonal supplementary food (see also Lawrence 1984, 19). Domestic pig numbers are low and sows mate with wild boars. Hunting is important. Kava was formerly grown and drunk in this system (Brunton 1989, 8-10). Contemporary use has not been recorded.

On the Ramu floodplain gardens are made on almost flat land, cover large areas, with three or four families working within one area, and are enclosed with heavy timber fences, one-and-a-half metres high. Fallow vegetation is taller and heavier than in the mountains, but fallow lengths are similar and only one planting is made before fallowing. Here also it is said that pigs break down the fences after one year. Small tributary streams of the Ramu backup and flood annually. Gardens are made on slightly higher ground above normal flood levels, but movement becomes more difficult during the wet season. Clearing occurs from June to August and planting from July to December, each year. Conton (1977, 31, 176-177) provides a brief description of gardening at Usino village on the eastern edge of the Ramu plain in 1974.

Notes continued

She estimated 15 to 20 year fallow intervals and lists taro and Chinese taro, banana, yam, sweet potato and pumpkin as important crops. Hunting and fishing are important, and access to the roadside markets on the Madang-Lae highway is reasonable.

Both Lawrence (1984, 19) and Conton (1977, 32) observe that the period January-March is a time of relative food shortage.

The only road access to the system is the Madang-Lae highway in the extreme southwest. Although the mountains are not particularly high, they are extremely rugged, are prone to landslides and lie in a major earthquake zone. A large logging project is underway in the headwaters of the Sogeram and Gogol Rivers and logging roads will shortly link with the Bogia-Josephstaal road in the northwest.

This system also occurs in Census Divisions 19, 20, 34, 35, 36, 37, 45, 46, 47, 48 and 49.

National Nutrition Survey 1982/83

176 families from 11 villages were asked in October or November 1982 what they had eaten the previous day. 56 per cent reported eating coconut, 52 per cent taro, 51 per cent sweet potato, 47 per cent Chinese taro, 43 per cent banana, 23 per cent yam, 3 per cent cassava and 1 per cent sago. 19 per cent reported eating rice. 3 per cent reported eating fresh fish. This is similar to the crop pattern.

Main References

None.

Other References

Brunton, R. 1989 *The Abandoned Narcotic: Kava and Cultural Instability in Melanesia*. Cambridge, Cambridge University Press.

Caven, R. and J. Gitai 1990 *A Rapid Rural Appraisal of the Upper Ramu District, Madang Province, Papua New Guinea (April-May, 1989)*. Port Moresby, Project Preparation Branch, Investment Division, Department of Agriculture and Livestock.

Conton, L. 1977 *Women's roles in a man's world: appearance and reality in a lowland New Guinea village*. PhD thesis, University of Oregon, Eugene.

Conton, L. 1985 *Social, economic and ecological parameters of infant feeding in Usino, Papua New Guinea*. *Ecology of Food and Nutrition* 16, 1, 39-54.

Lawrence, P. 1984 *The Garia: An Ethnography of a Traditional Cosmic System in Papua New Guinea*. Melbourne, Melbourne University Press.

Robbins, R.G., H.A. Haantjens, J.A. Mabbutt, R. Pullen, E. Reiner, J.C. Saunders and K. Short 1976 *Lands of the Ramu-Madang Area, Papua New Guinea*. Land Research Series No. 37, Commonwealth Scientific and Industrial Research Organization, Melbourne.

Ross, J. 1988 *Results of the 1988 Ramu Nutrition Survey*. In Caven, R. and J. Gitai (eds), *A Rapid Rural Appraisal of the Upper Ramu District, Madang Province, Papua New Guinea*. Port Moresby, Project Preparation Branch, Investment Division, Department of Agriculture and Livestock, 66-70.

Togiba, C., F. Daink and G. Agodop 1992 *Integrated conservation farming systems project, Samu-Garia Census Division, Upper Ramu District, Madang Province, Papua New Guinea*. Technical Report 92/2, Department of Agriculture and Livestock, Port Moresby.

Districts 3 Bogia
Population 15,088

Subsystem Extent 100 %
Population density 10 persons/sq km

Area (sq km) 1456
Population absent 18 %

System Summary

Located in foothills on both sides of the northern Adelbert range inland of Bogia and Hatzfeldhafen and around Josephstaal mission. Tall woody regrowth fallows, more than 15 years old, are cleared and burnt. Many trees are killed, pollarded and left standing. Taro and yam (*D. esculenta*) are the most important crops; Chinese taro, banana and sweet potato are important crops; other crops are cassava, sago and yam (*D. alata*). Two plantings are made before fallowing. Taro, yam and banana are planted in the first year gardens. Sweet potato and Chinese taro are often planted after the yam harvest. The most important crops are planted between September and November every year. Sago is used as a seasonal supplement. Yam (*D. esculenta*) is grown on stakes, but yam (*D. alata*) is not.

Extends across provincial border to System(s) None

Altitude range (m) 40-350 **Slope** Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
STAPLES SUBDOMINANT	Banana, Chinese taro, Sweet potato
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, <i>Amaranthus</i> spp., Bean (winged), Corn, Cucumber, Lowland pitpit, Pumpkin tips, Tulip, Bean (snake)
FRUITS	Mango, <i>Marita pandanus</i> , Pawpaw, Pineapple, Sugarcane, Ton
NUTS	Breadfruit, Coconut, Galip
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	None
CROP SEGREGATION	Minor
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	None
SMALL MOUNDS	Minor
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	Significant

OTHER DOCUMENTATION**Survey description**

In July 1991, a two-day road traverse from Bogia township to 10 km past Josephstaal mission, with excursions down new logging tracks towards the Ramu River, and a one-day traverse from Bogia to Makarup mission.

Boundary definition

The boundary with Systems 1303 and 1306 were based on ground traverses near Malala High School and Hatzfeldthafen and on the Bogia-Josephstaal road, extrapolated on the 1:100,000 topographic map. The boundary with System 1305 was based on ground traverses along the Bogia-Josephstaal road, extrapolated on the 1:100,000 topographic map. The boundary with System 1308 was determined by traverses at Josephstaal and south of Wadaginam village east on new logging tracks and extrapolated. It was based on the 40 m contour, which is the approximate boundary between the lower hill country (this system) and the upper margins of the Ramu plain (System 1308).

Notes

The system occupies generally lower and less steep hill country on the northern end of the Adelbert Range. This system is similar to System 1303, but only one planting is made before fallowing there; it is distinguished from System 1305 where fallow vegetation is short grass and short woody regrowth; from System 1306 where fallow vegetation is short grass, 5-6 years old; and from System 1308 where sago is the most important food.

Burridge (1969, 42-43), who lived at Wadaginam village in 1951-52, lists the most important crops then as taro, Chinese taro, banana, and yam (*D. alata* and *D. esculenta*), sago and coconut. Then only one planting was made before fallowing and sweet potato was unimportant. Since 1950, the cropping period has been extended to two years using sweet potato and Chinese taro as second crops after the yam harvest. In the 1950s, hill rice was cultivated by households for cash sale in fields cleared from woody regrowth, up to 0.2 ha in area.

In 1991, taro remained more important than Chinese taro, and *D. esculenta* yam was more important than *D. alata*. The clearing and planting of gardens takes places around the same time every year, between July and November. Underbrush is cleared and trees are pollarded, with a number left standing, killed by fire or ring-barking. Taro and sugarcane are commonly planted before burning. About half of all gardens observed in 1991 were fenced. Apart from Chinese taro, there is little crop segregation. *D. esculenta* yams are staked, but *D. alata* are often not. Sago is eaten between November and February, but its importance has been reduced by increased planting of sweet potato and Chinese taro. Households maintain between 2 and 4 gardens per year. Hunting, mainly of small game is a minor source of food. Insects (adults and larvae), lizards, birds and fish are also eaten.

In 1991 the area remained relatively isolated from commercial activities despite over 100 years of colonial contact. The sale of vegetables to mission and government workers was the main source of cash. A surfaced road now extends from the coast at Bogia to Josephstaal mission. A large logging project is planned for the area and new roads have been constructed from this road to the Ramu plain. Logging is already underway in the headwaters of the Sogerum and Gogol Rivers to the southeast (System 1303).

National Nutrition Survey 1982/83

118 families from 7 villages were asked in October or November 1982 what they had eaten the previous day. 79 per cent reported eating sago, 66 per cent yam, 35 per cent banana, 21 per cent sweet potato, 10 per cent coconut, 9 per cent taro, 6 per cent Chinese taro and 1 per cent cassava. 13 per cent reported eating rice. 5 per cent reported eating fresh fish. This differs from the crop pattern with higher consumption of sago and lower consumption of taro and Chinese taro.

Main References

None.

Other References

Burridge, K. 1969 Tangu Traditions. Oxford, Clarendon Press.

Robbins, R.G., H.A. Haantjens, J.A. Mabbutt, R. Pullen, E. Reiner, J.C. Saunders and K. Short 1976 Lands of the Ramu-Madang Area, Papua New Guinea. Land Research Series No. 37, Commonwealth Scientific and Industrial Research Organization, Melbourne.

Districts 3 Bogia
Population 6,520

Subsystem Extent 50 %
Population density 14 persons/sq km

Area (sq km) 467
Population absent 25 %

System Summary

Located inland of Bogia township on low hills at the northern end of the Adelbert Range in an area of grassland and secondary forest. Two subsystems are distinguished on the basis of fallow type. For the entire system, taro and yam (*D. esculenta*) are the most important crops; cassava, sweet potato and banana are important crops; other crops are Chinese taro and sago. This subsystem occupies about half of the total area covered by the system. Short grass (*Imperata*) fallows, about 7-10 years old, are cut and burnt around May and June each year. The garden site is initially dug over and then reworked. Gardens are planted between September and December. Yams are segregated from other crops. Two plantings are made before fallowing. Sweet potato and cassava are planted after the yam harvest. Sago is used between November and February. About half of the yams are grown on stakes.

Extends across provincial border to System(s) None

Altitude range (m) 40-200 **Slope** Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
STAPLES SUBDOMINANT	Banana, Cassava, Sweet potato
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Corn, Pumpkin tips
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane
NUTS	Breadfruit, Coconut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

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

GARDEN SEGREGATION

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

OTHER DOCUMENTATION**Survey description**

In July 1991, a two-day road traverse from Bogia township to 10 km past Josephstaal mission, with excursions down new logging tracks towards the Ramu River, and a one-day traverse from Bogia to Makarup mission.

Boundary definition

The boundary with System 1306 was based on walking and road traverses near Malala High School and Hatzfeldhafen and on the Bogia-Josephstaal road, extrapolated on the 1:100,000 topographic map. The boundary with System 1304 was based on ground traverses along the Bogia-Josephstaal road, extrapolated on the 1:100,000 topographic map. The boundary with System 1307 was determined by a traverse at Makarup mission. It was extrapolated using data from Robbins et al. (1976) on land that is seasonally inundated.

Notes

This subsystem is similar, but not as elaborated, as System 1306. This system is distinguished from System 1304 where fallow vegetation is tall woody regrowth, more than 15 years old; from System 1306 where fallow vegetation is short grass, 5-6 years old; and from System 1307 where fallow vegetation is tall woody regrowth, more than 15 years old, and only one planting is made before fallowing.

The population figures above include people living on the coastal terrace on land completely planted in coconuts who have access to garden sites inland. The grasslands are dominated by kunai (*Imperata cylindrica*). Some areas of grassland are not used for gardening, but they are important for hunting, when the grass is burnt and animals driven into ambushes.

Fallows probably average 7 to 10 years in length. On the selected garden site, the grass is burnt, allowed to regrow for a month or so, then slashed and burnt again. The site is dug over by men, who stand in a line and turn over the sod, using long wooden sticks and moving backwards across the garden. Newly dug gardens give the appearance of having been ploughed with a tractor-drawn mouldboard plough. The purpose of turning over the sod is to expose grass roots to the sun and so kill the grass. The garden is then again tilled to remove grass roots. Most gardens are fenced against wallaby and pigs. Some gardens have shallow drains in them to remove surface water. Clearing is begun annually in July. Taro is planted from September to October, with banana and greens, and yam (*D. esculenta*) from November and December. Yam is segregated from all other crops. About half of the yams are not staked, although staking is said to increase yields. The yams are planted in carefully arranged lines (see also System 1306), in marked contrast to the 'bush' gardens in which crops are intercultivated. Following the yam harvest, the dry yam vines are burnt and sweet potato and cassava is planted directly into the holes left by the yams. Sweet potato is planted in small mounds. In a number of places small areas of alluvial soils near streams are exploited to plant yams and taro more intensively.

Sago is used as a food from November to February. Connell (1979a, 81-82) gives a detailed description of sago processing, trading and marketing. Sago is sold at Bogia market.

Most families have current gardens in both the grassland and the bush subsystems in any year. Connell (1979a, 34-35) estimated that in 1979, garden areas were between 0.2 ha and 0.3 ha per family, usually split between two gardens.

In the 1950s, hill rice was grown in this system. Peanuts were produced in the 1960s and cocoa and coffee were introduced about the same time. Copra is also sold for cash. A limited number of village cattle projects were started, but most have failed. None of these activities is an important source of cash income. There is a large government-managed cattle ranch in a large area of grassland near Bogia. It is not known what direct benefits the villagers receive from this activity.

National Nutrition Survey 1982/83

108 families from 7 villages were asked in October or November 1982 what they had eaten the previous day. 82 per cent reported eating yam, 55 per cent sago, 44 per cent taro, 35 per cent banana, 32 per cent coconut, 26 per cent sweet potato, 5 per cent cassava and 1 per cent Chinese taro. 13 per cent reported eating rice. 17 per cent reported eating fresh fish. This is similar to the crop pattern, except for the high consumption of sago and low consumption of cassava.

Main References

Connell, J. 1979a Bogia Site: Final Report. Unpublished report, Institute of Applied Social and Economic Research, Port Moresby.

Connell, J. 1980 Development deprivation: the potential for agricultural change in Bogia. In Walter, M.A.H.B. (ed), Cattle Ranches are About People: Social Science Dimensions of a Commercial Feasibility Study. Monograph No. 14. Port Moresby, Institute of Applied Social and Economic Research, 99-140.

Other References

Burridge, K. 1969 Tangu Traditions. Oxford, Clarendon Press.

Connell, J. 1979b Saws for sago in Papua New Guinea. Harvest 5, 3, 135-139.

Robbins, R.G., H.A. Haantjens, J.A. Mabbutt, R. Pullen, E. Reiner, J.C. Saunders and K. Short 1976 Lands of the Ramu-Madang Area, Papua New Guinea. Land Research Series No. 37, Commonwealth Scientific and Industrial Research Organization, Melbourne.

Districts 3 Bogia

Subsystem Extent 50 %

System Summary

In this subsystem, short woody regrowth fallows, 5-15 years old, are cleared and burnt. Taro and yam (*D. esculenta*) are the most important crops; banana, sweet potato and cassava are important crops; other crops are Chinese taro and sago. Yam is intercultivated with other crops. Two plantings are made before fallowing. Gardens are planted between September and December. Sweet potato and cassava are planted after the yam and Colocasia taro harvests. Sago is eaten between November and February. All yams are grown on stakes.

Extends across provincial border to System(s) None

Altitude range (m) 40-200 **Slope** Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
STAPLES SUBDOMINANT	Banana, Cassava, Sweet potato
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, <i>Amaranthus</i> spp., Bean (winged), Corn, Lowland pitpit, <i>Nasturtium</i> spp., Pumpkin tips, Tulip, Bean (snake)
FRUITS	Mango, <i>Marita pandanus</i> , Pawpaw, Pineapple, Sugarcane
NUTS	Breadfruit, Coconut
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	None
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	Minor
Mounding Techniques:	
VERY SMALL MOUNDS	None
SMALL MOUNDS	Minor
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	Significant

OTHER DOCUMENTATION**Notes**

This subsystem is similar to System 1304. Undergrowth beneath woody regrowth is cleared and all the trees are cut down and burnt. About half of all gardens are fenced. Taro is planted first between September and October, together with banana, greens, lowland pitpit and sugarcane. Yam (*D. esculenta* and *D. alata*) are planted from October-December. All crops are interplanted and there is no segregation of the yams, as there is in the grass fallow gardens. All yams are staked. These 'bush' gardens have an untidy appearance, unlike the well organized grassland gardens. When the yams are harvested, the vines are burnt and sweet potato and cassava are planted directly into the holes left by the yams. Sweet potato is planted in small mounds. Chinese taro is not very common because it is said to grow poorly here. Sago is eaten between November and February.

It is said a steady loss of woody regrowth fallows is taking place, as grasses invade the fallow gardens and woody regrowth fails to become established.

Most men have current gardens in both the grassland and the bush subsystems in any year.

Districts 3 Bogia
Population 740

Subsystem Extent 100 %
Population density 57 persons/sq km

Area (sq km) 13
Population absent 23 %

System Summary

Restricted to small areas of highly fertile alluvial soil on the coastal terrace between Hatzfeldhafen and Hansa Bay. Short grass fallows 5-6 years old are cleared and the site dug over several times. All gardens are fenced with bamboo and are drained. Yam (*D. esculenta*) and sweet potato are the most important crops; taro, banana and coconut are important crops; other crops are Chinese taro, cassava and sago. Up to three plantings of yam are made, followed by two or three plantings of sweet potato. Most crops are segregated from other crops within the gardens. Between plantings, the soil is tilled and the weeds and vines from a short fallow are incorporated into the soil. Yams are planted in beds and are trained on low bamboo fences or trellises. Sweet potato are planted in small mounds. The gardens are visually striking in their internal regularity and organization. Gardens are cleared from August and planted from September to December. Sago is used between November and February.

Extends across provincial border to System(s) None

Altitude range (m) 10-20 **Slope** Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	Sweet potato, Yam (<i>D. esculenta</i>)
STAPLES SUBDOMINANT	Banana, Coconut, Taro (<i>Colocasia</i>)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Corn, Lowland pitpit, Nasturtium spp., Bean (snake)
FRUITS	Mango, Pawpaw, Pineapple, Sugarcane, Mon
NUTS	Breadfruit, Galip, Tulip
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Short grass
SHORT FALLOW	Minor
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	3-5 plantings
R VALUE	40 (medium)

GARDEN SEGREGATION

GARDEN SEGREGATION	None
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	Minor
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Coconuts	Significant
2 Fresh food	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	Very significant
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Significant
TILLAGE	Very significant
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	Very significant
Other Features:	
FENCES	Very significant
STAKING OF CROPS	Significant
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION**Survey description**

In July 1991, traverses by road between Bogia and Madang (4 days).

Boundary definition

The boundaries with Systems 1304 and 1305 were based on walking and road traverses near Malala High School and Hatzfeldhafen and on the Bogia-Josephstaal road, extrapolated on the 1:100,000 topographic map.

Notes

This system is distinguished from System 1304 where fallow vegetation is tall woody regrowth; and from System 1305 where both short grass and short woody regrowth fallows are used. This system is an elaboration and intensification of the grass subsystem of System 1305. However here people do not have 'bush' gardens and produce their main subsistence requirements from these fallow gardens, together with coconuts from the village plantings. Fishing and hunting are important sources of food.

Grass (*Imperata*) fallows between 5 and 6 years old are slashed, allowed to regrow, and slashed again, or pulled up. The cut and uprooted grass is allowed to dry and then burnt. The whole site is dug over by a group of men using long digging sticks. The grass roots are removed and the soil worked into a fine tilth with heavy, tined, 'hoes'. The garden is worked into a number of broad beds approximately 2 m wide. V-shaped drains up to 1 m deep separate the beds. Yam (*D. esculenta*) is planted in the beds and the vines trained onto bamboo fences or trellises, about 0.75 m in height, along the edges of the beds. The beds and the trellises are laid out with careful regularity. Taro and banana are planted with similar regularity along the side of the drains. Corn and greens may be intercultivated with the yams. Chinese taro and cassava, if planted, are grown around the edge of the sweet potato plots.

Up to three plantings of yams may take place, depending on the yield of the previous crop. Yams are followed by two or three plantings of sweet potato, planted on small mounds, laid out in regular rows. Between both the yam and sweet potato crops, a short fallow occurs. The weeds and grasses which grow during the fallow, together with dried vines from the previous crop, are incorporated into the beds.

German colonial influence began in this area in 1885 with the establishment of outposts at Bogia (Potsdamhafen) and Hatzfeldhafen, where tobacco growing was attempted. The tined 'hoes' presently used to till these gardens are said to have been introduced by the Germans and it is possible some of the techniques of tillage were also adopted at that time.

Copra is the main source of cash income with some local sales of fresh food.

National Nutrition Survey 1982/83

10 families from 1 village were asked in November 1982 what they had eaten the previous day. 90 per cent reported eating coconut, 70 per cent sago, 60 per cent banana, 50 per cent sweet potato, 20 per cent yam, 10 per cent taro, 10 per cent cassava and none Chinese taro. 40 per cent reported eating rice. 60 per cent reported eating fresh fish. This is similar to the crop pattern, except for the high consumption of sago and low consumption of yam.

Main References

None.

Other References

Bourke, R.M. 1974 Food garden survey, Madang and East Sepik Districts. Unpublished report, Lowlands Agricultural Experiment Station, Keravat.

Robbins, R.G., H.A. Haantjens, J.A. Mabbutt, R. Pullen, E. Reiner, J.C. Saunders and K. Short 1976 Lands of the Ramu-Madang Area, Papua New Guinea. Land Research Series No. 37, Commonwealth Scientific and Industrial Research Organization, Melbourne.

Districts 3 Bogia, 4 Middle Ramu
Population 8,457

Subsystem Extent 100 %
Population density 15 persons/sq km

Area (sq km) 567
Population absent 12 %

System Summary

Located on levees and slightly higher ground where the Ramu River floodplain is inundated annually. Gardens are cleared in patches of short woody regrowth, 10-15 years old. Fallow vegetation is cut, dried and burnt. Sago is the most important food; coconut is an important crop; other crops are taro, yam (*D. alata*), cassava, Chinese taro, sweet potato and banana. Fish is an important part of the diet. Gardens are few and widely scattered. Only one planting is made before fallowing. Gardens are cultivated between May and December. The system is regulated by the annual fall and rise of the Ramu River, which floods garden land between January and April.

Extends across provincial border to System(s) None

Altitude range (m) 10-50 **Slope** Flat (<2 degrees)

CROPS

STAPLES DOMINANT	Sago
STAPLES SUBDOMINANT	Coconut
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>)
OTHER VEGETABLES	Aibika, Corn, Pumpkin tips, Tulip, Bean (snake)
FRUITS	Mango, Pawpaw, Pineapple, Sugarcane, Watermelon, Mon
NUTS	Breadfruit, Galip
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	1 planting
R VALUE	9 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	None
CROP SEGREGATION	None
CROP SEQUENCES	None
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	Significant
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	Minor
2 Crocodile	Minor
3 Fish	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	None
SMALL MOUNDS	None
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	Very significant

OTHER DOCUMENTATION**Survey description**

In July 1991, a two day traverse from Bogia to Bak and Boroi villages, and from Hansa Bay to Bunapas mission and Buliva and Galek villages, via Sepen village. Gardens in this system are few and are widely scattered across a large grass and forest covered floodplain. No gardens were observed and the description is based on interviews.

Boundary definition

The boundaries with Systems 1305 and 1308 are based on a road traverse from Bogia to Bosmun mission and on data from Robbins et al. (1976) on land which is inundated seasonally. The boundary with System 1303 is based on Robbins et al.

Notes

This system is regulated by the annual rise and fall of the Ramu River. It is very similar to System 1413 in the East Sepik Province, except that yams are probably more important there and grass fallows do not seem to be used here. This system is distinguished from System 1303 and 1305 where gardening forms the basis of subsistence food production. It is distinguished from System 1308 where sago is the most important food, but agriculture is more important than here and annual inundation does not occur.

Almost all gardens are planted between May and July and harvested between August and December. Sago and fish are the most important food together with coconut. Gardening is a minor source of food. Gardens are made on levees and areas of slightly higher ground which either do not flood, or are flooded for a shorter period than most of the plain. Gardens are a mixture of crops including taro, yam (*D. alata*), banana, sweet potato, corn, watermelon, sugarcane and greens. The extensive grasslands in this area are not used for agriculture, but are used for hunting in the dry season.

Sago and fish are sold at coastal markets at Awar Plantation and Bogia. Sago is sent to people on Boisa and Manam Islands in exchange for tobacco and galip nut.

The lower Sepik and Ramu plains were, 10,000 years ago, a large inland marine estuary. The two rivers have rapidly filled in the estuary with silt, pushing the coastline eastward. Archaeological research along the former coastline of the estuary and on areas which were islands, has discovered large middens containing freshwater and marine shells, fishbones and the remains of nuts, many of which remain important sources of food today. These findings suggest aspects of this system may be at least 6000 years old (Swadling and Hope 1992, 31-37).

National Nutrition Survey 1982/83

30 families from 4 villages were asked in November 1982 what they had eaten the previous day. 93 per cent reported eating sago, 20 per cent coconut, 17 per cent yam, 17 per cent banana, 3 per cent sweet potato and none taro, Chinese taro or cassava. 13 per cent reported eating rice. 20 per cent reported eating fresh fish. This is similar to the crop pattern.

Main References

None.

Other References

Robbins, R.G., H.A. Haantjens, J.A. Mabbutt, R. Pullen, E. Reiner, J.C. Saunders and K. Short 1976 Lands of the Ramu-Madang Area, Papua New Guinea. Land Research Series No. 37, Commonwealth Scientific and Industrial Research Organization, Melbourne.

Swadling, P. and G. Hope 1992 Environmental change in New Guinea since human settlement. In Dodson, J. (ed), *The Naive Lands: Prehistory and Environmental Change in Australia and the Southwest Pacific*. Melbourne, Longman Cheshire, 13-42.

Districts 3 Bogia, 4 Middle Ramu
Population 7,583

Subsystem Extent 100 %
Population density 8 persons/sq km

Area (sq km) 1002
Population absent 12 %

System Summary

Located on the Ramu Plain above the annual flood level, from Aiome in the south to the Ramu mouth in Madang Province; and near the Keram River in East Sepik Province. Tall woody regrowth, more than 15 years old, is cleared and burnt. Sago is the most important food; taro, banana and sweet potato are important crops; other crops are yam (*D. esculenta* and *D. alata*), Chinese taro and cassava. Only one planting is made before fallow. Gardens are planted between July and September. The population figures above include people who live on the coast, on land completely planted in coconuts and who have access to garden sites inland.

Extends across provincial border to System(s) 1419

Altitude range (m) 10-200 **Slope** Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	Sago
STAPLES SUBDOMINANT	Banana, Sweet potato, Taro (<i>Colocasia</i>)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Corn, Ferns, Lowland pitpit, Pumpkin tips, Tulip, Bean (snake)
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane, Watermelon
NUTS	Breadfruit, Coconut
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	None
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	Minor
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	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	None
SMALL MOUNDS	Minor
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	Minor
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	Minor

OTHER DOCUMENTATION**Survey description**

In July 1991, a traverse from Bogia to Bak and Boroi villages, and from Hansa Bay to Bunapas mission and Buliva and Galek villages, via Sepen village (2 days). A vehicle traverse from Simbai to Aiome via Mambesap village and from Aiome station to the Ramu River (2 days). The East Sepik part of the system was not visited.

Boundary definition

The boundary with Systems 1304 was determined by traverses at Josephstaal and south of Wadaginam village east on new logging tracks and extrapolated on the 40 m contour, which is the approximate boundary between the lower hill country (System 1304) and the upper margins of the Ramu plain (this system). The boundaries with Systems 1305 and 1307 were based on a road traverse from Bogia to Bosmun mission and on data from Robbins et al. (1976) on land which is inundated seasonally (System 1307). The boundary with System 1315 is based on a road traverse between Simbai and Aiome and extrapolated on the 200 m contour. The boundary with System 1413 is based on a traverse on the Keram River, and is somewhat arbitrary.

Notes

This system is very similar to the extensive System 1402/1507 that extends from the Keram River in East Sepik through East and West Sepik Provinces to the Indonesian border. It is distinguished only on small differences in the important crops.

Some minor differences exist between the Aiome area and areas further down the river: sago is the most important crop everywhere, but in the Aiome area sweet potato is an important crop, whereas it is not in the lower Ramu. In the lower Ramu area, taro is an important crop and sweet potato is not. It tends to be planted mainly following the harvest of yam and taro.

Gardens are cleared from June to August and taro, yam and banana are planted from July to September. Sweet potatoe planting is said to be non-seasonal. It is planted in small mounds between 20 to 30 cm high in the Aiome area. Yams are staked. Near Aiome, gardens are occasionally made in patches of grass to cultivate sweet potato or peanuts. It is said these gardens are followed by the regeneration of a woody regrowth fallow. At Aiome, cocoa has been planted and a fermentary constructed, but it was not operating in 1991. Robusta coffee has also been planted but was not being harvested. Rice was grown in this system in the 1960s.

Main sources of cash are the sale of betel nut, sago, fish and fresh food at Aiome station, Awar plantation, Bunapas mission and Bogia township. Sago, shellfish and yams are traded with people from Boisa and Manam Islands (Systems 1309 and 1310) in exchange for tobacco, galip nut, taro, betel nut, betel pepper and pigs (Lutkehaus 1985, 123-125).

National Nutrition Survey 1982/83

99 families from 2 villages were asked in November 1982 what they had eaten the previous day. 80 per cent reported eating sweet potato, 49 per cent yam, 34 per cent sago, 24 per cent taro, 14 per cent coconut, 7 per cent banana, 3 per cent cassava and 1 per cent Chinese taro. 11 per cent reported eating rice. 4 per cent reported eating fresh fish. This differs from the crop pattern, with higher sweet potato and yam consumption and lower banana and sago consumption.

Main References

None.

Other References

Lutkehaus, N. 1985 Pigs, politics, and pleasure: Manam perspectives on trade and regional integration. *Research in Economic Anthropology* 7, 123-141.

Robbins, R.G., H.A. Haantjens, J.A. Mabbutt, R. Pullen, E. Reiner, J.C. Saunders and K. Short 1976 Lands of the Ramu-Madang Area, Papua New Guinea. Land Research Series No. 37, Commonwealth Scientific and Industrial Research Organization, Melbourne.

Districts 3 Bogia
Population 4,885

Subsystem Extent 100 %
Population density 87 persons/sq km

Area (sq km) 56
Population absent 20 %

System Summary

Located on Manam Island. Short woody regrowth, 6-10 years old, is cleared and burnt. Taro and sweet potato are the most important crops; cassava, banana and coconut are important crops; other crops are Chinese taro and yam (*D. esculenta*). Two or three plantings are made before fallowing. Sweet potato is planted following the taro harvest. This is a recent innovation. New gardens are planted from July to November each year. Purchased rice has replaced imported sago and local breadfruit as dry season foods. Galip nut and Polynesian chestnut are eaten between August and October; fishing is an important food source during the dry season. Sweet potato is planted in small mounds.

Extends across provincial border to System(s) None

Altitude range (m) 10-900 **Slope** Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	Sweet potato, Taro (<i>Colocasia</i>)
STAPLES SUBDOMINANT	Banana, Cassava, Coconut
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Corn, Lowland pitpit, Pumpkin tips, Tulip, Bean (snake)
FRUITS	Mango, Pawpaw, Pineapple, Sugarcane, Watermelon, Mon
NUTS	Breadfruit, Galip, 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	None
CROP SEGREGATION	Minor
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	Significant
2 Betel nut	Minor
3 Fish	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	Significant
MOUNDS	None
LARGE MOUNDS	None
Garden Bed Techniques:	
BEDS SQUARE	None
BEDS LONG	None
Other Features:	
FENCES	Significant
STAKING OF CROPS	None
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION**Survey description**

In July 1991, a two day visit to Manam Island from Bogia. Travel by dinghy around the northern end of the island and down the east coast to Abaria village. A traverse on foot inland to 600 m altitude at Abaria and to 300 m altitude at Budua village.

Boundary definition

Land use on Manam Island was allocated to a separate system following visits to nearby Boisa Island and nearby locations on the mainland.

Notes

The system is restricted to Manam Island. It was distinguished from System 1310 on nearby Boisa Island where the fallow vegetation is grass and short woody regrowth, less than 5 years old.

Manam Island is an active volcano, cone shaped, about 13 km in diameter and 1900 m in altitude. The whole population was evacuated because of an eruption in 1957. Further eruptions occurred in 1972. Between 1992 and 1994 lava flows again destroyed gardens and forced the evacuation of villages. There are no permanent streams. Near sea level, slopes are about 15 degrees while in the highest gardens the slopes are 35 degrees. The lowest slopes of the island are now almost completely planted in coconuts and fruit and nut trees. Gardening has been forced upslope and inland about 1 km. The wetter northwest season occurs from November to April and the drier southeast season from May to October. The southeast season is traditionally known as a 'time of scarcity' (Lutkehaus 1991, 167).

In 1991 fallow regrowth was everywhere below 10 m high and decreased in height with altitude. Underbrush is cleaned and all trees are cut down. When dry, the cut debris is burnt. All gardens below 400 m altitude are fenced against domestic pigs, but higher altitude gardens are not. After fencing, the remaining rubbish is burnt again. The second burn is said to be an important control measure against introduced giant African snails. The gardens are divided internally into blocks by sticks laid on the ground. Greens, corn and taro are planted first, followed by banana and sweet potato. Sweet potato is planted in small mounds. Chinese taro is said to have been more common some years ago, and to have declined in importance because of disease. New planting stock is being imported again from the mainland. Yams are uncommon and are said to grow poorly. Until about five years ago, only one planting was made before fallow. However many people have now begun to make a second and third planting of sweet potato after the taro harvest, with good results. This was the practice in the majority of gardens observed. Sweet potato increases in importance with altitude. Giant African snails, introduced by Japanese troops in 1943, are said to be a major pest.

Fishing is important as a food source. Small single outrigger canoes are used to fish up to 2 km offshore. Fishing is mainly a dry season activity because of dangerous seas in the wet season.

No sago is produced on Manam Island (Lutkehaus 1985b, 29). Prior to the introduction of cash and store-bought food, the import of sago from the mainland during the dry season, in exchange for galip nut, tobacco, pigs, taro, betel nut and betel pepper, was very important for subsistence. Breadfruit was also a much more important local food source in the dry season than it is now (Lutkehaus 1985b, 32). In the past, all Manam clans had large sea-going canoes and trading was undertaken with hereditary trading partners on the mainland coast between Malala and the Murik Lakes and inland to the Bosmun Plateau (Systems 1301, 1304, 1305, 1306, 1401, 1402). Although trading has become less important in the subsistence and political economy, it continues to be undertaken today in outboard motor powered dinghys. Men are mostly involved in this activity, whereas women are more involved than men in local marketing.

Copra is the most important source of cash income, with a little income from sales of fresh food, fish and betel nut.

National Nutrition Survey 1982/83

23 families from 2 villages were asked in November 1982 what they had eaten the previous day. 100 per cent reported eating coconut, 65 per cent sweet potato, 43 per cent banana, 13 per cent cassava, 9 per cent taro, 9 per cent sago, 4 per cent yam and none Chinese taro. 70 per cent reported eating rice. 39 per cent reported eating fresh fish. This is similar to the crop pattern, except for the low consumption of taro. The sago is imported from the mainland.

Main References

None.

Other References

Lutkehaus, N. 1985a Pigs, politics, and pleasure: Manam perspectives on trade and regional integration. *Research in Economic Anthropology* 7, 123-141.

Lutkehaus, N.C. 1985b The flutes of the 'tanepoa': the dynamics of hierarchy and equivalence in Manam. PhD thesis, Columbia University, New York.

Lutkehaus, N.C. 1991 Manam. In Hays, T.E. (ed), *Encyclopedia of World Cultures, Volume II Oceania*. Boston, G.K. Hall and Company, 167-169.

Districts 3 Bogia
Population 339

Subsystem Extent 100 %
Population density 170 persons/sq km

Area (sq km) 2
Population absent 17 %

System Summary

Located on Boisa Island 7 km northwest of Manam Island. Fallows of grass and low woody regrowth, less than 5 years old, are cleared and burnt. Cassava and sweet potato are the most important crops; taro, banana and coconut are important crops; Chinese taro is also grown. Sago, imported from the mainland, is also an important food. Three or more plantings are made before fallowing. A first year garden is planted with sweet potato and taro in separate sections. After harvesting, sweet potato is planted and this is followed by a planting of cassava. Gardens are planted seasonally. The island is severely effected by seasonal drought. Galip nuts are an important seasonal food, as well as being exchanged for sago and yams from the mainland. Gardens are tilled between plantings. Sweet potato is planted in small mounds. Soil walls and wooden fences control soil loss.

Extends across provincial border to System(s) None

Altitude range (m) 10-100 **Slope** Very steep (>25 degrees)

CROPS

STAPLES DOMINANT	Cassava, Sweet potato
STAPLES SUBDOMINANT	Banana, Coconut, Taro (Colocasia)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sweet potato, Taro (Colocasia)
OTHER VEGETABLES	Aibika, Corn, Tulip, Bean (snake)
FRUITS	Mango, Sugarcane
NUTS	Breadfruit, Galip
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Grass/woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	1-4 years
CROPPING PERIOD	3-5 plantings
R VALUE	57 (medium)

GARDEN SEGREGATION

GARDEN SEGREGATION	None
CROP SEGREGATION	Minor
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 Fish	Minor
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OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Significant
TILLAGE	Significant
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	Significant
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	Minor
STAKING OF CROPS	None
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

In July 1991, a two hour visit to Munigi village and circumnavigation of Boisa Island by outboard dinghy en route from Abaria village to Budua village, Manam Island.

Boundary definition

The system is restricted to Boisa Island. This island was assigned to a separate system following visits to Manam Island and nearby parts of the mainland.

Notes

This system is distinguished from System 1309 on Manam Island and System 1308 on the mainland because agriculture is less intensive there with longer fallow periods and shorter cropping periods.

Boisa Island is about 250 m high and 1 km across. Most land is precipitous and gardens are made on very steep slopes. All forest has been cleared from the island and fallows are a mixture of scrub and grass. New gardens are made in fallows less than five years old. About half of all gardens are planted with taro as a first planting and about half with sweet potato. After the first harvest, sweet potato is planted as a second planting. A third planting of cassava follows the sweet potato. Sweet potato is said not to yield satisfactorily as a third crop.

The wetter northwest season occurs from November to April and the drier southeast season from May to October. During the southeast season the island is strongly susceptible to drought. Trade with the mainland is very important for subsistence during the dry season. Sago is the main food during the dry season and is all imported from the Awar villages in Hansa Bay, in exchange for galip nuts. Trading was formerly conducted in large sailing canoes (Lutkehaus 1985, 70), but sailing skills have largely been lost and trading now requires cash to purchase motors and fuel. Copra is not produced on the island. The main source of cash is from irregular visits by tourist boats en route from Madang to the Sepik River.

People say there is a severe shortage of land on Boisa and their long term existence on the island is precarious.

National Nutrition Survey 1982/83

No villages from this system were included in the survey.

Main References

None.

Other References

Lutkehaus, N.C. 1985 The flutes of the 'tanepoa': the dynamics of hierarchy and equivalence in Manam. PhD thesis, Columbia University, New York.

Districts 6 Karkar
Population 20,924

Subsystem Extent 100 %
Population density 78 persons/sq km

Area (sq km) 267
Population absent 15 %

System Summary

Located on Karkar Island and the small island of Bagabag. Fallow vegetation is tall woody regrowth. Fallow periods vary considerably. Fallows are typically 6-9 years old, but approximately one quarter are more than 15 years old and one quarter less than 5 years. Fallow vegetation is cut, dried and burnt. Chinese taro, banana, taro and coconut are important crops; other crops are yam (*D. esculenta*) and sweet potato. Breadfruit (both flesh and nuts), galip, Polynesian chestnut, and *Pouteria maclayana* are important foods seasonally. New gardens are planted most commonly between May and August. Only one planting is made before fallowing. Yam, and sometimes Chinese taro and taro, are grown in separate sections of gardens.

Extends across provincial border to System(s) None

Altitude range (m) 0-450 Slope Multiple classes

CROPS

STAPLES DOMINANT	None
STAPLES SUBDOMINANT	Banana, Chinese taro, Coconut, Taro (<i>Colocasia</i>)
STAPLES PRESENT	Banana, Chinese taro, Coconut, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Tulip, Corn, Pumpkin tips, Kumu musong, Spring onion, Amaranthus spp., Ferns, Lowland pitpit
FRUITS	Sugarcane, Ton, Mango, Mon, Pawpaw, <i>Pouteria</i>
NUTS	Breadfruit, Galip, Okari, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

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

GARDEN SEGREGATION

GARDEN SEGREGATION	None
CROP SEGREGATION	Significant
CROP SEQUENCES	None
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	Very significant
2 Betel nut	Significant
3 Cocoa	Significant
4 Fresh food	Minor
5 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	Minor
SMALL MOUNDS	Minor
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	Significant

OTHER DOCUMENTATION

Survey description

In July 1991, visits to 7 villages over two and half days on the north, west and south sides of Karkar Island (32 gardens seen). At Narer village, gardens at the altitudinal limit of agriculture (450 m) were visited. Bagabag Island was not visited and information was taken from Fahey (1988).

Boundary definition

Karkar and Bagabag Islands were allocated to a separate system after visits to Karkar and nearby parts of the mainland.

Notes

This system is distinguished from System 1309 on Manam Island where fallow vegetation is short woody regrowth, sweet potato and taro are the most important crops, and two plantings are made before fallowing.

While tall woody regrowth is the main fallow vegetation everywhere, there is some spatial patterning of fallow periods. Very short fallows (<5 years) are more common near the coast, while longer periods (>15 years) are more common inland at higher altitudes.

Two major changes have effected the crop and food patterns in this system during the last century. First, Chinese taro has been widely adopted. Second, by the late 1960s, substantial smallholder cash cropping had resulted in imported purchased foods supplying a considerable proportion of dietary energy (24 per cent in a major study of Kaul village on Karkar Island, Norgan et al. 1974, 323). At three villages (Urugen, Urara and Kevasop) on Karkar Island, people said in 1991 that since contact and the introduction of steel tools, food gardens had become larger and more important. However, crop yields are widely believed to have declined. The use of purchased food has probably affected, but not replaced, past patterns of consumption of fruit and nut crops (see below).

The relative significance of the four currently important staple crops, taro, Chinese taro, banana and coconut is variable. At Kaul village in 1969, taro and Chinese taro were the main crops, accounting for 42 per cent of energy intake (their relative contributions were not distinguished, Norgan et al. 1974, 323; 1979). The three other major energy sources were rice with 12 per cent (with other purchased store foods adding a further 9 per cent), coconut 10 per cent and banana 7 per cent (Norgan et al. 1974, 323). Sweet potato and yam were insignificant. Aibika and tulip were the main green vegetables. On Bagabag Island, yam (*D. alata* and *D. esculenta*) and banana were said to have been the most important crops up to the 1960s, with taro also significant (Fahey 1988, 111). By 1979-80 however, very little yam was grown and banana and sweet potato were the most important crops (Fahey 1988, 302, 310). Though an increase in the relative importance of banana was not claimed on Karkar in 1991, both observation and the ranking of informants suggested a greater importance for banana than that shown by the 1969 Kaul study.

Nut and fruit crops are very significant, though the growing importance of purchased foods has probably resulted in a decline in their use. Karkar islanders claim that previously they were more dependent on such crops as galip, breadfruit, Polynesian chestnut, *Pouteria maclayana* and *mon*. Similarly Bagabag islanders in 1979-80 reported that they had previously been more dependent on sago (unplanted), Polynesian chestnut, Java almond, galip and breadfruit (Fahey 1988, 111). Currently Karkar villagers rely more on banana, breadfruit and galip during their season which coincides with the establishment of new gardens in the period June to August. Breadfruit is said to be available in June-August and November-January; galip in April-July. Other nuts eaten include Java almond and pao (*Barringtonia procera* and another species). The seasonal significance of nut and fruit crops was demonstrated in the nutritional study of Kaul village in 1969 (Norgan et al. 1974, 323; 1979). Breadfruit (both flesh and nuts, Norgan et al. 1979) replaced taro (and Chinese taro) as the main staple in September-October, and galip was eaten in July-August and January-February. Other fruits eaten frequently included pawpaw and *mon*, while consumption of mango, soursop, malay apple and oranges was less frequent (Norgan et al. 1974, 311, 327). Galip oil was mixed with banana to make a special dough (Norgan et al. 1979, 35).

Three types of breadfruit are grown: one of which only the seeds are eaten, one of which both flesh and seeds are eaten, and one without seeds. Previously kava was grown and consumed on Karkar but this is no longer the case (Brunton 1989; Lebot et al. 1992, 29-30).

At Kaul village in 1969, fishing was relatively unimportant and very little fish or seafood was eaten (Norgan et al. 1974, 311, 326). In 1991 it remained a minor activity generally. Hunting is also a minor activity. Both hunting and fishing appear to have been more important on Bagabag in the past (Fahey 1988, 310).

Notes continued

A single planting before fallow was observed everywhere in 1991. In 1969, Norgan et al. (1974, 311) reported that gardens on flat land at Kaul village were usually planted twice before fallowing. On Bagabag in 1979-80, Fahey (1988, 302) implied that a second planting of sweet potato or cassava might follow an initial planting of yam.

Currently, Chinese taro is not grown in separate gardens. Yam (*D. esculenta*) is planted in separate sections within gardens. Chinese taro and taro are also commonly segregated within gardens, though they are sometimes interplanted.

New gardens are cleared between March and May, and planted between May and August. It is said that the planting time of gardens containing tobacco is determined by the seasonal requirements of tobacco (May-July planting). Inland gardens are said to be planted earlier (May-July) than coastal ones (June-August). Taro is available between January and April, but Chinese taro and banana are less seasonal. Yam (*D. esculenta*) is harvested from May to July. On Bagabag Island in 1979-80, clearing also was reported from March, though new garden planting was said to be somewhat later between October and December (Fahey 1988, 302).

Taro production is constrained by taro beetle (*Papuana* spp.), by taro leaf blight, and by virus (*Alomae*). Chinese taro is subject to *Pythium* root rot. Some gardens are fenced, others not. In some areas, individual gardens are not fenced but pigs are excluded from garden areas by long fences.

There is very considerable cash cropping of coconut and cocoa. Copra has been the major income source since the 1950s. Following earlier investment in coconut, much smallholder cocoa was planted on Karkar in the 1950s and 1960s (Shand and Straatmans 1974; McSwain 1977, 104). By 1966 the average grower had a little more than 1.2 ha under cash crops: 0.4 ha under sole cocoa, 1.8 ha under sole coconut, or 0.8 ha mixed (Shand and Straatmans 1974, 74). A small number of growers had cash crop plantings greater than 4 ha (Shand and Straatmans 1974, 77). Coconut holdings were somewhat smaller, and cocoa considerably less important, on Bagabag in 1980 (Fahey 1988, 295-7, 313). By the late 1960s, Karkar islanders of poor economic status were significantly less healthy than those of higher economic status (Hornabrook et al. 1977, 373). At Kaul village in 1969, men spent 1.4 hours working on cash crops (mainly copra) a week, and women 0.4 hours (Norgan et al. 1974, 314, 334, 338-342). These figures seem low given that the average cash crop area per grower in Kaul village was approximately 2 ha in 1966: it may be important that less than one third of Kaul men were cash crop growers (Shand and Straatmans 1974, 70-5). In the late 1960s coconut was still the major cash crop, and mainly men's work, while women took responsibility for all major tasks associated with cocoa (McSwain 1977, 107). In 1980, Karkar women were still harvesting and selling cocoa (Fahey 1985, 150). Further surveys of aspects of smallholder cashcropping on Karkar were made in 1986 (Landell-Mills, 1986) and 1989 (Yarbro and Noble, 1989). The latter study indicated that copra income remained more important than that from cocoa, as it did still in 1991. It also suggested that cocoa blocks, while extensively intercropped with coconut, also contained considerable numbers of other economic trees including betel, banana and other fruit and nut trees (Yarbro and Noble 1989, 27). Some Robusta coffee was planted in the past but was no longer harvested by 1991.

Market sales are also an important source of income. Fresh food and tobacco is sold in local markets. Betel nut is shipped to the mainland, and sent to Madang, Lae and the Highlands. This pattern was already apparent by 1980 on Bagabag when income from betel nut was estimated at 10-25 per cent of household income of which the larger part (K337 per household per year) came from the sale of copra (Fahey 1988, 295-6, 298). A limited 1991 survey of 20 Karkar households, which used recall over a one-year period to collect marketing information, estimated annual household income from food sales at K88, or 7 per cent of total household income (Jarvis and Gubag 1991, 4, 8). Sales of betel nut and tobacco were also considerable. They were included in a more inclusive category of 'other' items which totalled 25 per cent of household income. Over 80 per cent of surveyed households claimed market income (Jarvis and Gubag 1991, 8, 19).

National Nutrition Survey 1982/83

119 families from 3 villages were asked in November 1982 what they had eaten the previous day. 82 per cent reported eating coconut, 76 per cent banana, 42 per cent taro, 32 per cent sweet potato, 13 per cent Chinese taro, 5 per cent yam, 4 per cent sago and 1 per cent cassava. 45 per cent reported eating rice. 29 per cent reported eating fresh fish. This is similar to the crop pattern except for the relatively high sweet potato consumption. Sago was not observed growing on Karkar. The consumption of fresh fish also appears relatively high.

Main References

Norgan, N.G., A. Ferro-Luzzi and J.V.G.A. Durnin 1974 The energy and nutrient intake and the energy expenditure of 204 New Guinean adults. *Philosophical Transactions of the Royal Society of London B* 268, 309-348.

Shand, R.T. and W. Straatmans 1974 Transition from subsistence: cash crop development in Papua New Guinea. *New Guinea Research Bulletin* No. 54, Australian National University, Port Moresby and Canberra.

Other References

Brunton, R. 1989 *The Abandoned Narcotic: Kava and Cultural Instability in Melanesia*. Cambridge, Cambridge University Press.

Fahey, S. 1985 Producers or consumers? Women's entry into the cash economy in Madang, Papua New Guinea. In, *Women in Development in the South Pacific: Barriers and Opportunities*. Canberra, Development Studies Centre, Australian National University, 137-155.

Fahey, S. 1988 *Class, capital and spatial differentiation in Papua New Guinea*. PhD thesis, Australian National University, Canberra.

Hornabrook, R.W., S. Serjeantson and J.M. Stanhope 1977 The relationship between socioeconomic status and health in two Papua New Guinean populations. *Human Ecology* 5, 4, 369-382.

Jarvis, P. and K. Gubag 1991 Report on survey of smallholder cocoa growers, Karkar Island, Madang Province. Unpublished report, ANZDEC in association with Department of Agriculture and Livestock, and Cocoa Board of Papua New Guinea, Port Moresby.

Landell-Mills, J.P. 1986 Threshold prices of small-holder copra production on Karkar. Report on Cambridge Commodities Study Group to Papua New Guinea, Cambridge.

Lebot, V., M. Merlin and L. Lindstrom 1992 *Kava: The Pacific Drug*. New Haven, Yale University Press.

McSwain, R. 1977 *The Past and Future People: Tradition and Change on a New Guinea Island*. Melbourne, Oxford University Press.

Norgan, N.G., J.V.G.A. Durnin and A. Ferro-Luzzi 1979 The composition of some New Guinea Foods. *Papua New Guinea Agricultural Journal* 30, 1-3, 25-39.

Yarbro, S. and S. Noble 1989 Smallholder production, processing and marketing of cocoa and copra in Papua New Guinea: a baseline survey. *Designing Monitoring Systems for Smallholder Agriculture in Papua New Guinea*, Working Paper No. 10, Australian Centre for International Agricultural Research, Canberra.

Districts 1 Rai Coast
Population 997

Subsystem Extent 100 %
Population density 16 persons/sq km

Area (sq km) 63
Population absent 9 %

System Summary

Located on Long Island, an active volcano with a large crater lake, approximately 65 km north of Saidor station. The system was not visited and all information is from Ball and Hughes (1982) who made their observations in 1979. Tall woody regrowth fallows, more than 15 years old, were cut and burnt. Taro and yam (probably *D. esculenta*) were the most important crops; coconut, yam (probably *D. alata*) and sago (some of which was imported from the mainland) were important crops; other crops were banana, sweet potato, cassava and Chinese taro. Gardens were planted once before fallowing. Taro was grown in segregated gardens. Yam and taro were planted on small mounds. Crop were planted in October-November. Breadfruit, fruit and nuts trees, and sago were important dry season foods, together with store-bought rice.

Extends across provincial border to System(s) None

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

CROPS

STAPLES DOMINANT	Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
STAPLES SUBDOMINANT	Coconut, Sago, Yam (<i>D. alata</i>)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (common), Bean (winged), Corn, Cucumber, Kumu musong, Lowland pitpit, Peanuts, Pumpkin tips
FRUITS	Malay apple, Mango, Orange, Pawpaw, Pineapple, Sugarcane, Watermelon, Mon
NUTS	Breadfruit, Galip, Java almond, 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	None
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	Minor
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Coconuts	Significant
2 Betel nut	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	Minor
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	Minor
STAKING OF CROPS	None
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

Long Island was not visited. This description is based on published sources, in particular Ball and Hughes (1982) who visited the island in November 1979.

Boundary definition

Long Island was allocated to a separate system after visits to Karkar Island and the nearby mainland, and reviewing the literature.

Notes

This system is distinguished from System 1311 on Karkar and Bagabag Islands and System 1320 on the nearby mainland because of differences in fallow length and the important crops.

The information contained in this description is drawn from observations made by Eldon Ball and Ian Hughes in 1979 (Ball and Hughes 1982, 488-493) for another purpose. The information is therefore dated and incomplete. The main points of interest are listed below.

Long Island is an active volcano with a history of catastrophic eruptions. There is archaeological evidence of occupation at least 1000 years ago and oral historical accounts of periodic dramatic evacuation to the mainland and other nearby islands. The island was last evacuated in 1953 for one year. Minor eruptions have occurred in 1968, 1973 and 1974. Nearby Crown Island is uninhabited but is used for subsistence activities by the residents of Long Island.

In 1979 yams were the most important crop. In a good year, yam is eaten all year round. However Long Island is subject to severe seasonal droughts and it is common by the end of the dry season (December to May) for people to be surviving on breadfruit, fruit, nuts, sago (some imported), hunted animals and fish. Taro was grown in segregated gardens and taro suckers were kept alive in swamps and ponds during the dry season. There is no information on the segregation of crops within gardens, nor on the importance of household gardens. In main gardens, large trees were killed by ring-barking, smaller trees cut down, and the whole garden site burnt. Not all gardens were fenced. Small streams were 'frequently diverted' into taro gardens - the most extensive area of irrigated gardens occurred along 'the entire course of the Arapos River' and it is presumed this practice provided minor amounts of silt to these gardens. Gardens were cleared from August and were planted in October and November. Yam and taro were grown on small mounds.

Trade was an important part of the economy. Historically, stone mortars, pigs, dogs, drums, dogs' teeth, fowls' feathers and pigs tusks were exported and canoes, wooden bowls, clay pots, sago, cassowary plumes, stone axes, obsidian, net bags and cloth imported. In 1979 tobacco was grown extensively and with pigs was traded to the mainland. Other exports were turtle meat and eggs, trochus shell, green snail shells, fowls' feathers and wild fowl eggs. Main imports in 1979 were long wooden bowls, sago, clothing, cooking utensils and metal garden tools. In 1970, copra was the main source of cash (\$65-\$70 per year), with betel nut.

National Nutrition Survey 1982/83

No villages from this system were included in the survey.

Main References

Ball, E.E. and I.M. Hughes 1982 Long Island, Papua New Guinea - people, resources and culture. Records of the Australian Museum 34, 10, 463-525.

Other References

None.

Districts 5 Upper Ramu
Population 6,096

Subsystem Extent 100 %
Population density 13 persons/sq km

Area (sq km) 455
Population absent 17 %

System Summary

Located in rugged mountainous land on the south side of the Finisterre Mountains, north of Kaiapit village and extending into Madang Province. Tall woody regrowth fallows, 5-15 years old, are cleared and burnt. Sweet potato and banana are the most important crops; taro is an important crop; other crops are cassava, Chinese taro, yam (*D. alata*), sago and potato. Two plantings are made before fallowing. Sweet potato, banana and taro are planted in the first year. Sweet potato and taro are replanted after harvesting; banana is not replanted, but persists in the gardens. If fences remain intact, a third planting of sweet potato may be made. Gardens are planted in August-November.

Extends across provincial border to System(s) 1202

Altitude range (m) 600-1400 Slope Very steep (>25 degrees)

CROPS

STAPLES DOMINANT	Banana, Sweet potato
STAPLES SUBDOMINANT	Taro (<i>Colocasia</i>)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Potato, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (common), Choko tips, Corn, Cucumber, Highland pitpit, Lowland pitpit, Pumpkin tips, Spring onion
FRUITS	Mango, Marita pandanus, Pawpaw, Sugarcane
NUTS	Breadfruit, Coconut, Galip, Karuka (planted)
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall 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	None
CROP SEQUENCES	None
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 Coffee Arabica	Significant
2 Fresh food	Significant
3 Betel nut	Minor
4 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	Minor
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	Minor
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

In October 1981, a road traverse from the Lae-Madang highway to Tauta station (1 day). In October 1991, a road traverse from the Lae-Madang highway to Tauta station and from Tauta to Niningo village, and return, with garden inspections en route (1 day).

Boundary definition

The boundary with System 1201/1123/1331 was based on a traverse from the Madang-Lae Highway to Tauta mission and extrapolated along the edge of the Finisterre Mountains and the Markham and Ramu plains. The boundary with System 1203 was based on a road traverse from the Highlands Highway to Wantoat Mission with garden observations and interviews at Wantoat. The boundary with System 1323, in Madang Province, is extrapolated from that between this system and System 1201/1123/1331.

Notes

This system is distinguished from System 1201/1123/1331 in the Markham Valley, where fallow vegetation is short grass and the most important crops are banana and sweet potato; or tall woody regrowth with yam (*D. alata*) as the most important crop. It differs from System 1203, where fallow vegetation is short woody regrowth and sweet potato and Chinese taro are the most important crops. It is distinguished from System 1323 where fallow vegetation is short woody regrowth and short grass, more than 15 years old, and banana is the most important crop.

Rainfall is over 3700 mm in a year and fallow regrowth is rapid. Most rain falls between November-April, but there is no marked dry season. However most gardens are cleared from July-November.

The altitudinal range of the system means that a wide variety of food crops are cultivated, but the main attributes of the system are the same in both the higher and lower zones. The Rawa people, who occupy the area, distinguish between a 'hot' zone above and north of Tauta, and a 'warm' zone below Tauta. Dalton (1988, 90) argues that the altitudinal range, and the existence of rivers which are difficult to cross and so divide the Rawa into at least two groups, has resulted in an important internal trade and exchange of food items which are mutually unavailable between villages at higher and lower altitudes. These include the two pandanus species, potato, coconuts, sago, pawpaw, temperate climate vegetables and betel nut. *Marita* pandanus is grown at lower altitudes; and *karuka* pandanus is planted in the forest above the limits of cultivation. Sago is said to be a recent introduction and is not important as a food.

Fallows being cleared for cultivation in 1991 were tall, with large trees, but fallow periods all appeared to be shorter than 15 years. Fallows are cleared and burnt. Sweet potato is planted in very small mounds, intercultivated with banana, taro, Chinese taro, highlands and lowlands pitpit, sugarcane, pumpkin, pawpaw, corn and a wide variety of greens. A second planting includes the replanting of taro suckers and sweet potato. Banana and Chinese taro from the first planting continue into the second planting. Third plantings may occur if fences remain secure, and are always sweet potato only. Sweet potato is planted in very small mounds made with small spades and digging sticks.

The Rawa people have historical cultural affiliations with people on the Rai coast, north of the Finisterre Mountains. The Rawa were an important link in a trade network between the Vitiaz Straits, the Rai Coast and the Eastern Highlands. They were the major route by which shells reached the Highlands from the north coast (Dalton 1988, 72; 1992, 24-26). They exchanged clay pots, bark blankets, tobacco, bows and arrows with people on the northern side of the Finisterre mountains for shells and lime; and exchanged the shells, clay pots and wooden bowls for dogs' teeth, salt, stone axe blades and women with people in the Eastern Highlands. The internal economy was based upon the use of shells in marriage and death payments and the exchange of shells for pigs in special ritual feasts. Dalton (1988, 102-103) notes that from around 1945 the shell-pig-woman economy suffered from severe inflation.

Arabica coffee was introduced in the 1960s, was widely adopted and is now an important source of cash. An airstrip was opened at Tauta, in Madang Province, in 1964. A road linking Tauta with the Lae-Madang Highway was completed in 1979 and it became possible to drive to Lae and Madang in 1980. The road link greatly facilitated the marketing of coffee. The road, and the establishment of Ramu Sugar at Gusap in the Ramu Valley, on the Madang-Morobe Province border, allows the sale of vegetables in the Ramu Sugar market, another important source of cash. Money earned as wages at Ramu Sugar is also important (Sabel 1989). Minor quantities of betel nut and tobacco are sold locally.

National Nutrition Survey 1982/83

98 families from 3 villages were asked in November or December 1982 what they had eaten the previous day. 94 per cent reported eating sweet potato, 15 per cent Chinese taro, 11 per cent banana, 9 per cent taro, 1 per cent cassava and none yam, sago or coconut. 12 per cent reported eating rice. None reported eating fresh fish. This is similar to the crop pattern, except for the low consumption of banana.

Main References

Dalton, D.M. 1992 From shells to money: symbolic transformations in a highland Papua New Guinea economy. In Wassmann, J. (ed), *Abschied von der Vergangenheit: Ethnologische Berichte aus dem Finisterre-Gebirge in Papua New Guinea*. Berlin, Dietrich Reimer Verlag, 23-48.

Other References

Dalton, D.M. 1988 Inside and outside Rawa culture: a study of social symbolic process in Papua New Guinea. PhD thesis, University of Virginia, Charlottesville.

Sabel, C. 1989 A case study of rural employment in Papua New Guinea: Ramu Sugar. In Millett, J. (ed), *Institute of National Affairs/Rural Industries Council Agriculture Seminar, May 1989. Discussion Paper No. 38*. Port Moresby, Institute of National Affairs, 193-204.

Districts 2 Madang
Population N/A

Subsystem Extent 100 %
Population density persons/sq km N/A

Area (sq km) 14
Population absent N/A

System Summary

Located on the southwestern boundary of Madang town. Settlers from the lower Sepik River, Maprik, Lumi, Finschhafen, Karkar Island and Bundi cultivate gardens around migrant settlements. The system includes a complex mixture of practices and detailed information is not available. Crops grown are sweet potato, cassava, triploid bananas, Chinese taro, taro and yam (*D. esculenta* and *D. alata*). Peanuts and greens for sale in the town markets are also important. Fallow vegetation is low scrub and short grass. A wide range of soil fertility maintenance techniques are used, including tillage, raised beds, mounds and legume rotations. The traditional villages of Yabob, Kesup and Gum (see System 1301) have adopted some of the characteristics of this system.

Extends across provincial border to System(s) None

Altitude range (m) 20-40 Slope Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	None
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (lablab), Corn, Lowland pitpit, Nasturtium spp., Peanuts, Pumpkin tips, Bean (snake)
FRUITS	Mango, Pawpaw, Pineapple, Sugarcane, Guava, Mon
NUTS	Breadfruit, Coconut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Grass/woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	N/A
CROPPING PERIOD	N/A
R VALUE	N/A

GARDEN SEGREGATION

GARDEN SEGREGATION	None
CROP SEGREGATION	None
CROP SEQUENCES	None
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 Fresh food	Significant
2 Artifacts	Minor

OTHER AGRONOMIC PRACTICES

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

OTHER DOCUMENTATION

Survey description

In July 1991, road traverses in and out of the Madang urban area. In April 1994, a visit to settlements within the Madang urban area and aerial reconnaissance (half day).

Boundary definition

The boundaries with Systems 1301 and 1302 were determined by road traverses and low level aerial observations. It approximates to the boundary of the Madang urban area, but includes a number of peri-urban traditional villages such as Yabob, Kesup and Gum.

Notes

The people who practice agriculture in this system are the residents of the permanent settlements which evolved from migrant camps that developed to the southwest of Madang town in the 1960s and 1970s (Lea 1976). This system is characterised by the wide range of agricultural techniques which are used. Many originate in the home areas of the settlers. For example, Sepik settlers grow triploid bananas and *D. esculenta* yam as their most important crops, while Bundi settlers grow sweet potato on small mounds. Because techniques vary so much no attempt has been made to provide details, other than to make a subjective judgement of the crops grown. Growing food for sale in the urban markets is an important activity. Apart from wage employment in the town, other cash earning activities include the manufacture of artifacts, in particular wooden carvings, for sale to tourists and townspeople.

National Nutrition Survey 1982/83

No villages from this system were included in the survey.

Main References

None.

Other References

Lea, D.A.M. 1976 Madang. In Jackson, R.T. (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, 371-386.
Spencer, T. n.d. Field report on Yabob. Unpublished report, Papua New Guinea Institute of Medical Research, Madang.
Vicary, J.R. 1960 Agricultural year at Yabob village. Papua and New Guinea Agricultural Journal 12, 4, 180-191.

Districts 4 Middle Ramu
Population 6,292

Subsystem Extent 100 %
Population density 13 persons/sq km

Area (sq km) 503
Population absent 10 %

System Summary

Located to the southeast of the Ramu Plains, especially in the Asai, Tagui and Simbai River Valleys and extending into the middle Jimi Valley in Western Highlands Province. Typically, tall woody regrowth 8-15 years old is cut, dried and burnt. However, there is some use of primary forest, and older regrowth, as well as some shorter regrowth. Sweet potato is the most important crop; taro and banana are important crops; other crops are cassava, Chinese taro and yam (*D. alata* and *D. esculenta*). There is an altitudinal difference in the garden pattern. Above 1200 m, sweet potato tends to predominate in gardens. Below 1200 m, there are separate gardens in which taro, banana and yam (*D. alata* and *D. esculenta*) are interplanted. Only one planting is made by dibbling before a long fallow. Many new gardens are cleared and planted between May and September. Arboriculture is important, consisting of plantings of marita pandanus and tulip in particular, and including breadfruit and *Ficus* species.

Extends across provincial border to System(s) 0908

Altitude range (m) 200-1900 Slope Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	Banana, Taro (<i>Colocasia</i>)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Choko tips, Corn, Cucumber, Highland pitpit, Kumu musong, Lowland pitpit, Pumpkin tips, Rungia, Tulip
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane
NUTS	Breadfruit, Karuka (planted), Karuka (wild)
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

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

GARDEN SEGREGATION

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

SOIL FERTILITY MAINTENANCE

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

CASH EARNING ACTIVITIES

1 Animal skins	Minor
2 Coffee Arabica	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	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	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

In August 1982, a vehicle/foot traverse from Banz township, via Tabibuga station, to Koinambe mission in Western Highlands Province (1 day). In December 1990, a helicopter traverse from Mt Hagen to Koinambe mission and back to Mt Hagen (with brief stops at Koinambe mission and Togban community school). Detailed site information is limited in the Western Highlands Province part of the system. In Madang Province, in July 1991, a vehicle traverse on the Simbai-Aiome road from Simbai station to the vicinity of Bokapi; a foot traverse by one party, via Tsungup and Komilaga villages, to Kanainj airstrip (one and a half days); foot traverse by a second party through the Asai Valley, via Arung and Giringiri villages, to Kanainj airstrip (one and a half days; 17 gardens inspected). Traverse by vehicle from Simbai station to Aiome station, and from Aiome to Mambusap village (2 half days; 10 gardens inspected).

Boundary definition

In this province, the boundary with System 0907 was determined from a road traverse from Banz to Tabibuga station and Koinambe mission. It was extrapolated by reference to the regrowth vegetation boundary (woody and short grass to the north, woody to the south) mapped by Saunders (1993). The boundary with System 0909 to the west was also based on the regrowth vegetation boundary (woody and short grass regrowth to the east, woody to the west) distinguished by Saunders (1993). The boundary with System 0910 to the north was based mainly on Clarke (1977). In Madang Province, the boundaries between System 1315 and Systems 1308 and 1316 were determined from a road traverse between Simbai and Aiome, and extrapolated by reference to altitude (System 1308 below 200 m, System 1316 above about 1600 m where it is bordered by System 1315). The boundary with System 1317, in the Gebrau Valley north of Dusin mission, followed the 1600 m contour.

Notes

This system straddles the Madang and Western Highlands Provincial border. It is distinguished from System 0910/1316 to the north, where the fallow periods are shorter, the cropping period longer and planted casuarina is an important part of the fallow; from System 1308 in Madang Province to the east and north, where sago is the most important food; from System 0909/1318 to the west, where the fallow period is longer and taro is a most important crop; and from System 1317 in Madang Province to the southwest, where the important crops are different. It is similar to System 0907 to the south, where banana and taro are less important crops.

Over the last 30 years, several major studies of human ecology, all including accounts of agriculture, have been made in parts of this system. In Madang Province, the major accounts include Rappaport (1984), Clarke (1971), Buchbinder (1977b), Wood (1980) and Vayda (1989). In Western Highlands Province, the major accounts are Healey (1990), Joughin and Thistleton (1987), Lowman (1980) and Manner (1976).

Reported fallow lengths vary. In the early 1960s, in low density areas such as Sipapai at the eastern end of the Simbai Valley, they averaged 16 years, but some were as long as 40 years (Clarke 1966, 349; 1971, 71, 157). Ten per cent of gardens made in 1965 were cleared from previously unused forest (Clarke 1971, 74). By comparison, at Tsembaga in the middle Simbai Valley, only one per cent of gardens made between 1961 and 1963 were cleared from primary forest (Rappaport 1984, 42). At this location, fallows in the early 1960s averaged 15 years in the altitude zone 1000-1300 m, but 25 years above 1300 m (Rappaport 1984, 52-53). Over the range to the south, at Tsuwenkai in the Jimi Valley, there was no tendency for fallow periods to increase with altitude, nor did they become shorter during the 1970s. In this area fallow periods averaged 15-16 years at two surveys in the 1970s, and 18-19 years in 1985 (Healey 1990, 23). In the Gainj area, in the late 1970s, most fallows were in the range 8-12 years (Wood 1980, 36). In 1991, some gardens adjacent to the new Simbai-Aiome road had been made in previously uncut forest. In summary, average fallow lengths reported over the last 30 years fall within the range 10-25 years. Some ecological differences within the area covered by the system seem likely, possibly effecting regrowth vegetation. In the Gainj area of the Tagui and Asai Valleys in 1991, much woody regrowth was less than 10 m high, and tree fern was a marked component. The latter was also apparent from an aerial survey of the lower Asai Valley in 1968 (Bulmer 1968, 2). Some casuarina, but much less than in the neighbouring System 1316, is planted in fallows in the Gainj area, a practice that was apparent in the 1970s (Wood 1980, 36). It may have spread more recently, following the wider use of casuarina as shade for Arabica coffee.

The crop pattern in gardens varies with altitude. Above 800 m, sweet potato interplanted with banana is the major type. Below 800 m, there are two types: gardens planted with sweet potato, banana and cassava; and gardens containing taro, banana, yam (*D. esculenta*) and sweet potato. Within gardens, taro, banana and yam (*D. esculenta* and *D. alata*) are interplanted. Sweet potato is usually segregated. However, in sweet potato, cassava and banana gardens there is very little crop segregation. At Sipapai, two major named types of gardens were distinguished: taro-yam gardens and unimportant gardens (Clarke 1971, 74-75). The unimportant gardens could be further subdivided into a number of types named after specific crops (for instance, sweet potato gardens or greens garden). Cassava and Chinese taro were usually

Notes continued

planted near the edges of gardens. At Sipapi in the far east of the Maring region, there was an increase in the amount of cassava planted between 1965 and 1977 (Clarke 1980, 181). In the middle Simbai Valley where most agriculture occurs between about 900 and 1500 m, two kinds of garden are made: taro-yam gardens below 1300 m and sugarcane-sweet potato gardens between 1300 and 1600 m (Rappaport 1984, 43).

The relative importance of the three major root crops, sweet potato, taro and Chinese taro, has varied both by place and through time. In the early 1960s at the eastern end of the Simbai Valley, crop frequency counts showed sweet potato as the most important crop; however, consumption data showed Chinese taro as slightly more important than sweet potato, and much more significant than taro (Clarke 1971, 71, 179). Consumption data from Tsembaga village in the middle Simbai Valley in 1962-63 showed taro as slightly more significant than sweet potato (Rappaport 1984, 73). In 1968, dietary studies by Buchbinder (1977b, 125-126) in the Simbai Valley also indicated that more taro than sweet potato was eaten. In the 1970s in the Gainj area, Wood (1980, 36) ranked the three most important staples as sweet potato, taro and Chinese taro. One road traverse in 1991 on the Simbai-Aiome road recorded no Chinese taro. Generally, yams (up to 5 species) are of minor importance. However, abrupt differences between neighbouring communities in the significance of, for instance, yam (*D. esculenta*) have been reported (Clarke 1971, Appendix C). Yam (*D. nummularia*) was recorded in the Simbai Valley during the 1960s studies, but was not seen in 1991.

Beside the listed vegetables, others reported as present by earlier surveys, or observed as minor occurrences in 1991, include amaranthus, bamboo shoots, beans (lablab, winged and common), bottle gourd, cabbage, Chinese cabbage, ferns, ginger, *Nasturtium schlechteri*, oenanthe, peanuts, pumpkin fruit, sweet potato leaves (eaten only in northern part of the system), watercress and commelina. Other minor fruits include several *Ficus* spp., orange and golden apple. Minor nuts include candlenut, castanopsis and galip. Coconut is only present in the lower foothills (below 800 m) to the south of Aiome. Betel nut and betel pepper were not present in the Simbai Valley in the recent past but were grown in the Asai Valley. They have spread recently between Kenainj and Tsungup villages. For the Simbai Valley in the early 1960s, extensive lists of planted crops and edible wild plants are given by Clarke (1971, 207-240) and Rappaport (1984, 44-46, 247-251, 263-269, 270-277).

Crops are planted seasonally to some extent, though the evidence is not unanimous. In the lower Simbai Valley in the 1960s, Clarke (1966, 348; 1971, 130, 160) reported little seasonality, noting that, while some gardens were started sporadically throughout the year, there was more planting, especially of the main taro-yam gardens, in the dry period between May and August. In the middle Simbai Valley also in the 1960s, new major gardens were cleared between April and early June, and burnt and planted between June and September (Rappaport 1984, 42-43). Additional gardens were planted between November and April, largely with greens (Rappaport 1984, 44). In the Gainj area in the 1970s, gardens were cleared in May-June, burnt and fenced between May and August, and planted between July and September (Wood 1980, 39). Sweet potato was most available from November to March, and least between May and September; taro and yam were most available between May and September, and least between October and April (Wood 1980, 39). However, in the Simbai Valley in 1968, the pattern was different; sweet potato was more available between July and September, when taro was relatively scarce (Buchbinder 1977b, 126). Information collected during the 1991 survey also indicated that much new garden preparation occurs in the May-October period, with the planting of taro and yam (*D. esculenta* and *D. alata*) between August and September. Taro and yam (*D. esculenta* and *D. alata*) are eaten between April and September. However, sweet potato is unlikely to be planted seasonally. The availability of other vegetables is said to be partly seasonal. Aibika, for instance, is said to be most abundant between August and September.

Records of the availability, or fruiting, of tree crops throughout the area also show some variation: breadfruit between June and August in the Gainj area (Wood 1980, 39); but in September-October in the lower Simbai Valley (Clarke 1971, 183). *Marita pandanus* was most abundant between March and April in the Gainj area (Wood 1980, 39), between December and February in the middle Simbai Valley (Buchbinder 1977b, 125), and in January-February but also throughout the year, except for the driest period (May-August) in the lower Simbai Valley (Clarke 1971, 182, Appendix C).

Yam (*D. esculenta*) are planted with stakes 2-3 m high. All gardens are stoutly fenced.

Arabica coffee was introduced as a cash crop in the 1970s. By comparison with the Central Highland region, Clarke (1980) and Johnson (1988, 1990) have suggested that most work associated with coffee production has fallen upon women. Using data on household composition changes between 1978 and 1983, Johnson (1988, 108) has argued that, because of the major reliance on womens' labour in coffee production, the structure of more commercially successful

households in the Gainj area changed to incorporate significantly more women. Clarke (1980, 183) also suggested that the expansion of coffee might be associated with a decrease in the plantings of marita pandanus, breadfruit and tulip.

Notes continued

Some cocoa was planted before 1991 at lower altitudes, but had not been sold by that date. Minor quantities of fresh food and betel nut are sold at Aiome station.

Much of the bio-physical evidence collected in the 1960s and 1970s has been interpreted to mean that nutritional stress was a significant factor for the people using this system (Malcolm 1970; Buchbinder 1973; Wood 1980). In an important regional synthesis, Buchbinder (1977b) showed that adult stature and the nutritional status of children declined from east to west up the Simbai Valley, which she suggested was related to increasing population density, decreasing access to animal protein and possibly declining protein composition of the major root crops.

National Nutrition Survey 1982/83

17 families from 2 villages were asked in December 1982 what they had eaten the previous day. 82 per cent reported eating sweet potato, 47 per cent cassava, 29 per cent yam, 18 per cent taro, 12 per cent Chinese taro and none sago, coconut or banana. None reported eating rice or fresh fish. The absence of banana consumption, and the relatively high consumption of cassava and yam, differ from the crop pattern.

Main References

- Joughin, J. and B. Thistleton 1987 A rapid rural appraisal in the Jimi Valley, Western Highlands Province, Papua New Guinea. Discussion Paper 87/3. Department of Agriculture and Livestock, Port Moresby.
- Manner, H.I. 1976 The effects of shifting cultivation and fire on vegetation and soils in the montane tropics of New Guinea. PhD thesis, University of Hawaii, Honolulu.
- Rappaport, R.A. 1984 Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People. New Haven, Yale University Press.

Other References

- Bino, B., H. Yandanai and J. Mombo n.d.a Planting density. In, Agricultural Research Division: 1989 Annual Research Report. Port Moresby, Department of Agriculture and Livestock, 33.
- Bino, B., H. Yandanai and J. Mombo n.d.b Seasonality. In, Agricultural Research Division: 1989 Annual Research Report. Port Moresby, Department of Agriculture and Livestock, 32.
- Buchbinder, G. 1973 Maring microadaptation: a study of demographic, nutritional, genotypic and phenotypic variation in a Highland New Guinea population. PhD thesis, Columbia University, New York.
- Buchbinder, G. 1974 Where do Maring pigs come from? Unpublished paper, 73rd Annual Meeting of the American Anthropological Association, Mexico City.
- Buchbinder, G. 1977a Endemic cretinism among the Maring: a by-product of culture contact. In Fitzgerald, T.K. (ed), Nutrition and Anthropology in Action. Amsterdam, Van Gorcum, 106-116.
- Buchbinder, G. 1977b Nutritional stress and postcontact population decline among the Maring of New Guinea. In Greene, L.S. (ed), Malnutrition, Behaviour and Social Organization. New York, Academic Press, 109-142.
- Buchbinder, G. 1991 When all else fails: suicide among Maring women. In Pawley, A. (ed), Man and a Half: Essays in Pacific Anthropology and Ethnobiology in Honour of Ralph Bulmer. Auckland, The Polynesian Society, 177-181.
- Bulmer, R.N.H. 1968 Notes on the Western Schraders and the Pinaye-speaking people of the Jimi (Yuat) Gorge. Unpublished paper, Department of Anthropology and Sociology, University of Papua New Guinea, Port Moresby.
- Burton, J. 1989 Repeng and the salt-makers: 'Ecological trade' and stone axe production in the Papua New Guinea Highlands. *Man (New Series)* 24, 255-272.
- Clarke, W.C. 1966 From extensive to intensive shifting cultivation: a succession from New Guinea. *Ethnology* 5, 4, 347-359.
- Clarke, W.C. 1971 Place and People: An Ecology of a New Guinean Community. Berkeley, University of California Press.
- Clarke, W.C. 1977 Bismarck-Schrader Reports: No. 1. Patrol of contact, 1965. Working Papers in Anthropology, Archaeology, Linguistics, Maori Studies No. 49, Department of Anthropology, University of Auckland, Auckland.
- Clarke, W.C. 1980 At the tail of the snake. In Jennings, J.N. and G.J.R. Linge (eds), Of Time and Place: Essays in Honour of O.H.K. Spate. Canberra, Australian National University Press, 173-192.
- Clarke, W.C. 1993 Highland fringe Papua New Guinea. In Clarke, W.C. and R.R. Thaman (eds), Agroforestry in the Pacific Islands: Systems for Sustainability. Tokyo, United Nations University Press, 35-41.
- Clarke, W.C. and J.M. Street 1967 Soil fertility and cultivation practices in New Guinea. *Journal of Tropical Geography* 24, 7-11.
- Cook, E.A. and S.M. Pflanz-Cook 1988 'Children make me happy': reproductive decision making among the Manga, Jimi District, Western Highlands Province. In McDowell, N. (ed), Reproductive Decision Making and the Value of Children in Rural Papua New Guinea. Monograph 27. Port Moresby, Institute of Applied Social and Economic Research, 71-102.

Other References continued

- Crittenden, R., D. Archibald, K.O. Tiekou, A. Bush, W. Gwiseuk, A. Iorive, D. Kwamillon and S. Sivasupiramaniam 1989 Report on an Internal Evaluation of Phase One of the Smallholder Market Access and Food Supply Project (1988-1992). Port Moresby, Department of Agriculture and Livestock.
- Ghodake, R.D. and B. Gaupu 1990 Adaptive research in the SMAFSP areas for integrated development. Lowlands Farming Systems Research Team: Conference Paper 3, Bubia Agricultural Research Centre, Lae.
- Healey, C.J. 1985 Pioneers of the Mountain Forest: Settlement and Land Redistribution Among the Kundagai Maring of the Papua New Guinea Highlands. Oceania Monograph 29. Sydney, University of Sydney.
- Healey, C.J. 1986a Dependence and development in the Jimi Valley: a report on research. *Research in Melanesia* 10, 12-35.
- Healey, C.J. 1986b Men and birds in the Jimi Valley: the impact of man on birds of paradise in the Papua New Guinea Highlands. *Muruk* 1, 2, 4-33.
- Healey, C. 1990 Maring Hunters and Traders: Production and Exchange in the Papua New Guinea Highlands. Berkeley and Los Angeles, University of California Press.
- Johnson, P.L. 1981 When dying is better than living: female suicide among the Gainj of Papua New Guinea. *Ethnology* 20, 325-334.
- Johnson, P.L. 1988 Women and development: a Highland New Guinea example. *Human Ecology* 16, 2, 105-122.
- Johnson, P.L. 1990 Changing household composition, labor patterns, and fertility in a Highland New Guinea population. *Human Ecology* 18, 4, 403-416.
- Kanua, M.B. and G. Liripu n.d. Seasonality. In, Agricultural Research Division: 1984-1988 Annual Research Report. Port Moresby, Department of Agriculture and Livestock, 40.
- LiPuma, E. 1981 Cosmology and economy among the Maring of Papua New Guinea. *Oceania* 61, 266-285.
- LiPuma, E. 1988 *The Gift of Kinship: Structure and Practice in Maring Social Organization*. Cambridge, Cambridge University Press.
- Lowman, C. 1980 Environment, society and health: ecological bases of community growth and decline in the Maring region of Papua New Guinea. PhD thesis, Columbia University, New York.
- Maclean, N.L. 1984 'To develop our place': a political economy of the Maring. PhD thesis, University of Adelaide, Adelaide.
- Maclean, N.L. 1989 The commoditization of food: an analysis of a Maring market. *Canberra Anthropology* 12, 1-2, 74-98.
- Malcolm, L.A. 1970 Growth of the Asai child of the Madang District of New Guinea. *Journal of Biosocial Science* 2, 3, 213-226.
- Manner, H.I. 1976 The effects of shifting cultivation and fire on vegetation and soils in the montane tropics of New Guinea. PhD thesis, University of Hawaii, Honolulu.
- Manner, H.I. 1977 Biomass: its determination and implications in tropical agro-ecosystems, an example from montane New Guinea. In Bayliss-Smith, T. and R.G. Feachem (eds), *Subsistence and Survival: Rural Ecology in the Pacific*. London, Academic Press, 215-242.
- Manner, H.I. 1981 Ecological succession in new and old swiddens of montane Papua New Guinea. *Human Ecology* 9, 3, 359-377.
- Manner, H. and H. Lang 1981 A quantitative analysis of the induced grasslands of the Bismarck Mountains, Papua New Guinea. *Singapore Journal of Tropical Geography* 2, 1, 40-48.
- McArthur, M. 1977 Nutritional research in Melanesia: a second look at the Tsembaga. In Bayliss-Smith, T.P. and R.G. Feachem (eds), *Subsistence and Survival: Rural Ecology in the Pacific*. London, Academic Press, 91-128.
- Rappaport, R.A. 1971 The flow of energy in an agricultural society. *Scientific American* 225, 116-132.
- Sar, S. and T. Solulu n.d. A survey of the Taro beetle (*Papuana* spp.) in the Highlands. In, Agricultural Research Division: 1989 Annual Research Report. Port Moresby, Department of Agriculture and Livestock, 53-54.
- Street, J.M. 1966 Grasslands on the Highland fringe in New Guinea: localization, origin, effects on soil composition. *Capricornia* 3, 9-12.
- Temon, B. 1991 Roadside price movements and marketing efficiency in selected areas of the Western Highlands. *Designing Monitoring Systems for Smallholder Agriculture in Papua New Guinea*, Working Paper No. 20, Australian Centre for International Agricultural Research, Canberra.
- Thomas, D. 1976 Interpretation of social profiles of production in Tsembaga-Maring, Simbai Valley, Eastern Highlands, New Guinea. *Oceania* 47, 1, 21-35.
- Vayda, A.P. 1989 Explaining why Marings fought. *Journal of Anthropological Research* 45, 2, 159-177.
- Wood, J.W. 1980 Mechanisms of demographic equilibrium in a small human population, the Gainj of Papua New Guinea. PhD thesis, University of Michigan, Ann Arbor.

Districts 4 Middle Ramu
Population 8,801

Subsystem Extent 50 %
Population density 28 persons/sq km

Area (sq km) 318
Population absent 9 %

System Summary

Located in the centre of the Schrader Range, in the middle and upper Kaironk Valley, in the upper Asai Valley and in the basin at the head of the Simbai Valley and extending into Western Highlands Province. Three subsystems are distinguished, mainly on the basis of fallow type. For the entire system, sweet potato is the most important crop; taro and banana are important crops; other crops are Chinese taro, cassava, and yam (*D. alata*). In this subsystem, which covers approximately half the system, and occurs below 2000 m altitude, gardens are made in fallows of planted casuarina typically 8-15 years old. Two plantings are made before fallowing. Taro is commonly planted in separate gardens. An initial planting of taro is typically followed by a planting of sweet potato. Tillage is usual before planting. Pigs are let into gardens between crops. Household gardens are common. Most clearing and planting of new taro gardens occurs between May and September.

Extends across provincial border to System(s) 0910

Altitude range (m) 1500-2100 Slope Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	Banana, Taro (<i>Colocasia</i>)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>)
OTHER VEGETABLES	Bean (<i>lablab</i>), Choko tips, Corn, Highland pitpit, Lowland pitpit, Peanuts, Pumpkin tips, Rungia, Sweet potato leaves, Taro leaves
FRUITS	Avocado, Marita pandanus, Passionfruit (yellow), Sugarcane
NUTS	Castanopsis, Karuka (planted), Karuka (wild), <i>Elaeocarpus</i>
NARCOTICS	Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall 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	Minor
CROP SEQUENCES	Significant
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Very significant

SOIL FERTILITY MAINTENANCE

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

CASH EARNING ACTIVITIES

1 Coffee Arabica	Significant
2 Cattle	Minor
3 Fresh food	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	Minor
IRRIGATION	Minor
Soil Management:	
PIGS PLACED IN GARDENS	Significant
BURN FALLOW VEGETATION	Very significant
TILLAGE	Very significant
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	Minor
Mounding Techniques:	
VERY SMALL MOUNDS	None
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	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

The Western Highlands part of this system was not surveyed; information is taken from Clarke (1977). In Madang Province, one year residence at Simbai mission in 1962-63; and a brief visit in 1967, including a walk from Simbai station, through the Kaironk Valley, to the Jimi Valley (3 days). In July 1991, a foot traverse from Simbai to Kaironk village and return (2 days); and a foot traverse from Dusin mission to Simbai station, via the southeast side of Kaironk Valley through grasslands (1 day).

Boundary definition

In Western Highlands Province, the boundary with System 0908 west of Ginjinji village, and the boundary with System 0908 south of Ginjinji village, were both based on Clarke (1977). The boundary with System 0909 was extrapolated along the 1600 m contour. In Madang Province, the boundary between this System (1316) and System 1315 was determined from a road traverse between Simbai and Aiome, and extrapolated by reference to altitude. The boundary with System 1317 was determined from a foot traverse between Sangapi and Simbai stations (3 days), and by flights from Simbai to Sangapi, and from Dusin mission over the Upper Kaironk Valley.

Notes

This system is distinguished from System 0908/1315 to the southeast, east and north; and from System 1317 to the west, where there are no subsystems, the cropping period is shorter and there is only minor use of planted casuarina fallows. To the west, it differs from System 0909/1318, where the fallow period is longer, planted casuarina tree fallows are insignificant and tillage is not used.

This system is distinctive within the region for the use of a suite of intensive practices including extended cultivation periods, tillage and planted casuarina fallows. Despite prehistoric evidence of settlement in the area for at least 5000 years (S. Bulmer 1977), people claim that several major trends of agricultural change have only taken place during the past century. These include the introduction of pig husbandry, the use of ditches to keep pigs out of gardens and the planting of casuarina fallows. The husbandry of domesticated pigs is said to have been introduced only in the time of grandfathers of current adult men (Majnep and Bulmer 1977, 19). Using oral history, Riebe (1987, 216) has dated the first use of domesticated pigs at a festival in the upper Kaironk Valley to about 1845, with the first pig fences constructed at the end of the 19th century. By the 1960s, the ratio of pigs to people was approximately 1:1, though R. Bulmer (1977, 171-172) suggested that the number may have increased in the early 1970s. Three changes are said to have been associated with the introduction of pig husbandry, or to have occurred at about the same time. The tall cane grass, *Miscanthus floridulus*, is believed to have arrived from the Maring area in the neighbouring Simbai and Jimi Valleys (Majnep and Bulmer 1977, 23). Also, the large open grassland gardens of sweet potato, bounded by deep drains that also serve as pig ditches, are believed to have begun at the same time that pig husbandry was introduced (Bulmer 1982, 283). Thirdly, people in the Kaironk Valley also believe that systematic planting of casuarina only developed within the lifetime of either the fathers of living men (Bulmer 1982, 283), or perhaps their grandfathers (Majnep and Bulmer 1977, 23). Regular colonial contact only started in the 1950s, and was preceded both by steel tools, and by the arrival of crops such as Chinese taro, corn and cassava in the 1940s.

Planted casuarina fallows are the most distinctive feature of the landscape in this subsystem. Seedlings are transplanted into gardens soon after the planting of food crops. This practise was described in 1963 (Burnett 1963, 80). In gardens where casuarina is unlikely to do well, Majnep and Bulmer (1977, 195) have recorded that people will sometimes disperse the seed and transplant seedlings of the small tree *Dodonaea viscosa*. Planting of *Dodonaea* in grassland has also been reported from the neighbouring Jimi Valley (Manner 1976, 63, 141). In the upper Kaironk Valley, almost single species stands of *Parasponia* regrowth are also common, and are said to indicate fertile soils. Majnep and Bulmer (1977) have published good, dated photographs of agricultural landscapes in the upper Kaironk Valley and some neighbouring areas.

Two main kinds of garden are made, for sweet potato and for taro. There is also very minor use of irrigated taro gardens. Cultivation techniques for the two types of garden are generally similar: initial clearing and burning of grass under the casuarina; pollarding of the casuarina and felling of some; tillage of the soil (previously using sticks, but today mostly spades); and planting without any form of mounding. In 1965, Clarke (1966, 353; 1977, 54-55) observed that good fertile soils were sometimes not tilled before planting. There is some use of drainage in wetter areas, and plot dividers of casuarina and other wood also serve as soil retention devices on steeper slopes. When taro is planted in sweet potato gardens it is planted in separate areas. Two sweet potato crops in succession are common, and a planting of sweet potato frequently follows a taro crop.

Notes continued

Small irrigated taro gardens were described for the Asai Valley in 1962 (Burnett 1963). None were seen during this survey in 1991, though some were viewed in the Kaironk Valley during visits in the 1960s (Clarke 1977, 55). These were cleared and burnt in May, and strongly fenced. They were subdivided into many small plots and planted in June-July with a monocrop of taro (Burnett 1963, 82). There was some planting of aibika, Chinese taro and cassava along the borders. Water was brought, from up to 25 m away, to the garden in small ditches, and, in short parts, by bark flumes. The water is progressively restricted during the wet season, so that by the time of harvesting the garden is dry. Some owners reported an occasional second planting of taro before fallowing.

In 1963, Burnett (1963, 79) reported that while mixed gardens were planted throughout the year, there was 'a more or less seasonal' planting of sweet potato in November-December. In 1991, it was said that taro gardens were mainly cleared and planted between May and September. Some villagers indicated that sweet potato gardens were typically cleared between April and June. In July at the time of the survey, a very significant amount of garden preparation was underway.

Lack of road access limits income opportunities. Coffee is the major source of cash income, but has to be air freighted to Mt Hagen or Madang. Fresh food is sold at numerous small markets and Simbai station. Cattle are run on the grasslands in Subsystem 3. There is some alluvial gold mining in parts of the Simbai Valley.

National Nutrition Survey 1982/83

27 families from 1 village were asked in January 1982 or January or October 1983 what they had eaten the previous day. 96 per cent reported eating sweet potato, 19 per cent banana and none yam, taro, Chinese taro, sago, coconut or cassava. 7 per cent reported eating rice. None reported eating fresh fish. This is similar to the crop pattern except for the absence of taro consumption.

Main References

Bulmer, R. 1982 Crop introductions and their consequences in the Upper Kaironk Valley, Simbai area, Madang Province. In Bourke, R.M. and V. Kesavan (eds), *Proceedings of the Second Papua New Guinea Food Crops Conference*. Port Moresby, Department of Primary Industry, 282-288.

Other References

- Bulmer, R.N.H. 1964 Edible seeds and prehistoric stone mortars in the Highlands of east New Guinea. *Man* 183, 147-150.
- Bulmer, R. 1977 Selectivity in hunting and in disposal of animal bone by the Kalam of the New Guinea Highlands. In Sieveking, G.d.G., I.H. Longworth and K.E. Wilson (eds), *Problems in Economic and Social Archaeology*. London, Duckworth, 169-186.
- Bulmer, R. and B.J. Allen 1987 News: pigs and pitpit. *Science in New Guinea* 13, 2, 97-99.
- Bulmer, S. 1977 Between the mountain and the plain: prehistoric settlement and environment in the Kaironk Valley. In Winslow, J.H. (ed), *The Melanesian Environment*. Canberra, Australian National University Press, 61-73.
- Burnett, R.M. 1963 Some cultural practices observed in the Simbai Administrative Area, Madang District. *Papua and New Guinea Agricultural Journal* 16, 2-3, 79-84.
- Clarke, W.C. 1966 From extensive to intensive shifting cultivation: a succession from New Guinea. *Ethnology* 5, 4, 347-359.
- Clarke, W.C. 1977 Bismarck-Schrader Reports: No. 1. Patrol of contact, 1965. Working Papers in Anthropology, Archaeology, Linguistics, Maori Studies No. 49, Department of Anthropology, University of Auckland, Auckland.
- Clarke, W.C. 1993 Highland fringe Papua New Guinea. In Clarke, W.C. and R.R. Thaman (eds), *Agroforestry in the Pacific Islands: Systems for Sustainability*. Tokyo, United Nations University Press, 35-41.
- Clarke, W.C. and J.M. Street 1967 Soil fertility and cultivation practices in New Guinea. *Journal of Tropical Geography* 24, 7-11.
- Majnep, I.S. and R. Bulmer 1977 *Birds of My Kalam Country*. Auckland, Auckland University Press.
- Majnep, I.S. and R. Bulmer 1983 Some food plants in our Kalam forests, Papua New Guinea. Working papers in Anthropology, Archaeology, Linguistics, Maori Studies No. 63, Department of Anthropology, University of Auckland, Auckland.
- Manner, H.I. 1976 The effects of shifting cultivation and fire on vegetation and soils in the montane tropics of New Guinea. PhD thesis, University of Hawaii, Honolulu.
- Riebe, I. 1987 Kalam witchcraft: a historical perspective. In Stephen, M. (ed), *Sorcerer and Witch in Melanesia*. Melbourne, Melbourne University Press, 211-245.

System Summary

In this subsystem, which covers approximately one quarter of the system, gardens are made in fallows of tall woody regrowth at the forest edge, or in previously unused forest. Fallow periods are typically 10-20 years. The subsystem is mostly located at 2000 m altitude and above. Vegetation is cut, dried and burnt. One planting is made before fallowing. Sweet potato is usually the main crop planted.

Extends across provincial border to System(s) 0910

Altitude range (m) 1500-2100 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sweet potato, Taro (Colocasia), Yam (D. alata)
OTHER VEGETABLES	Bean (lablab), Choko tips, Corn, Highland pitpit, Lowland pitpit, Peanuts, Pumpkin tips, Rungia, Sweet potato leaves, Taro leaves
FRUITS	Avocado, Marita pandanus, Passionfruit (yellow), Sugarcane
NUTS	Castanopsis, Karuka (planted), Karuka (wild), Elaeocarpus
NARCOTICS	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	Minor
CROP SEQUENCES	None
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Very significant

SOIL FERTILITY MAINTENANCE

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

CASH EARNING ACTIVITIES

1 Coffee Arabica	Significant
2 Cattle	Minor
3 Fresh food	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	Minor
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	Minor
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	Minor
Mounding Techniques:	
VERY SMALL MOUNDS	None
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	None
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Notes

The lower forest edge in the Kaironk Valley is at about 2000 m altitude; in other valleys it may be lower. The gardens in this subsystem are made in the forest edge zone and thus usually over 2000 m. The woody succession component of fallows is outlined by Majnep and Bulmer (1977, 36), who have also summarised the altitudinal breaks in the Kaironk Valley, and described the main plants which appear in each zone. The forest zone is particularly important both for hunting and for harvesting wild karuka pandanus. At least up to the 1970s, there was a seasonal concentration of hunting in the period May to August (R. Bulmer 1977, 177). Wild karuka pandanus is reported to bear in the dry months between May and August (R. Bulmer 1977, 177). Karuka is occasionally planted by people (Majnep and Bulmer 1977, 36), but wild karuka is a more significant crop than planted karuka (Majnep and Bulmer 1977, 9197). Other wild plants that are eaten are described by Bulmer (1964), and by Majnep and Bulmer (1977, 193-202; 1983). Many people in the most densely populated part of the upper Kaironk Valley also have land rights in the less populated valleys to the north and south (Majnep and Bulmer 1977, 32). To the north there are two areas of land use at the head of the Aunjang Valley (spelt Aunja on the 1:100,000 topographic map). These gardens are at relatively high altitude (2000-2400 m, according to Majnep and Bulmer 1977, 27-28), and were first cleared only two generations ago. Some casual gardens are made by hunting parties in such valleys, for instance in the Aunja Valley by people from the Upper Asai (Burnett 1963, 80).

Gardens in this subsystem were not inspected (except at a distance from the valley floor). The description is based on interviews at Kaironk, and on information in Bulmer (1982) and other references. Most gardens are fenced.

System Summary

In this subsystem, which covers approximately one quarter of the system, gardens are made in short and tall (Miscanthus) grassland. Fallow periods are in the range 5-15 years, but typically less than 10 years. The soil is tilled before planting. Sweet potato is the most important crop. Two or more plantings are made before fallowing.

Extends across provincial border to System(s) 0910

Altitude range (m) 1500-2100 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sweet potato, Taro (Colocasia), Yam (<i>D. alata</i>)
OTHER VEGETABLES	Bean (lablab), Choko tips, Corn, Highland pitpit, Lowland pitpit, Peanuts, Pumpkin tips, Rungia, Sweet potato leaves, Taro leaves
FRUITS	Avocado, Marita pandanus, Passionfruit (yellow), Sugarcane
NUTS	Castanopsis, Karuka (planted), Karuka (wild), Elaeocarpus
NARCOTICS	Tobacco

FALLOW & CROPPING PERIOD

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

GARDEN SEGREGATION

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

SOIL FERTILITY MAINTENANCE

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

CASH EARNING ACTIVITIES

1 Coffee Arabica	Significant
2 Cattle	Minor
3 Fresh food	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	Minor
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	Significant
BURN FALLOW VEGETATION	Very significant
TILLAGE	Very significant
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	Minor
Mounding Techniques:	
VERY SMALL MOUNDS	None
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	None
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Notes

There is a marked difference between the vegetation on the northern and southern sides of the middle and upper Kaironk Valley, with extensive grasslands covering the latter. The southern slopes of the Kaironk Valley are believed by villagers to have always been covered in grass (Majnep and Bulmer 1977, 28). The grass is maintained by regular burning. Gardens made in the grassland are mainly planted with sweet potato. As noted in the general description in the Notes for subsystem 1, the technique of making gardens in grassland is believed to have been adopted relatively recently. Cultivation periods appear to be irregular, and may be longer than in gardens made in casuarina fallows. The fallow periods are often shorter (Majnep and Bulmer 1977, 31). Gardens are fenced or surrounded by ditches. Deep ditches around gardens to exclude pigs are an adaptation to the lack of timber for fencing (Majnep and Bulmer 1977, 24). The ditches are made both by digging, and by directing water from streams into them in order to scour them deeper. No information is available on the seasonality of planting.

Cattle are run on the grasslands. On some ridgetops, their movement has dug deep grooves into the subsoil. When Clarke (1966, 352; 1977, 54-57) visited the upper Kaironk Valley in 1965, he considered that the extensive grasslands, and visible yellow clay subsoil on many slopes to be indicative of 'degradation and the presence of ecological pressure'.

PROVINCE 13 Madang AGRICULTURAL SYSTEM No. 17 Subsystem No. 1 of 1

Districts 4 Middle Ramu
Population 4,600

Subsystem Extent 100 %
Population density 24 persons/sq km

Area (sq km) 192
Population absent 9 %

System Summary

Located in the western part of the Schrader Range, in the Sangapi Basin at the head of the Aramia River and in the upper Gebrau Valley north of Dusin. Many people using this system also make gardens and grow tree crops at lower altitudes in System 1318. Tall woody regrowth, usually 10-15 years old, is cut, dried and burnt. There is some use of previously uncut forest, and minor use of planted casuarina fallow. Sweet potato is the most important crop; other crops are taro, Chinese taro, banana and yam (*D. alata*). About half of all gardens are tilled before planting. Gardens are planted once only before fallowing. Taro and Chinese taro are planted separately from sweet potato within gardens.

Extends across provincial border to System(s) None

Altitude range (m) 1600-2100 **Slope** Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Chinese taro, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>)
OTHER VEGETABLES	Bean (common), Choko tips, Corn, Highland pitpit, Lowland pitpit, Nasturtium spp., Oenanthe, Pumpkin tips, Rungia, Spring onion
FRUITS	Avocado, Passionfruit (yellow), Pawpaw, Sugarcane
NUTS	Karuka (wild)
NARCOTICS	Tobacco

FALLOW & CROPPING PERIOD

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

GARDEN SEGREGATION

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

SOIL FERTILITY MAINTENANCE

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

CASH EARNING ACTIVITIES

1 Coffee Arabica	Minor
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OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	Minor
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	Significant
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	None
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	Minor
SEASONAL SEC'DARY CROPS	Minor

OTHER DOCUMENTATION

Survey description

In July 1991, a flight from Simbai station to Sangapi station. Gardens were visited 3 km northwest of Sangapi station, and up a ridge to southwest of the station (1 day, 11 gardens visited). Foot traverse from Sangapi station to Dusin mission (1 day). Foot traverse from Dusin to the head of the Gebrau Valley and return (1 day, 6 gardens visited). Foot traverse from Dusin mission up the south side of the Kaironk Valley to Simbai station (1 day).

Boundary definition

The boundary to the south and northwest with System 1318 was determined with reference to written accounts (Flanagan 1983, 49, 77; Jackson 1975, 33-39), interviews at Sangapi, and foot traverses around Dusin mission. It approximately follows the 1600 m contour. The system was distinguished from System 1319 which occupies two isolated areas of land use to the west. The boundary to the east with System 1316 was determined by a foot traverse between Sangapi and Simbai stations (3 days), and by flights from Simbai to Sangapi and from Dusin mission to the Upper Kaironk Valley and return. The boundary with System 1315 to the northeast was extrapolated by reference to altitude.

Notes

This system was distinguished from Systems 1318 and 1319 where the fallow period is longer; from System 1316 where greater use is made of planted casuarina fallows and the soil is tilled; and from System 1315 where banana and taro are important crops.

In many cases, the same people use both this system and System 1318 immediately to the south, claiming rights to a range of ecological zones stretching from low hill forest near the Jimi River at 400-800 m, through to montane forest at over 2000 m (Flanagan 1983, 49). According to Flanagan, ideally people prefer to live within the higher altitude area of this system, while retaining control of low lying resources. Detailed climatic data are not available. Annual rainfall is approximately 3000 mm, with the dry period between June and August (Flanagan 1983, 49-50).

Fallow periods range considerably. In 1991, some woody regrowth near the forest edge was over 30 years old, and elsewhere some fallow periods were more than 20 years. Typically, however, fallow periods were less than 15 years. In 1978-79 in the Aramia Valley, Flanagan (1983, 74) reported that fallows were generally 10-15 years old, with only a small number of gardens each year made in primary, or very old secondary, forest (Flanagan 1983, 74). At that time no gardens were made in areas of short kunai grass, and people said that woody regrowth should grow higher than 5 m before being re-cut (Flanagan 1983, 75-6). In 1991, there were only small areas of planted casuarina fallow near Sangapi, and in the upper Gebrau Valley, but the amount of casuarina increased near Dusin mission.

In 1978-79, Flanagan (1983, 74) reported that only one planting was made before fallowing, and he noted one instance of a second planting being strongly disapproved of by other group members. By 1991, a second planting of sweet potato was not unusual both near Sangapi and in the Gebrau Valley north of Dusin mission. Also noted were pigs on tethers in gardens before replanting. In explicit ethnic contrast to the practice among the Kopon people to the east and southeast of the Sangapi area, gardens made by Wovan people were fenced before planting (Flanagan 1983, 75). Unusually, men shared the planting of sweet potato with women, though they did not harvest this crop (Flanagan 1983, 75-76). In 1991, the soil in new gardens appeared to have been tilled in about half the gardens inspected. Around Sangapi, tillage was common in the altitude zone 1650-1850 m, particularly following a fallow with more swordgrass. It was not usual after fallows of old secondary or primary forest.

In 1991, most gardens seen were predominantly planted with sweet potato, with only a minority primarily planted with taro. Above 1800 m, a few gardens cleared from very old regrowth or previously uncut forest were mainly planted with lowland pitpit and sugarcane. Flanagan (1983, 77, 81, 83-4) describing both this system and the lower altitude System 1318 to the south, noted that gardens were named after the principal crops planted (for example, taro, sweet potato, tobacco, marita, pitpit, and sugarcane), although most contained a mixture of crops (Flanagan 1983, 77). He noted that taro gardens tended more to a monocrop, and were usually made in areas of older regrowth (Flanagan 1983, 81). Of a sample of 123 gardens in 1978-9 (again spanning both this system and System 1318), 37 (30%) were taro, 29 (24%) sweet potato, 23 (19%) coffee, and the remainder included marita, betel nut, banana, breadfruit, and low lying yam gardens (Flanagan 1983, 83-4). People said that they ate as much taro as sweet potato, and taro was the preferred food (Flanagan 1983, 84). The greater importance of sweet potato described for this system in the present account appears to reflect an altitudinal change. When Clarke (1977, 43) travelled through the area on a patrol in 1965 he noted that the amount of taro declined with altitude up the Aramia Valley, and that gardens near Sangapi were dominated by sweet potato. However, the significance of taro may also have declined over the last 15 years.

Notes continued

According to Flanagan (1983, 78), sweet potato gardens were made throughout the year, but taro gardens were planted at the end of the dry season and harvested during the following dry season. Corn was then always planted with taro, and thus harvested in December-January when it dominated intakes at that time of year as a substitute for taro (Flanagan 1983, 55). This is of interest in the light of Clarke's observation (1977, 42) that corn was absent in 1965 in the Aramia Valley below Sangapi at 1470 m. Some marita pandanus is available in the dry period (Flanagan 1983, 48), with karuka nut pandanus available either in mid-July (Flanagan 1983, 64) or early in the wet season (1983, 48). The period after a pig kill when garden crops have been used to feed guests is described as one of food shortage (Flanagan 1983, 48).

In 1965, Clarke (1977, 45-46) considered that edaphic and botanical indicators in the basin at Sangapi indicated pressure on land. For instance, much of the secondary forest was floristically simple with almost pure stands of *Dodonaea viscosa*, there was an absence of topsoil in many gardens leaving a reddish clay subsoil exposed, and the population was greater. In 1991, the stands of *Dodonaea* were still a marked feature of recent fallows.

Hunting is a significant activity, particularly for wild pigs at lower altitudes (Flanagan 1983, 58). Some hunting and trapping is scheduled by the occurrence of most major ceremonies between late November and early February (Flanagan 1983, 61). Such ceremonies require the planting of gardens one year before, and are preceded by serious hunting and the trapping of eels three months before.

Sources of cash income are limited. In the past bird plumes, and the skins and fur of animals were traded east to the Kopon people (Flanagan 1983, 24). A small amount of coffee was planted in the 1970s, usually in gardens following the harvest of one root crop planting, but had not been harvested by 1978 (Flanagan 1983, 35, 74). In 1978, annual cash income was estimated at only K5 per person (Flanagan 1983, 57). In 1991, only minor amounts of coffee were sold, after transport to Hagen by air. Cardamom had been tried, but did not grow successfully over 1600 m.

National Nutrition Survey 1982/83

48 families from 2 villages were asked in October or December 1982 what they had eaten the previous day. 92 per cent reported eating sweet potato, 46 per cent Chinese taro, 33 per cent taro, 6 per cent yam, 4 per cent banana, 2 per cent cassava and none sago or coconut. 2 per cent reported eating rice. None reported eating fresh fish. This is similar to the crop pattern except for the high consumption of Chinese taro and taro.

Main References

Flanagan, J.G. 1983 Wovan social organization. PhD thesis, University of Pennsylvania, Philadelphia.

Other References

Clarke, W.C. 1977 Bismarck-Schrader Reports: No. 1. Patrol of contact, 1965. Working Papers in Anthropology, Archaeology, Linguistics, Maori Studies No. 49, Department of Anthropology, University of Auckland, Auckland.
 Jackson, G. 1975 The Kopon: life and death on the fringes of the New Guinea Highlands. PhD thesis, University of Auckland, Auckland.

Districts 4 Middle Ramu
Population 1,548

Subsystem Extent 100 %
Population density 9 persons/sq km

Area (sq km) 178
Population absent 7 %

System Summary

Located in the western part of the Schrader Range, in the lower Kaironk and Aramia Valleys, and to the north of Sangapi station (and extending into the lower Jimi Valley in the Western Highlands Province as System 0909). Some people using this system also make gardens in the adjoining System 1317 above 1600 m. Typically, tall woody regrowth more than 15 years old is cut, dried and burnt. A few gardens are made in grassland. Two kinds of garden are made: sweet potato gardens usually dominated by that crop, and taro gardens containing other crops. Sweet potato and taro are the most important crops; banana is an important crop; other crops are cassava, Chinese taro and yam (*D. alata*). One planting is made before fallowing. Planting is by dibble, except in grassland gardens. Sweet potato gardens are made throughout the year. Taro gardens are cleared between May and September, and planted between August and November. Fruit and nut trees, both cultivated and wild, provide important foods. Hunting is important.

Extends across provincial border to System(s) 0909

Altitude range (m) 600-1600 Slope Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato, Taro (<i>Colocasia</i>)
STAPLES SUBDOMINANT	Banana
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>)
OTHER VEGETABLES	Bean (winged), Corn, Cucumber, Lowland pitpit, Pumpkin tips, Bottle gourd, Tulip
FRUITS	Mango, Marita pandanus, Pawpaw, Sugarcane
NUTS	Breadfruit, <i>Pangium edule</i>
NARCOTICS	Betel nut (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	None
MIXED VEGETABLE GARDENS	None
HOUSEHOLD GARDENS	Minor

SOIL FERTILITY MAINTENANCE

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

CASH EARNING ACTIVITIES

1 Animal skins	Minor
2 Coffee Arabica	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	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

This system was not visited (with the exception of a rapid walk in 1967 from Kaironk village in Madang Province, via Tsendiap village, to Koinambe mission in Western Highlands Province). The description is based on information in Jackson (1975), Clarke (1977) and Flanagan (1983), and from interviews at Sangapi and Dusin.

Boundary definition

In Western Highlands province, the northeastern boundary between this system and System 0910 was mainly determined with reference to Clarke (1977), and extrapolation on the 1600 m contour. The boundary with System 0908 to the east was based on the regrowth vegetation boundary (woody and short grass to the east, woody to the west) distinguished by Saunders (1993). In Madang Province, the boundaries between this system and System 1317 to the north were determined with reference to written accounts (Flanagan 1983, 49, 77; Jackson 1975, 33-39), interviews at Sangapi and foot traverses around Dusin mission. They approximately follow the 1600 m contour. The system was also distinguished from Madang System 1319 which occupies two isolated areas of land use to the west and south.

Notes

This is a very low intensity system of long fallow and a single planting, characterized by the combination of sweet potato and taro as most important crops. It is distinguished to the east from the higher altitude System 0910/1316, where the fallow period is shorter, and there is greater use of planted casuarina fallow and tillage. It also differs from System 0908/1315, where fallow periods are shorter and sweet potato is the single most important crop. In Madang Province, this system differs from the higher altitude System 1317, where the fallow period is shorter and sweet potato is the single most important crop. In the western part of the system in Madang Province around Sangapi station, some Wovan people, who mainly use this system, also have gardens between 1600 and 1800 m in System 1317 (Flanagan 1983, 77). Similarly, in Western Highlands Province, some people who occupy this system probably also use land above 1600 m in System 0910.

Gardens are made mostly between 600 m and 1600 m, but occasionally small, unfenced, ill-tended gardens are planted below 600 m. However, the zone below 600 m is more important for hunting and the collection of breadfruit and wild yam (Jackson 1975, 33). The lower altitude part of this system below 600 m is probably similar to System 1319, and to the description by Telban (1988a, b, c) for the Jimi flats, west of Ruti station in this province. The latter area was not mapped by Saunders (1993) as agriculturally used.

Although gardens are typically made in tall woody regrowth, there is minor use of grassland fallows. When Clarke (1977, 32-43) walked through the lower end of the Kaironk Valley, and up the Aramia River Valley to Sangapi in 1965, he noted that grassland covered up to one third of the area in the lower Kaironk but it was not cultivated. However, in 1966-68, at Yhal village (1350 m altitude), some sweet potato gardens were made in grassland (Jackson 1975, 43). After the grass was burnt, the soil was broken with black palm digging sticks and, more recently, with spades. Grassland cultivation of this kind was seen in 1991 in the valley below 1400 m at Dusin. The length of fallow periods under woody regrowth are problematic. According to Jackson (1975, 43), in the late 1960s at Yhal village in the east, fallow periods were 5-10 years or longer, with some less than 5 years. To the west, describing both this system and System 1317, Flanagan (1983, 74) estimated fallows at 10-15 years. Drawing on observations south of Dusin, fallow periods have been classified as typically longer than 15 years. Describing the lower Kaironk area, Clarke (1977, 33) noted that some fallows were composed of strikingly uniform growths of *albizzia*, a leguminous tree which people said enriched the soil.

One planting is made before fallowing (Jackson 1975, 42; Flanagan 1983, 74). Comparing techniques at Yhal with those used in the upper Kaironk Valley in System 1316, Jackson (1975, 42) noted the absence of a second planting of sweet potato after the harvesting of taro; the absence of irrigation and deep ditches around gardens; and the virtual absence of planted casuarina. Most gardens are fenced.

At Yhal village (1350 m altitude) in 1966-68, the two main crops were sweet potato and taro, with banana and Chinese taro important. Two garden types were made: sweet potato gardens containing mostly that crop, and taro gardens with taro and other crops (Jackson 1975, 40). Chinese taro was grown both in taro gardens and in separate patches (see also Clarke 1977, 40). In the lower Kaironk Valley in 1965, Clarke (1977, 40) noted that gardens (on very steep slopes) contained only a limited mixture of crops, compared to the mixed gardens of the Jimi Valley. Taro and banana predominated in some gardens, and in foods offered to the patrol. In the Aramia Valley, Flanagan (1983, 77, 81, 83-4) reported gardens named after principal crops (taro and sweet potato the main ones, with taro gardens slightly outnumbering sweet potato gardens), with less intercropping in taro gardens.

Notes continued

According to both Jackson (1975, 40-41) and Flanagan (1983, 78-79), new taro gardens were cleared between May and September, and planted between August and November. Taro was consequently scarce around December (Jackson 1975, 41), when its place was taken either by Chinese taro, or in the Aramia Valley, by corn (Flanagan 1983, 55, 79). At Yhal, crops such as corn, cucumber and gourds were available only for a short period, determined by the planting schedule of new gardens. Sweet potato, unlike taro, was planted, and available, throughout the year.

Arboriculture is important. In 1965 in the lower Aramia Valley, marita pandanus and breadfruit plantings were plentiful, and betel nut was grown (Clarke 1977, 40). Flanagan (1983, 55) described marita pandanus as the most desired food in the Aramia Valley, and in 1991, villagers at Sangapi reported plantings of tulip and banana as well as marita pandanus at lower altitudes in the Aramia Valley. Jackson (1975, 40) noted the importance of breadfruit (seeds only eaten), mango, marita pandanus and Pangium edule in the lower Kaironk Valley. While most food is provided by agriculture, hunting is also a significant activity, especially for wild pig at lower altitudes (Jackson 1975, 38; Flanagan 1983, 58). For the lower Kaironk Valley, other animals eaten included more than 30 species of rodents and marsupials, a python, many kinds of lizards and bats, and at least 150 species of birds and their eggs (Jackson 1975). Collecting was also significant. This included insects and their larvae, the tubers of pueraria and wild yam, 40 kinds of wild fruits and nuts, some 30 kinds of leaves and vegetables, and about 10 kinds of fungi. The only fish eaten are eels.

Cash income is low, with no direct external road connection. In Madang Province, small amounts of Arabica coffee are grown, and sold at Mt Hagen after being flown from Sangapi or Dusin airstrips. There is some trade of animal skins and bird plumes up the Kaironk Valley. In Western Highlands Province, some coffee is flown from Tsendiap or Koinambe airstrips to Mt Hagen, and animal skins and bird plumes are traded to the Wahgi Valley.

National Nutrition Survey 1982/83

40 families from 2 villages were asked in December 1982 what they had eaten the previous day. 60 per cent reported eating sweet potato, 60 per cent Chinese taro, 45 per cent taro, 23 per cent banana and none yam, sago, coconut or cassava. 3 per cent reported eating rice. None reported eating fresh fish. This is similar to the crop pattern except for the high consumption of Chinese taro.

Main References

- Flanagan, J.G. 1983 Wovan social organization. PhD thesis, University of Pennsylvania, Philadelphia.
 Jackson, G. 1975 The Kopon: life and death on the fringes of the New Guinea Highlands. PhD thesis, University of Auckland, Auckland.
 Joughin, J. and B. Thistleton 1987 A rapid rural appraisal in the Jimi Valley, Western Highlands Province, Papua New Guinea. Discussion Paper 87/3. Department of Agriculture and Livestock, Port Moresby.

Other References

- Bulmer, R.N.H. 1968 Notes on the Western Schraders and the Pinaye-speaking people of the Jimi (Yuat) Gorge. Unpublished paper, Department of Anthropology and Sociology, University of Papua New Guinea, Port Moresby.
 Clarke, W.C. 1977 Bismarck-Schrader Reports: No. 1. Patrol of contact, 1965. Working Papers in Anthropology, Archaeology, Linguistics, Maori Studies No. 49, Department of Anthropology, University of Auckland, Auckland.
 Crittenden, R., D. Archibald, K.O. Tiekou, A. Bush, W. Gwaiseuk, A. Iorive, D. Kwamillon and S. Sivasupiramaniam 1989 Report on an Internal Evaluation of Phase One of the Smallholder Market Access and Food Supply Project (1988-1992). Port Moresby, Department of Agriculture and Livestock.
 Ghodake, R.D. and B. Gaupu 1990 Adaptive research in the SMAFSP areas for integrated development. Lowlands Farming Systems Research Team: Conference Paper 3, Bubia Agricultural Research Centre, Lae.
 Gorecki, P. 1989a Ethnobotany of the Jimi Valley. In Gorecki, P.P. and D.S. Gillieson (eds), A Crack in the Spine: Prehistory and Ecology of the Jimi-Yuat Valley, Papua New Guinea. Townsville, James Cook University, 56-79.
 Gorecki, P. 1989b Prehistory of the Jimi Valley. In Gorecki, P.P. and D.S. Gillieson (eds), A Crack in the Spine: Prehistory and Ecology of the Jimi-Yuat Valley, Papua New Guinea. Townsville, James Cook University, 130-187.
 Gorecki, P.P. and D.S. Gillieson 1989 A Crack in the Spine: Prehistory and Ecology of the Jimi-Yuat Valley Papua New Guinea. Townsville, James Cook University.
 Gorecki, P. and J. Pernetta 1989 Hunting in the lowland rainforest of the Jimi. In Gorecki, P.P. and D.S. Gillieson (eds), A Crack in the Spine: Prehistory and Ecology of the Jimi-Yuat Valley, Papua New Guinea. Townsville, James Cook University, 80-101.
 Telban, B. 1988a Firemaking and stone-mortar use on the Upper Yuat, Papua New Guinea. Canberra Anthropology 11, 2, 31-43.

Other References continued

Telban, B. 1988b People, illness and plants: ethnomedicine in the Highlands fringe of New Guinea. MA thesis, University of Zagreb, Zagreb.

Telban, B. 1988c The role of medical ethnobotany in ethnomedicine: a New Guinea example. *Journal of Ethnobiology* 8, 2, 149-169.

Districts 4 Middle Ramu
Population 250

Subsystem Extent 100 %
Population density 4 persons/sq km

Area (sq km) 64
Population absent 0 %

System Summary

Located at the western end of the Schrader Range, between the Yuat River Gorge in the southwest and the peaks of the Schraders in the north and east. Gardens are made in tall woody regrowth, typically more than 25 years old, or in previously uncut forest. After underbrushing, trees are felled and the cut vegetation is burnt. Sweet potato is the most important crop; taro and banana are important crops; other crops are cassava, Chinese taro and sago. Only one planting is made before fallowing. Two named garden types are made. One contains sweet potato and a mixture of all other crops. The other is planted with almost a monocrop of taro. Gardens are prepared and planted throughout the year. Tree crops, both cultivated and wild, provide important foods. Household gardens are common. Hunting is important.

Extends across provincial border to System(s) None

Altitude range (m) 300-1800 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	Banana, Taro (Colocasia)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sago, Sweet potato, Taro (Colocasia)
OTHER VEGETABLES	Amaranthus spp., Bean (winged), Corn, Cucumber, Highland pitpit, Lowland pitpit, Nasturtium spp., Peanuts, Pumpkin fruit, Rungia
FRUITS	Malay apple, Mango, Marita pandanus, Pawpaw, Sugarcane, Ton, Watermelon, Pouteria
NUTS	Breadfruit, Karuka (planted), Pangium edule, Polynesian chestnut
NARCOTICS	Betel nut (lowland), Betel pepper (highland), 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	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 Animal skins	Minor
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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	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

This isolated system was not visited. This description is based on unpublished information from D.J. Boyd, who worked in the area in the late 1980s and early 1990s, and on Jenkins and Milton (1993), which reported on extensive work from 1984 to the early 1990s.

Boundary definition

The restriction of this system to two areas of low intensity land use (Saunders 1993) in the far western corner of the province is based on Jenkins and Milton (1993), information from D.J. Boyd and interviews at Sangapi.

Notes

This system is distinguished from System 1317 where fallow periods are shorter; and from System 1318 where taro is an important crop.

This is an extremely isolated area where regular contact only followed 1984 (Jenkins et al. 1989). The population was not included in the 1980 National Population Census, and the figure of 250 persons is taken from Jenkins et al. (1989, 31) for the year 1987. A large proportion (60 per cent) of the region is covered by primary forest, and the gross population density is about 1 person per square km (Jenkins and Milton 1993, 282). People are highly mobile, living much of the time away from their major residence at secondary sites. Climatic data are limited but annual rainfall is probably about 3000 mm, with the drier period between May and August.

Food frequencies for children's diets recorded by recall which were collected over a whole year (1990-91), showed that sweet potato was the most commonly eaten starchy food (74 per cent), followed by banana (69 per cent) and taro (39 per cent). Marita pandanus (34 per cent), breadfruit (20 per cent) and *Pangium edule* (10 per cent) were also eaten relatively frequently (Jenkins and Milton 1993, 287). Yam (mainly *D. esculenta* and *D. alata*, but including *D. bulbifera*, *D. pentaphylla* and *D. hispida*) has been observed, but people denied planting it to Boyd. The latter contrasts partly with the account of a brief early visit in 1968 made by Bulmer (1968, 6), who described plentiful food with sweet potato and yam in 'roughly equal quantities with some taro and a great deal of very good sugar cane.' Taro (*Alocasia*) is grown but is rare. Many other kinds of vegetables are grown or collected than are listed: these include oenanthe, common bean, lima bean, pumpkin tips, bamboo shoots, taro leaves and sweet potato leaves, watercress and bottle gourd (for containers only). Ferns, ginger and kumu mosong are also gathered from outside the gardens. It is claimed that neither aibika nor tulip, which both grow in the area, were eaten until contact with missionaries from Enga Province. Spring onion and tomato are recent introductions in the 1980s.

Two main garden types are named after the main crop grown in them: sweet potato or taro. When a household does not plant a taro garden, taro is usually planted in a separate section of a sweet potato garden. Gardens are strongly fenced. In household gardens, crops such as banana, pawpaw, tobacco, *Alocasia* taro and greens are planted.

Domesticated pigs are raised, with many acquired by capture as piglets. Holdings have been estimated at 0.57 pigs per person (Jenkins and Milton 1993, 285). Arboriculture is very important. Four tree crops - sago, breadfruit, marita pandanus and karuka pandanus - are sometimes planted in monocrop groves or orchards. Marita pandanus is an important crop, with fruit available from at least August to February. Breadfruit seeds are eaten especially during the dry season. Sago is planted in small swampy areas below 900 m altitude. All sago processing is done by men. It is a highly prized, but infrequently eaten, food which is considered a gift from men to women. Residential groups have been estimated to cut and process 1-2 sago trees per year. These crops, as well as others including betel nut, may also be planted together. In 1968, Bulmer (1968, 6) also observed sago, breadfruit, marita pandanus and betel nut. Other tree crops are *Pangium edule*, ton, *Semecarpus* sp, mango, *Pouteria maclayana* and Polynesian chestnut. These are usually not planted by people. Coconut was not grown until a new dwarf variety was introduced in the late 1980s from Madang.

Although people claim garden clearing is usually begun before the onset of the rainy season, most households have been observed to have gardens at three different stages: currently harvesting, almost ready to harvest, and under preparation. This implies that the planting of gardens is not seasonal.

There is very little cash income. Most probably comes from the sale of items such as animal skins and fur, bird plumes, cassowary chicks and tobacco to their neighbours to the east.

National Nutrition Survey 1982/83

No villages from this system were included in the survey.

Main References

Jenkins, C. and K. Milton 1993 Food resources and survival among the Hagahai of Papua New Guinea. In Hladik, C.M., A. Hladik, O.F. Linares, H. Pagezy, A. Semple and M. Hadley (eds), *Tropical Forests, People and Food: Biocultural Interactions and Applications to Development*. Volume 13, Man and the Biosphere Series. Paris, UNESCO and the Parthenon Publishing Group, 281-293.

Other References

Bulmer, R.N.H. 1968 Notes on the Western Schraders and the Pinaye-speaking people of the Jimi (Yuat) Gorge.

Unpublished paper, Department of Anthropology and Sociology, University of Papua New Guinea, Port Moresby.

Jenkins, C.L. 1987 Medical anthropology in the Western Schrader Range, Papua New Guinea. *National Geographic Research* 3, 4, 412-430.

Jenkins, C., M. Dimitrakakis, I. Cook, R. Sanders and N. Stallman 1989 Culture change and epidemiological patterns among the Hagahai, Papua New Guinea. *Human Ecology* 17, 1, 27-57.

Districts 1 Rai Coast, 2 Madang	Subsystem Extent 75 %	Area (sq km) 579
Population 8,498	Population density 15 persons/sq km	Population absent 12 %

System Summary

Located on the Rai Coast from Bogadjim plantation and east into Morobe Province on a narrow coastal plain. Two subsystems are distinguished on the basis of fallow types and crops grown. For the entire system, banana, taro, Chinese taro, yam (*D. esculenta*) and coconut are important crops. In this subsystem, woody regrowth up to 10 m tall and 5-15 years old, is cleared and burnt. Chinese taro, taro, banana and coconut are important crops; other crops are sweet potato, cassava, yams (*D. alata* and *D. esculenta*) and sago. Increasingly Chinese taro is planted with ABB triploid bananas in separate gardens. Only one planting is made before fallowing. Gardens are planted between August-November.

Extends across provincial border to System(s) 1209

Altitude range (m) 10-300 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	None
STAPLES SUBDOMINANT	Banana, Chinese taro, Coconut, Taro (<i>Colocasia</i>)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (<i>lablab</i>), Bean (<i>winged</i>), Corn, Cucumber, Lowland pitpit, Pumpkin tips, Tulip, Bean (<i>snake</i>)
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane, Ton, Pouteria, Mon
NUTS	Breadfruit, Galip, Java almond, Pangium edule
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	1 planting
R VALUE	9 (very low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Significant
CROP SEGREGATION	Significant
CROP SEQUENCES	None
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 Coconuts	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	None
SMALL MOUNDS	Minor
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	Minor
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

In Madang Province, in October 1991, a road traverse from Madang to Saidor station with garden observations en route (2 days). In November 1991, a foot traverse from Tariknam village to Saidor down the Nankina River via Yogayoga village (2 days). In December 1993, aerial observations en route from Madang to Teptep station.

Boundary definition

The southern boundary with System 1208/1328 was determined on a walking traverse in Madang Province from Tariknam village to Saidor station and extrapolated along the 300 m contour in Morobe Province. This system was distinguished from System 1210 following field visits in the Kabwum and Wasu areas.

Notes

This system is distinguished from the inland System 1208/1328 where the fallow vegetation is tall woody regrowth, two plantings are made before fallow, and sweet potato is the most important crop.

The narrow coastal plain is formed by alluvial fans and crossed by braided river channels and narrow river terraces. A mosaic of grasslands and low secondary forest covers the plain, with larger areas of grassland nearer the coast. Gardens are made in both woody regrowth (this subsystem) and in the grasslands (subsystem 2). More gardens are planted in woody regrowth fallows than in grass fallows.

In this subsystem, woody regrowth fallows are cleared and planted to numerous crops with taro, Chinese taro and banana the most commonly grown. Woody regrowth is cut and burnt. Taro, greens and corn are planted from August, followed by sweet potato, cassava and Chinese taro. Increasingly Chinese taro is being planted with ABB triploid bananas in separate gardens. Sweet potato is planted separately from taro, bananas and yam within the same garden. Yam vines are trained up standing saplings which are cut off 2 m above the ground for this purpose. Gardens containing sweet potato are always fenced.

It was in the western part of this system, at Bongu village, that Miklouho-Maclay lived from 1871 to 1872 and from 1876 to 1877 (Miklouho-Maclay 1975). He then listed in order of importance as food crops: coconuts, taro, yams, sweet potato, banana, sugarcane, lowland pitpit, winged bean, breadfruit, galip, sago and greens. In 1871 Maclay introduced pumpkin, corn, beans, pawpaw and watermelon from seed he brought from Java and Tahiti. He observed them being planted widely in gardens along the coast before he left. In 1876 he brought in mangosteen, durian, orange, lemon and coffee from Ambon and the Celebes (Miklouho-Maclay 1886, 347-349, 354). He observed people drinking kava (Miklouho-Maclay 1886, 351).

The system is accessible by road from Madang, but none of the major rivers are bridged and in the wet season several river crossings are dangerous and the road is impassable. In Morobe Province, the system is not accessible by road. As a result it is very isolated and there is very little cash earning activity. Minor amounts of copra, fresh food, betel nut, cocoa and tobacco are sold.

National Nutrition Survey 1982/83

103 families from 8 villages were asked in October or November 1982 what they had eaten the previous day. 85 per cent reported eating coconut, 79 per cent banana, 66 per cent yam, 44 per cent taro, 27 per cent sweet potato, 23 per cent Chinese taro, 11 per cent cassava and 4 per cent sago. 17 per cent reported eating rice. 3 per cent reported eating fresh fish. This is similar to the crop pattern, except for the high consumption of yam and sweet potato.

Main References

None.

Other References

Brunton, R. 1989 *The Abandoned Narcotic: Kava and Cultural Instability in Melanesia*. Cambridge, Cambridge University Press.

Miklouho-Maclay, N.N. 1975 *New Guinea Diaries: 1871-1883* (translated by C.L. Sentinella). Madang, Kristen Press.
Miklouho-Maclay, N. 1886 *List of plants in use by the natives of the Maclay-Coast, New Guinea*. Linnean Society of New South Wales, *Proceedings* 10, 346-358.

System Summary

In this subsystem, short grass (*Imperata*), 5-15 years old, is cut and burnt, and part of the garden is tilled with forks. Yam (*D. esculenta*) is the most important crop; taro, banana and coconut are important crops; other crops are sweet potato, yam (*D. alata*) cassava, Chinese taro and sago. Only one planting is made before fallowing. Gardens are cleared and planted between August-November each year. Yam (*D. esculenta*) is planted in separate blocks on mounds up to 50 cm high. Sweet potato, taro, cassava and banana are interplanted. Yams are grown on stakes.

Extends across provincial border to System(s) 1209

Altitude range (m) 10-300 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Yam (<i>D. esculenta</i>)
STAPLES SUBDOMINANT	Banana, Coconut, Taro (<i>Colocasia</i>)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (lablab), Bean (winged), Corn, Cucumber, Lowland pitpit, Pumpkin tips, Tulip, Bean (snake)
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane, Ton, Pouteria, Mon
NUTS	Breadfruit, Galip, Java almond, Pangium edule
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

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

GARDEN SEGREGATION

GARDEN SEGREGATION	None
CROP SEGREGATION	Very significant
CROP SEQUENCES	None
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	Minor
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	Minor
2 Coconuts	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	Significant
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	Significant
STAKING OF CROPS	Very significant
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Very significant
SEASONAL SEC'DARY CROPS	Very significant

OTHER DOCUMENTATION

Notes

In this subsystem, heavy forks are used to dig up some of the garden site after the short grass has been cut and burnt. Yam (*D.esculenta*) is planted in segregated blocks on mounds up to 50 cm high. Sweet potato, taro, cassava, banana and pumpkin are planted together, with pumpkin towards the edges. Chinese taro is rarely seen in these gardens.

PROVINCE 13 Madang AGRICULTURAL SYSTEM No. 21 Subsystem No. 1 of 1

Districts 5 Upper Ramu
Population 1,383

Subsystem Extent 100 %
Population density 6 persons/sq km

Area (sq km) 237
Population absent 25 %

System Summary

Located in the Bismarck Mountains north, east and west of Bundi mission in Madang Province and extending a short distance into Eastern Highlands Province. Tall woody regrowth, more than 15 years old, is cleared and burnt. Sweet potato is the most important crop; other crops are banana, taro, Chinese taro, cassava, yam (*D. alata* and *D. esculenta*) and sago. Only one planting is made before fallowing. Most planting occurs between July and November each year. Sweet potato is planted in small mounds. Household gardens are common.

Extends across provincial border to System(s) 1124

Altitude range (m) 600-1400 **Slope** Very steep (>25 degrees)

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Choko tips, Corn, Lowland pitpit, Peanuts, Pumpkin tips, Rungia, Tulip, Bean (snake)
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane, Watermelon
NUTS	Breadfruit, <i>Pangium edule</i>
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	Minor
CROP SEGREGATION	Minor
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 Animal skins	Minor
2 Cardamom	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	Minor
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	Very significant
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

In October 1984, a walking traverse from upper Chimbu to Braham mission, via Bundi mission (3 days). In July 1991, a vehicle traverse from Braham to Bundi, and from Bundi 10 km south towards Gembogl station to around 1600 m altitude and return (2 days). The Eastern Highlands part of the system was not visited.

Boundary definition

The boundary with Madang Province System 1303 was determined from walking and road traverses between Braham and Bundi missions, and extrapolated along the central mountains/Ramu plain boundary. The boundary with Madang Province System 1322 was determined from walking and road traverses on the Bundi-Gembogl road and extrapolated on the 1400 m contour. The boundaries with Systems 1104 and 1109/1330 were determined from aerial observations.

Notes

This system is distinguished from System 1303 where sweet potato and taro are the most important crops; and it was distinguished from System 1104 where fallow vegetation is cane grass. It is similar to System 1109/1330 but two plantings are made before fallowing in that system.

This system and System 1322 are used by the Gende people of the Bundi area in Madang Province. The Eastern Highlands part of this system is very small. The Gende people cultivate mountainous land from 600 m to 2200 m altitude. They make a clear distinction between environments below about 1400 m which are termed 'hot' and those above 1400 m which are termed 'cold'. This system is the 'hot' zone and System 1322 is the 'cold' zone. The distinction is based largely on plant species that will not grow or that grow poorly above 1400 m and those that do well. It also relates to the maturation times of crops that will grow in both zones such as sweet potato, banana and taro; the rate at which fallow vegetation regrows; and the potential for soil erosion. The Gende people have been the subject of a number of studies, including nutritional studies, but the range of altitude and the variation in food available from the two zones has not been specifically studied (Aufenanger 1979; Malcolm 1970; Zemel 1989; Zimmer 1985; Zemel and Jenkins 1989). Historical trade and marriage relationships exist between the Gende people and the people resident in the upper Asaro and Benabena Valleys in the Eastern Highlands Province and the upper Chimbu Valley.

The major difference between this system and System 1322 is the number of plantings before fallowing, one planting here and two and sometimes three plantings in System 1322. In addition, yam is grown in this system, breadfruit, marita pandanus and mango are available only here, and karuka pandanus only in System 1322. Gardens in this system are all fenced whereas gardens in System 1322 may not be. In both systems, land is cleared from May to July and planted from July to November. Soil retention measures are less important in this system. People make gardens in both systems and schedule planting times to take account of the difference in maturation times of crops in order to better spread the supply of food throughout the year.

Sweet potato is planted by women in small mounds about 30 cm high, spaced about 1 m apart. Banana, bamboo, pitpit and sugarcane are planted by men (Zimmer 1985, 114). Taro, yam, greens, corn, watermelon, cucumber and beans are planted between the mounds. Chinese taro is planted around the edges of the garden. Zimmer (1985, 114) notes the existence of 'scattered mixed gardens' in which these crops may be planted in the absence of sweet potato. In 1934 Aufenanger (1979, 54) observed Chinese taro and cassava being cultivated. Soil retention in this system merely involves placing light logs across the slope, fixed behind stumps.

Coffee was introduced in the late 1970s but poor road access and low prices were discouraging production in 1991. Minor local vegetable markets exist. Most cash income in the area comes from remittances and wage labour on a nearby cardamom plantation. Men and women are employed. The area is accessible by road from the Ramu valley via an extremely rough track and from Gembogl station in Chimbu Province on a track prone to landslides.

National Nutrition Survey 1982/83

No villages from this system were included in the survey.

Main References

None.

Other References

- Aufenanger, H. 1979 The Gende of Central New Guinea: of the life and thought of a tribe in the Bismarck Ranges, Papua New Guinea. *Oral History* 7, 8-9, 1-293.
- Fitz-Patrick, D. and J. Kimbuna 1983 *Bundi: The Culture of a Papua New Guinea People*. Nerang, Queensland, Ryebuck Publications.
- Jenkins, C., P. Heywood and B. Zemel 1987 Secular change in growth in Bundi. In Heywood, P. and B. Hudson (eds), *Rural Health Services in Papua New Guinea*. Monograph No. 5. Port Moresby, Department of Health, 77-80.
- Malcolm, L.A. 1970 *Growth and Development in New Guinea: A Study of the Bundi People of the Madang District*. Monograph Series No. 1. Madang, Papua New Guinea Institute of Human Biology.
- Zemel, B.S. 1989 *Dietary change and adolescent growth among the Bundi (Gende-speaking) people of Papua New Guinea*. PhD thesis, University of Pennsylvania, Philadelphia.
- Zemel, B. and C. Jenkins 1989 *Dietary change and adolescent growth among the Bundi (Gende-speaking) people of Papua New Guinea*. *American Journal of Human Biology* 1, 709-718.
- Zimmer, L.J. 1985 *The losing game - exchange, migration and inequality among the Gende people of Papua New Guinea*. PhD thesis, Bryn Mawr College, Philadelphia.

Districts 5 Upper Ramu
Population 3,844

Subsystem Extent 100 %
Population density 27 persons/sq km

Area (sq km) 140
Population absent 23 %

System Summary

Located in the Bismarck Mountains south of Bundi mission. Tall woody regrowth, more than 15 years old, is cleared and burnt. Some gardens are made after cane grass fallows. Sweet potato is the most important crop; other crops are banana, taro, Chinese taro and cassava. Two plantings are made before fallowing. Most planting occurs between July and November each year. The people using this system also use System 1321 that is located below 1400 m altitude. Household gardens are common. Sweet potato is planted in small mounds. Soil retention barriers are common.

Extends across provincial border to System(s) None

Altitude range (m) 1400-2200 Slope Very steep (>25 degrees)

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sweet potato, Taro (Colocasia)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (common), Bean (winged), Choko tips, Corn, Cucumber, Highland pitpit, Pumpkin tips, Rungia
FRUITS	Marita pandanus, Pawpaw, Sugarcane
NUTS	Karuka (planted)
NARCOTICS	Betel nut (highland), Betel pepper (highland), 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	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 Animal skins	Minor
2 Coffee Arabica	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	Significant
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	Significant

OTHER DOCUMENTATION

Survey description

In October 1984, a three day walking traverse from Upper Chimbu to Braham mission, via Bundi mission. In July 1991, a two day vehicle traverse from Braham to Bundi and from Bundi 10 km south towards Gembogl station to around 1600 m altitude and return.

Boundary definition

The boundary with System 1321 was determined by walking and road traverses on the Bundi-Gembogl road and extrapolated on the 1400 m contour. The boundary with System 1002 in Chimbu Province was determined on a walking traverse from the Upper Chimbu Valley to Bundi.

Notes

This system and System 1321 are used by the Gende people of the Bundi area (see Fitz-Patrick and Kimbuna (1983) for good photographs of the landscape and people). They cultivate mountainous land from 600 m to 2200 m altitude. They make a clear distinction between environments below about 1400 m which are termed 'hot' and those above which are termed 'cold'. This system is the 'cold' zone and System 1321 is the 'hot' zone. The distinction is based largely on plant species that will not grow or that grow poorly above 1400 m and those that do well. It also relates to the maturation times of crops that will grow in both zones such as sweet potato, banana and taro; the rate at which fallow vegetation regrows; and the potential for soil erosion. The Gende people have been the subject of a number of studies, including nutritional studies, but the range of altitude and the variation in food available from the two zones has not been specifically studied (Aufenanger 1979; Malcolm 1970; Zemel 1989; Zimmer 1985; Zemel and Jenkins 1989). Historical trade and marriage relationships exist between the Gende people and the people resident in the upper Asaro and Benabena valleys in the Eastern Highlands Province and upper Chimbu valley.

The major difference between this system and System 1321 is the number of plantings made before fallowing, one planting in System 1321 and two and sometimes three plantings here. In addition, yams are grown, and breadfruit and mango are available only in System 1321, and karuka pandanus only in this system. Gardens in this system are often not fenced whereas gardens in System 1321 are almost always fenced. The seeds of some common greens like amaranthus and nasturtium are said to be brought into this system to be planted from System 1321 each year. In both systems, land is cleared from May and planted from July to November. Soil retention measures are more important in this system. People make gardens in both systems and schedule planting times to take account of the difference in maturation times of crops in order to better spread the supply of food throughout the year. The majority of people reside in this system.

Sweet potato is planted by women on small mounds about 30 cm in height, spaced about 1 m apart. Banana, bamboo and sugarcane are planted by men (Zimmer 1985, 114). Taro, yam, greens, corn, watermelon, cucumber and beans are planted between the mounds. Chinese taro is planted around the edges of the garden. Zimmer (1985, 114) notes the existence of 'scattered mixed gardens' in which these crops may be planted in the absence of sweet potato. In 1934 Aufenanger (1979, 54) observed Chinese taro and cassava being cultivated. Soil retention in this system involves the construction of stout low fences and low stone walls across the slope.

The number of plantings made before fallowing is of interest. Aufenanger (1979, 50, 57), who made his observations in 1934, states 'a garden is never made on the same spot two years in a row', and 'once everything has been harvested, the garden is allowed to become overgrown'. Other comments he makes, for example about the distribution of pineapple, marita and karuka, implies that he is aware of the distinctions between the 'hot' and 'cold' zones and that he is discussing both zones. Commenting on the situation around 1966, Malcolm (1970, 8) notes 'two crops only are obtained and the ground is left fallow to revert to bush'. In 1984 most gardens were planted twice with sweet potato. In 1991 people near Bundi mission insisted they replanted sweet potato up to three times before fallowing. It seems reasonable to suggest that the number of plantings made before fallowing in this system has been extended from one to at least two and perhaps more during the last 60 years.

Census data presented by Malcolm (1970, 26) indicates that between 1956 and 1964 the infant mortality rate fell from 117/1000 to 65/1000 and between 1956 and 1969 the toddler mortality rate fell from 170/1000 to 50/1000. These rates then remained fairly stable to 1984 (Jenkins et al. 1987, 78). The population resident in the census division increased from 5700 to 6700 in the same period. But in the 1970s large numbers of Gende migrated from Bundi so by 1978, 6600 were resident in the census division and 2000 or 23 per cent were absent (National Statistical Office 1982, 210). So the apparent increase in agricultural intensity would seem not to be directly related to a rapid increase in the resident population.

Notes continued

Coffee was introduced in the late 1970s but poor road access and low prices were discouraging production in 1991. Minor local vegetable markets exist. Most cash income in the area comes from remittances and wage labour on a nearby cardamom plantation. Men and women are employed. The area is accessible by road from the Ramu valley via an extremely rough track and from Gembogl station in Chimbu Province on a track prone to landslides.

National Nutrition Survey 1982/83

51 families from 3 villages were asked in November 1982 what they had eaten the previous day. 100 per cent reported eating sweet potato, 31 per cent taro, 20 per cent banana, 6 per cent Chinese taro, 2 per cent cassava and none yam, sago or coconut. 14 per cent reported eating rice. None reported eating fresh fish. This is similar to the crop pattern, except for the high taro consumption.

Main References

None.

Other References

- Aufenanger, H. 1979 The Gende of Central New Guinea: of the life and thought of a tribe in the Bismarck Ranges, Papua New Guinea. *Oral History* 7, 8-9, 1-293.
- Corden, M.W. 1970 Some observations in village life in New Guinea. *Food and Nutrition Notes and Reviews* 27, 77-82.
- Fitz-Patrick, D. and J. Kimbuna 1983 *Bundi: The Culture of a Papua New Guinea People*. Nerang, Queensland, Ryebuck Publications.
- Jenkins, C., P. Heywood and B. Zemel 1987 Secular change in growth in Bundi. In Heywood, P. and B. Hudson (eds), *Rural Health Services in Papua New Guinea*. Monograph No. 5. Port Moresby, Department of Health, 77-80.
- Malcolm, L.A. 1970 *Growth and Development in New Guinea: A Study of the Bundi People of the Madang District*. Monograph Series No. 1. Madang, Papua New Guinea Institute of Human Biology.
- National Statistical Office 1982 Madang Province. Provincial Data System Rural Community Register, National Statistical Office, Port Moresby.
- Zemel, B.S. 1989 *Dietary change and adolescent growth among the Bundi (Gende-speaking) people of Papua New Guinea*. PhD thesis, University of Pennsylvania, Philadelphia.
- Zemel, B. and C. Jenkins 1989 *Dietary change and adolescent growth among the Bundi (Gende-speaking) people of Papua New Guinea*. *American Journal of Human Biology* 1, 709-718.
- Zimmer, L.J. 1985 *The losing game - exchange, migration and inequality among the Gende people of Papua New Guinea*. PhD thesis, Bryn Mawr College, Philadelphia.

Districts 5 Upper Ramu
Population 566

Subsystem Extent 100 %
Population density 7 persons/sq km

Area (sq km) 87
Population absent 7 %

System Summary

Located between Kesawai village and Ramu Sugar in the middle Ramu valley. Fallows are a mixture of short woody regrowth and short grass, usually more than 15 years old. The grass fallows become increasingly important to the southeast. Fallow vegetation is cut and burnt. Triploid ABB banana is the most important crop; other crops are cassava, sweet potato, Chinese taro, taro, sago and yam (*D. esculenta*). The bananas yield for more than 5 years. The other crops are planted with bananas only in the first year of the banana garden, otherwise they are planted in separate gardens. In these gardens, two plantings are made before fallowing. An unknown number of people occupy resettlement blocks. Banana, yam (*D. esculenta*) and sweet potato are the most important crops on the resettlement blocks. Gardens are planted in August-November.

Extends across provincial border to System(s) None

Altitude range (m) 100-300 Slope Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	Banana
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (common), Choko tips, Corn, Lowland pitpit, Peanuts, Pumpkin tips, Tulip
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane, Watermelon
NUTS	Breadfruit, Coconut, Galip
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Grass/woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	>15 years
CROPPING PERIOD	1 planting
R VALUE	20 (low)

GARDEN SEGREGATION

GARDEN SEGREGATION	Very significant
CROP SEGREGATION	Minor
CROP SEQUENCES	None
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	Minor
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Betel nut	Significant
2 Fresh food	Significant
3 Cocoa	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	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	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

A number of traverses by road along the Lae-Madang highway between July and November 1991.

Boundary definition

The boundaries with Systems 1303 and 1331 are based on traverses on the Lae-Madang highway. The boundary with System 1313 is extrapolated from the boundary between Systems 1313 and 1331.

Notes

This system is distinguished from Systems 1303 and 1313 where fallow vegetation is tall woody regrowth; and from System 1331 where both short grass and tall woody regrowth are used.

This system is located between Kesawai village and Ramu Sugar. Here the widespread taro-yam-banana forest fallow systems of the Adelbert Ranges and the Ramu Valley change into the complex 'grass fallow' triploid banana-yam-sweet potato systems of the Markham Valley. Description of the system is complicated by resettlement blocks around Kesawai.

The system is located on low alluvial fans and swampy alluvial plains, with patches of grassland amongst forest. The grassland gradually increases in area to the southeast. Fallow vegetation varies from woody regrowth in the northwest to short grass in the southeast. Bananas are planted in segregated gardens and maintained for over 5 years. Only in the first year of a banana garden are other crops interplanted with bananas. Yam (*D. esculenta*), cassava and sweet potato, together with greens, corn, pineapple and watermelon are grown in separate, smaller gardens. Chinese taro is not common.

An unknown number of settlers occupy blocks between Walium and Kesawai, growing mainly sweet potato, yam (*D. esculenta*) and vegetables for market. The Lae-Madang highway runs the length of the system and is an important influence on agriculture. Many gardens contain small beds of vegetables such as spring onion, Chinese cabbage and other greens grown specifically for sale at Ramu Sugar or on the roadside.

The main source of cash income is fresh food and betel nut. Some income is derived from sales of cocoa, tobacco, Robusta coffee and cattle.

National Nutrition Survey 1982/83

No villages from this system were included in the survey.

Main References

None.

Other References

Sabel, C. 1989 A case study of rural employment in Papua New Guinea: Ramu Sugar. In Millett, J. (ed), Institute of National Affairs/Rural Industries Council Agriculture Seminar, May 1989. Discussion Paper No. 38. Port Moresby, Institute of National Affairs, 193-204.

Districts 2 Madang
Population 4,577

Subsystem Extent 100 %
Population density 8 persons/sq km

Area (sq km) 598
Population absent 13 %

System Summary

Located in the Gogol Timber Project concession area. The Gogol project is clear felling secondary forest and re-forested areas for woodchips. The pre-project agricultural system was similar to Systems 1302 and 1303, but logging operations have created large areas of short woody regrowth, less than 20 years old, that are used for subsistence cultivation. Following cultivation these areas are either replanted with fast growing pulpwood tree species, or with smallholder cocoa, or are left as natural regrowth fallows. Fallows range from 5 to 15 years old (the project cutting cycle is between 16 and 20 years) and comprise woody regrowth of varying heights. Fallow vegetation is cut, dried and burnt. In the western part of the area, only one planting is made before fallowing, but east of the Lae-Madang highway two plantings are made. Chinese taro and banana are the most important crops; taro and yam (*D. esculenta*) are important crops; other crops are cassava, sweet potato, yam (*D. alata*) and sago. New gardens are cleared from June to August and planted from August to December each year. Taro, Chinese taro and yam tend to be planted in separate gardens.

Extends across provincial border to System(s) None

Altitude range (m) 20-150 Slope Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	Banana, Chinese taro
STAPLES SUBDOMINANT	Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (lablab), Bean (winged), Choko tips, Corn, Cucumber, Lowland pitpit, Pumpkin tips, Bean (snake)
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane, Ton, Mon
NUTS	Breadfruit, Coconut, Galip
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	None
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 Fresh food	Significant
2 Betel nut	Minor
3 Cocoa	Minor
4 Coconuts	Minor
5 Firewood	Minor
6 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	Minor
Mounding Techniques:	
VERY SMALL MOUNDS	None
SMALL MOUNDS	Minor
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	Significant

OTHER DOCUMENTATION

Survey description

In July and October 1991 and April 1994, road transects from the Lae-Madang highway to Utu mission, Mawan Base Camp and Baku DPI station, and to Maraga, Dogia and Balima villages; and from Baku DPI to Amele village. In October 1991 and April 1994, aerial reconnaissance of parts of Gogol Timber Project area .

Boundary definition

The boundaries with Systems 1301, 1303, 1320, 1325 and 1326 are based on the borders of the Gogol Timber Project operations areas, copied from a 1:100,000 topographical map in the Jant office at Madang.

Notes

The lower Gogol River Valley was selected as the site for a major clear felling timber project in 1971. Jant, a subsidiary of the large Japanese company Honshu Paper Manufacturing Company Ltd, constructed a wood chip mill on Madang Harbour, and exported the first ship load of chips from the Gogol Timber Project to Japan in 1974. In order to create the conditions for a sustainable operation, it was planned to reforest 20,000 ha with selected species (mainly *Eucalyptus deglupta*) on land leased to the project by local landowners. The land use plan also included a range of large and small agricultural projects, mainly cocoa and cattle. Due partly to landowner reluctance to lease the required land, and partly to a lack of commitment from Jant, by 1986 only 5500 ha had been acquired for reforestation (Lamb 1988, 418). As a result, in 1994, the project is being extended into natural forests to the northwest.

The clear felling and the irregular adoption of the land use plan by landowners has disrupted pre-project cultivation-fallow cycles. Following clear felling, landowners are leaving sites to natural regrowth for between 5 and 6 years. Then woody regrowth less than 10 m tall and 5-15 years old is cleared, burnt and the site gardened. Following cultivation, some landowners are planting *E. deglupta* trees, others are planting cocoa and yet others are leaving the site to natural regrowth.

Taro, Chinese taro and yam (*D. esculenta*) tend to be planted in different gardens; taro on low lying wetter land, and Chinese taro and yam on slopes. Taro and yam are always segregated if they are planted within the same garden. Although in terms of area planted, taro is dominant, Chinese taro is a more important source of food because it continues to produce throughout the life of the garden and into the early fallow period. Sago is eaten about once a month. Steeper slopes have poles laid along the contour as soil retention devices. Yams are staked to 2 m and are planted in small mounds.

As a result of the project, the area has very good road access to the project base camp and to the Lae-Madang highway and the Madang town market for the sale of vegetables and betel nut. Cocoa is becoming more important as a source of cash. Coffee and copra continue to provide a low level of income. The most important source of cash in the area is timber royalties and wages.

National Nutrition Survey 1982/83

22 families from 1 village were asked in November 1982 what they had eaten the previous day. 91 per cent reported eating coconut, 82 per cent taro, 14 per cent sweet potato, 9 per cent yam, 5 per cent sago, 5 per cent banana and none Chinese taro or cassava. 73 per cent reported eating rice. 5 per cent reported eating fresh fish. This single village differs from the crop pattern, with low banana and nil Chinese taro consumption.

Main References

Lamb, D. 1988 A radical approach to tropical forestry: an account of pulpwood logging in Papua New Guinea. In Dargavel, J., K. Dixon and N. Semple (eds), *Changing Tropical Forests. Historical Perspectives on Today's Challenges in Asia, Australasia and Oceania*. Canberra, Centre for Resource and Environmental Studies, Australian National University, 413-426.

Other References

- Brunton, R. 1989 *The Abandoned Narcotic: Kava and Cultural Instability in Melanesia*. Cambridge, Cambridge University Press.
- De'Ath, C. 1980 *The Throwaway People: Social Impact of the Gogol Timber Project, Madang Province*. Monograph No. 13. Port Moresby, Institute of Applied Social and Economic Research.
- Kube, R. 1990 *Tropical Lowland Rain Forests*. Madang, Wau Ecology Institute and Kristen Pres.
- Lamb, D. 1990 *Exploiting the Tropical Rain Forest: An Account of Pulpwood Logging in Papua New Guinea*. Volume 3, *Man and the Biosphere Series*, UNESCO and the Parthenon Publishing Group, Paris.
- Mikloucho-Maclay, N.N. 1975 *New Guinea Diaries: 1871-1883* (translated by C.L. Sentinella). Madang, Kristen Pres.
- Saulei, S.M. 1984 *Natural regeneration following clear-fell logging operations in the Gogol Valley, Papua New Guinea*. *Ambio* 13, 5-6, 351-354.

Districts 2 Madang
Population 4,718

Subsystem Extent 100 %
Population density 50 persons/sq km

Area (sq km) 95
Population absent 7 %

System Summary

Located on low, strongly dissected hill country between the Gum River and the Gogol River, south of Madang town. Short woody regrowth fallows, around 10 years old, are cleared and burnt. Banana, Chinese taro, yam (*D. esculenta*), taro and coconut are important crops; other crops are sweet potato, cassava, yam (*D. alata*) and sago. Two plantings are made before fallowing. Sweet potato and cassava are usually planted after the yam and taro harvest. New gardens are usually planted between July and November each year. Yams are grown on stakes. The sale of food in local and town markets and employment in Madang town are important sources of cash income.

Extends across provincial border to System(s) None

Altitude range (m) 40-100 Slope Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	None
STAPLES SUBDOMINANT	Banana, Chinese taro, Coconut, Taro (<i>Colocasia</i>), Yam (<i>D. esculenta</i>)
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Corn, Cucumber, Kumu musong, Lowland pitpit, Pumpkin tips, Tulip, Bean (snake)
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane, Ton, Watermelon, Mon
NUTS	Breadfruit, Galip, Okari
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	Minor
CROP SEQUENCES	Very 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	Significant
2 Fresh food	Significant
3 Cocoa	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	Minor
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	Significant

OTHER DOCUMENTATION

Survey description

In March 1980, a two day survey of gardens at Bandup village, near Yagaum Health Centre. In July 1991, a one day visit to the area with numerous garden observations. In April 1993, a one day visit to the area. In April 1994, a road traverse from the 4-Mile junction on the Lae-Madang highway to Omuru DPI station and Dolonu village, and an aerial reconnaissance from Madang airport to Omuru DPI station, and from Mawan Base Camp to Madang Airport.

Boundary definition

The boundaries with Systems 1301, 1302, 1303 and 1324 were determined by road traverses from the Madang-Lae highway to Amele mission and Mawan Base Camp. They are based on Saunders (1993) Land Use Intensity Class 2.

Notes

This system is distinguished from System 1301 where short woody regrowth and tall grass fallows, less than 5 years old, are used; from Systems 1302 and 1303 where only one planting is made before fallowing; from System 1324 where banana and Chinese taro are the most important crops.

This is an area with good road access to the Lae-Madang highway, to Madang town for wage earning and marketing, and in which there is good access to schools and health care facilities. The area came under the German colonial administration before 1914 and mission activities began here in the 1890s.

A detailed eight month long study by Janet Banag in 1986-87 of banana growing in 38 villages in this system and the adjacent coastal area (System 1301) provides a good description of this system (King et al. 1989). In 1986 the average household (n=106) comprised 6 people (range 2-11). Most households maintained one or two gardens. The average area under cultivation per person was 0.11 ha (range 0.01 ha to 0.68 ha). The great majority of gardens (98 per cent) were cleared from woody regrowth and the rest from short grass. Forty per cent were on slopes greater than 25 degrees. The average fallow length was 12 years (range less than 5 to greater than 20); 46 per cent were between 6 and 10 years and 39 per cent between 11 and 20 years. Most gardens were planted between July and November. The crop composition of gardens (in terms of the number of gardens in which a crop was planted) changed over time. Gardens changed over 18 months from banana-yam-taro gardens to banana-Chinese taro-sweet potato gardens. From planting to 18 months, bananas were maintained in all gardens and Chinese taro in 77-82 per cent of all gardens. Sweet potato increased in importance from 20 per cent of gardens aged less than six months to 60 per cent at 18 months. Cassava also increased in importance, but was never found in more than 30 per cent of gardens. Taro and both species of yams declined in importance from 88 per cent at six months to 30 per cent at over 18 months for taro, and from 74 per cent of all gardens at under six months for *D. esculenta* to 43 per cent at over 18 months.

Statistically significant differences were observed between the planting densities of crops in the adjacent System 1301 and those in this system. Yam (*D. esculenta*) was planted more intensively in the first year in System 1301, while taro was planted more intensively in the first year in this system. Bananas were also planted more densely in System 1301. In the second year, Chinese taro and sweet potato were more important in this system and taro and *D. esculenta* yam more important, in system 1301.

In 1986-87 about a third of all adults in the households surveyed were making an average of one trip to the Madang market per week (two new markets have appeared between this system and Madang town since 1987) and earned an average K8.22 (range K0.01->K20) per week. Ten per cent of adult males were then in wage earning employment, but Jenkins et al. (1984, 267) state that 'about 25 per cent of adult men' were in employment or running their own businesses, mainly trade stores.

Almost half of all households surveyed owned no pigs, 25 per cent had 1 or 2, 19 per cent 3-5 and 9 per cent 6 or more. The main pests and diseases were Black Cross and Sigatoka disease in bananas and giant African snails.

National Nutrition Survey 1982/83

77 families from 5 villages were asked in October or November 1982 what they had eaten the previous day. 95 per cent reported eating coconut, 58 per cent banana, 52 per cent sweet potato, 49 per cent yam, 45 per cent taro, 45 per cent Chinese taro, 1 per cent sago and none cassava. 64 per cent reported eating rice. 1 per cent reported eating fresh fish. This is similar to the crop pattern, except for the high consumption of sweet potato.

Main References

King, G.A., J. Banag, R.N. Kambuou, K. Ovia, A. Ovia, P.F. Heywood and R.L. Hide 1989 Production of bananas by the Amele in Madang Province and in the Vanapa River and Kabadi areas of Central Province Papua New Guinea. Research Bulletin No. 44, Department of Agriculture and Livestock, Port Moresby.

Other References

Allen, B.J. 1980 Report on a reconnaissance visit to Madang, April 1980. Unpublished report, Office of Environment and Conservation, Port Moresby.

Brunton, R. 1989 The Abandoned Narcotic: Kava and Cultural Instability in Melanesia. Cambridge, Cambridge University Press.

Jenkins, C.L., A.K. Orr-Ewing and P.F. Heywood 1984 Cultural aspects of early childhood growth and nutrition among the Amele of lowland Papua New Guinea. Ecology of Food and Nutrition 14, 261-275.

Districts 2 Madang, 5 Upper Ramu	Subsystem Extent 100 %	Area (sq km) 320
Population 4,599	Population density 14 persons/sq km	Population absent 28 %

System Summary

Located in steep hill country between the Gogol Timber Project and Usino village. Tall woody regrowth fallows, 5-15 years old, are cut and burnt. Taro and Chinese taro are the most important crops; cassava, banana and sweet potato are important crops; other crops are yam (*D. alata*) and sago. Only one planting is made before fallowing. New gardens are planted between August and November.

Extends across provincial border to System(s) None

Altitude range (m) 150-650 **Slope** Multiple classes

CROPS

STAPLES DOMINANT	Chinese taro, Taro (<i>Colocasia</i>)
STAPLES SUBDOMINANT	Banana, Cassava, Sweet potato
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sago, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (lablab), Corn, Cucumber, Lowland pitpit, Peanuts, Pumpkin tips, Bean (snake)
FRUITS	Mango, Marita pandanus, Pawpaw, Pineapple, Sugarcane, Watermelon, Guava, Mon
NUTS	Breadfruit, Coconut, Galip
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

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

GARDEN SEGREGATION

GARDEN SEGREGATION	None
CROP SEGREGATION	Minor
CROP SEQUENCES	None
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 Coffee Robusta	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	Minor
Mounding Techniques:	
VERY SMALL MOUNDS	None
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	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

In March 1980, a road traverse from Madang to Negiri village and two days intensive study of gardens at Negiri (see Spencer and Heywood 1983). In September 1991, a road traverse from the Lae-Madang highway to Barum aid post. Then foot traverse up the Kokun River to Bamsos village and return to Barum. In April 1994, an aerial reconnaissance from Maraga Hook to overhead Bagasin station via the highway and from Bagasin to Mawan Base Camp. In addition numerous traverses of the Usino to Madang road between 1980 and 1994.

Boundary definition

The boundaries with System 1303 were determined by walking and road traverses from the Lae-Madang highway, from the highway to Negiri village and from the Gogol Timber Project to Bamsos village. The boundaries are based on Saunders (1993) distinction of Land Use Intensity Class 4 from Class 5 and 6, in order to represent the shorter fallows which occur in System 1326. The boundary with System 1324 is the southern boundary of the Gogol Timber Project.

Notes

Most of the system occupies steep hill country around Bagasin station, but includes some villages to the northeast of Bagasin in the lower and flatter Sogeram River Valley. Many similarities exist with System 1303. The main distinguishing feature is that fallow periods are shorter in this system. The system is distinguished from System 1324 where two plantings are made before fallowing.

Spencer and Heywood (1983) provide a good description of the main features. Clearing of land begins in May each year in fallows of tall woody regrowth between 5 and 15 years old. Cut debris is burnt and the gardens are fenced. Planting begins in August or September. Larger cleared areas are subdivided in family portions and blocks are set out on the ground with long sticks. Banana and taro are planted first and the layout of the bananas structures the pattern of planting of the other crops, with taro spaced regularly around each banana plant. Chinese taro is planted last, around the edges of the garden and on steeper slopes. In 1981, the ratio of area planted in taro to area planted in Chinese taro was 4:1, but Chinese taro was becoming increasingly important. Yams were unimportant and are mainly seen in the Sogeram Valley, where they are staked and grown on small mounds. Corn, watermelon, beans and pumpkins are harvested in December, followed by taro from March to October and Chinese taro from February of the following year. The maintenance of fences is said to be more important than weeding. The garden is allowed to revert to fallow after one planting.

Prior to the introduction of Chinese taro, there was a period during the agricultural year in which the gardens produced little food. Sago was then more important as a supplement, and bananas were also probably more important than they are now. The Lae-Madang highway passes through the system to the south. There is rough track from the highway to Negiri village and the northeastern part of the system is accessible through the Gogol Timber Project. People have access to roadside markets. Cocoa and coffee provide small amounts of cash.

National Nutrition Survey 1982/83

49 families from 3 villages were asked in October, November or December 1982 what they had eaten the previous day. 73 per cent reported eating taro, 39 per cent coconut, 18 per cent Chinese taro, 14 per cent yam, 14 per cent banana, 12 per cent sweet potato, 2 per cent cassava and none sago. 33 per cent reported eating rice. 2 per cent reported eating fresh fish. This is similar to the crop pattern, except for the low consumption of Chinese taro and cassava.

Main References

Spencer, T. and P. Heywood 1983 Seasonality, subsistence agriculture and nutrition in a lowlands community of Papua New Guinea. *Ecology of Food and Nutrition* 13, 221-229.

Other References

Brunton, R. 1989 *The Abandoned Narcotic: Kava and Cultural Instability in Melanesia*. Cambridge, Cambridge University Press.

Lawrence, P. 1984 *The Garia: An Ethnography of a Traditional Cosmic System in Papua New Guinea*. Melbourne, Melbourne University Press.

Spencer, T.J. 1981 A study of land use, subsistence agriculture and nutrition: a preliminary report. Unpublished report, Papua New Guinea Institute of Medical Research, Madang.

Togiba, C., F. Daink and G. Agodop 1992 Integrated conservation farming systems project, Samu-Garia Census Division, Upper Ramu District, Madang Province, Papua New Guinea. Technical Report 92/2, Department of Agriculture and Livestock, Port Moresby.

Districts 1 Rai Coast
Population 555

Subsystem Extent 100 %
Population density 50 persons/sq km

Area (sq km) 11
Population absent 11 %

System Summary

Located in the Finisterre Mountains near Teptep and extending into Morobe Province. Cane grass fallows, typically 5-10 years old, are cleared, and the roots dug out. Fallow vegetation is sometimes burnt. Soil is completely tilled and formed into composted contour ridges. Sweet potato is the most important crop; potato is an important crop; other crops are banana and Chinese taro. Between 5-10 plantings are made before fallowing. Short fallows are used between crops of sweet potato. Pigs are fenced out of garden areas, and are moved into garden land between sweet potato crops. Household gardens are common.

Extends across provincial border to System(s) 1205

Altitude range (m) 2000-2600 Slope Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	Potato
STAPLES PRESENT	Banana, Chinese taro, Potato, Sweet potato
OTHER VEGETABLES	Bean (common), Cabbage, Choko tips, Corn, Highland pitpit, Oenanthe, Pumpkin tips, Bamboo shoots, Spring onion
FRUITS	Avocado, Orange, Passionfruit (yellow), Sugarcane
NUTS	Karuka (planted), Karuka (wild)
NARCOTICS	Betel nut (highland), Betel pepper (highland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall grass
SHORT FALLOW	Significant
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	6-14 plantings
R VALUE	50 (medium)

GARDEN SEGREGATION

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

SOIL FERTILITY MAINTENANCE

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

CASH EARNING ACTIVITIES

1 Coffee Arabica	Minor
2 Fresh food	Minor
3 Tobacco	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	Minor
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	Significant
BURN FALLOW VEGETATION	Significant
TILLAGE	Very significant
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	None
SMALL MOUNDS	None
MOUNDS	Very significant
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 October 1991, a foot traverse from Gorgiok village to Kewieng village in Morobe Province (1 day); garden visits in the area of Kawieng and a foot traverse to Teptep station, in Madang Province (1 day); and garden visits near Teptep (half day). In December 1993, a flight from Saidor to Teptep and examining gardening within one-half days walk of Teptep station at Teptep, Kangalat, Gua and Wasikokop villages in Madang Province (2 days).

Boundary definition

The boundary with System 1203 was determined following garden observations and interviews in the vicinity of Wantoat station. The boundary with System 1206 was determined on a walking traverse from Gogiok village to Kawieng village. The boundary with System 1207/1329 was determined by a walking traverse from Kawieng No. 4 village to Teptep station; aerial observations between Teptep, the Nankina Valley and Saidor station; and information on the Yupna Valley from Kocher Schmid (1991). The boundary was extrapolated along the 2000 m contour.

Notes

This system is distinguished from System 1203 where sweet potato and Chinese taro are the most important crops and fallow vegetation is short woody regrowth; it is distinguished from System 1206 where fallow periods are longer and only 1-3 plantings are made before fallowing. It is distinguished from the nearby System 1207/1329 at lower altitudes where land use is less intensive and fallow vegetation is tall woody regrowth.

This system is situated at a higher altitude than most so-called 'Highlands' systems and it displays many 'highlands' systems attributes. The system runs from 2000 m altitude at the Teptep airstrip to 2600 m above Kawieng village. In that altitudinal range there are a number of differences which deserve comment. At lower altitudes, fallows contain more low woody regrowth than at higher altitudes where cane grass is more common. Fallows are shorter at lower altitudes where they are typically 5-10 years but may be as short as 2-5 years. At higher altitudes, they are longer (>15 years). At higher altitudes, permanent 'live' cordyline (tanget) fences are important and enclose many fields to a height of 2-3 m. (They may reduce the effects of cold air drainage at night.) Three to five crops are planted at higher altitudes before fallowing, compared to between 5 and 10 at lower altitudes. Composting is less common at higher altitudes.

The main garden areas are located in a number of small gently sloping basins among extremely rugged mountains, where the soils are almost certainly derived from volcanic ash showers from nearby Long Island. There are stories at Teptep of a cement-like sand falling from the sky in the past. Elsewhere on the steep slopes of the surrounding mountains, the ash has been lost through erosion. Good photographs of the landscape are contained in Wassmann (1993). A detailed ethnobotanical study of Nokopo village at 1900 m altitude on the boundary between this system and System 1329 is found in Kocher Schmid (1991).

The 'mounds' in this system are in fact composted contour ridges. Ridges are typically 1.2-1.5 m apart and 50-60 cm high. After a sweet potato crop is harvested, a short fallow of up to 8 weeks takes place. Weeds and grasses from the fallow, and old vines, are placed between the existing ridges, together with other green manure brought in from surrounding fallows. The ridges are then broken up with short spades, such that half of one ridge is moved to the back and half of another ridge to the front and a new ridge is created on top of the organic matter. Sweet potato vines are planted into the new ridge. Composting is less important at the top of the altitudinal range.

Little is known about the history of this system. Older people at Teptep claim that knowledge of composting and ridge mounding is pre-colonial, although they say it is now used by everyone, whereas before it was less universal. Younger agricultural extension workers suggest the technique was introduced by Yangpela Didiman and government extension workers, and it is true these workers encouraged people to use the technique as part of a vegetable growing project. It seems as though temperate vegetables were first introduced to the system in the 1950s by Lutheran missionaries for their own use (Kocher Schmid 1991, 108). Ernest Haab, a German volunteer with a number of years experience at Teptep, states that composting was well established as a soil fertility maintenance technique before the airstrip was constructed in 1971, but that the system has been intensified since then. In trials at Teptep he finds he can grow three crops of sweet potato on uncomposted ridges and more than seven crops on composted ridges, before fallowing. He also believes a cessation of burning has contributed importantly to the ability of the system to sustain an extended cropping interval. Gardens are generally intercropped but sometimes potato and vegetables are planted in separate gardens from sweet potato.

Notes continued

Of some interest are the figures Kocher Schmid (1991, 101-102) presents for the numbers of pigs being raised at Nokopo at altitude 1900 m, in System 1329. She finds a pig:person ratio of 3.9:1, which is as high or higher than ratios found elsewhere in PNG. During field visits in 1991 and 1993 at Kawieng and Teptep, where the agriculture is more intensive than at Nokopo, the large number of pigs and the pig management practices which this ratio presumes, were not observed. Thus a question remains over the place of pigs in this system.

Arabica coffee and vegetable marketing are the main sources of cash. The airstrip at Teptep is the only access to the system from the coast, other than walking. A little tobacco is taken to Madang and Lae for sale.

National Nutrition Survey 1982/83

No villages from this system were included in the survey.

Main References

None.

Other References

Kocher Schmid, C. 1991 *Of People and Plants: A Botanical Ethnography of Nokopo Village, Madang and Morobe Provinces, Papua New Guinea*. Basler Beiträge zur Ethnologie, Band 33, Ethnologisches Seminar der Universität und Museum für Völkerkunde, Basel.

Wassmann, J. 1993 *Worlds in mind: the experience of an outside world in a community of the Finisterre Range of Papua New Guinea*. *Oceania* 64, 117-145.

Districts 1 Rai Coast, 2 Madang
Population 11,341

Subsystem Extent 100 %
Population density 10 persons/sq km

Area (sq km) 1094
Population absent 19 %

System Summary

Located on the north side of the Finisterre Mountains from inland of Bogadjim plantation and extending east into Morobe Province. Tall woody regrowth fallows, 5-15 years old, are cleared and burnt. Sweet potato is the most important crop; Chinese taro and taro are important crops; other crops are banana and yam (*D. esculenta* and *D. alata*). Two plantings are made before fallowing with sequences of different crops common. Short fallows are sometimes used between crops. Separate gardens are often used to cultivate the following crop combinations: Chinese taro alone; taro with bananas and greens; sweet potato with sugarcane and pitpit; and marita pandanus. When these crops are planted within a single garden, they are segregated from one another. Most gardens are planted between July-October.

Extends across provincial border to System(s) 1208

Altitude range (m) 300-1600 Slope Gentle (2-10 degrees)

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	Chinese taro, Taro (<i>Colocasia</i>)
STAPLES PRESENT	Banana, Chinese taro, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, <i>Amaranthus</i> spp., Cabbage, Choko tips, Corn, Lowland pitpit, Peanuts, Pumpkin tips, Bean (snake), Karakap
FRUITS	Mango, Marita pandanus, Orange, Pawpaw, Pineapple, Sugarcane
NUTS	Breadfruit, Coconut, Karuka (wild), <i>Pangium edule</i>
NARCOTICS	Betel nut (highland), Betel nut (lowland), Betel pepper (highland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall woody regrowth
SHORT FALLOW	Minor
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	Minor

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 Betel nut	Minor
2 Cocoa	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	Minor
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	None
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	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

In October 1991, walking traverses from Gwarawon village in the Nankina Valley to Tariknam village (1 day); and around Gwarawon village up to 2000 m altitude (1 day). In December 1993, an aerial reconnaissance en route Teptep station to Saidor station via the Yupna and Nankina valleys.

Boundary definition

The boundaries with Systems 1207/1329 and 1209/1320 were determined on a walking traverse in Madang Province from Gwarawon village to Saidor station and was extrapolated along the 300 m and 1600 m contours respectively. The boundary with System 1206 was determined on a walking traverse from Gorgiok village in Morobe Province to Teptep station in Madang Province. This system was distinguished from System 1210 after field visits in the Kabwum and Wasu areas.

Notes

This system is distinguished from the coastal System 1209/1320 where the fallow vegetation is short woody regrowth; one planting is made before fallow; banana, Chinese taro, taro and coconut are important crops. It is distinguished from System 1207/1329 where the fallow period is longer. It is distinguished from System 1206 where tall grass or tall woody regrowth fallows are used; it is distinguished from System 1210 where Chinese taro is the most important crop.

Fallows vary in both age and type of vegetation. Some tall grass and some bamboo fallows were observed near the track between Gwarawon and Tariknam villages in Madang Province, while elsewhere tall woody fallows were common. The average length of fallows was about 10 years with a range of 5-25 years. Most gardens are cleared and planted between July-October. Most gardens are fenced.

There is a marked tendency to segregate particular crops and crop combinations into different gardens, or to segregate them within a single garden. Crop sequences also vary. Examples of sequences observed include sweet potato followed by taro and peanuts; sweet potato-peanuts-sweet potato; and taro followed by sweet potato. The use of peanuts in rotations is notable. Complete soil tillage is used where the second crop is peanuts. Sweet potato is planted in small mounds as a second crop, but first plantings are made without mounding. The minor crops, beans and yams, are staked.

Cash income is limited with some betel nut and cocoa being sold.

National Nutrition Survey 1982/83

113 families from 10 villages were asked in October or November 1982 what they had eaten the previous day. 78 per cent reported eating Chinese taro, 67 per cent sweet potato, 48 per cent taro, 43 per cent coconut, 31 per cent banana, 4 per cent yam, 1 per cent cassava and none sago. 8 per cent reported eating rice. None reported eating fresh fish. This is similar to the crop pattern, except for the high consumption of Chinese taro and banana.

Main References

None.

Other References

Mikloucho-Maclay, N.N. 1975 New Guinea Diaries: 1871-1883 (translated by C.L. Sentinella). Madang, Kristen Pres.

Districts 1 Rai Coast
Population 3,097

Subsystem Extent 50 %
Population density 21 persons/sq km

Area (sq km) 147
Population absent 16 %

System Summary

Located on the northern side of the Finisterre Mountains and extending into Morobe Province. Two subsystems are identified on the basis of fallow and important crops. For the entire system, the most important crop is sweet potato. Chinese taro is an important crop. Other crops are banana, potato and taro. This subsystem occupies about half of the system. Woody regrowth fallows taller than 10 m and more than 15 years old are cleared and burnt. Usually up to five crops are planted before fallowing. Short fallows are used between crops. In some gardens, compost is made from old sweet potato vines and weeds. Complete soil tillage occurs between crops, after the first crop. Chinese taro is normally planted separately from other crops; other crops may be segregated but are often intercropped. Crop sequences and household gardens are important.

Extends across provincial border to System(s) 1207

Altitude range (m) 1600-2000 **Slope** Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	Chinese taro
STAPLES PRESENT	Banana, Chinese taro, Potato, Sweet potato, Taro (Colocasia)
OTHER VEGETABLES	Bean (common), Cabbage, Bean (winged), Choko tips, Corn, Ferns, Highland pitpit, Lowland pitpit, Pumpkin tips, Spring onion
FRUITS	Marita pandanus, Orange, Passionfruit (yellow), Sugarcane, Tree tomato
NUTS	Karuka (planted)
NARCOTICS	Betel nut (highland), Betel pepper (highland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall woody regrowth
SHORT FALLOW	Significant
LONG FALLOW PERIOD	>15 years
CROPPING PERIOD	3-5 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	Minor
ANIMAL MANURE	None
ISLAND BED	None
SILT FROM FLOOD	None
INORGANIC FERTILISER	None

CASH EARNING ACTIVITIES

1 Coffee Arabica	Minor
2 Fresh food	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Significant
TILLAGE	Significant
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	Very significant
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	Minor

OTHER DOCUMENTATION

Survey description

In October 1991, in Madang Province, a flight from Teptep station to Nankina airstrip and Gwarawon village. Gardens were observed above and below the village and interviews conducted (2 half-days). Walking traverse from Gwarawon to Tariknam village and Saidor station, in Madang Province (2 days). The Morobe part of the system was not visited.

Boundary definition

The boundary with System 1205/1327 was determined by a walking traverse from Kawieng No. 4 village to Teptep station in Madang Province; aerial observations between Teptep station, the Nankina Valley and Saidor station; and information on the Yupna Valley from Kocher Schmid (1991). This boundary was extrapolated along the 2000 m contour. The boundary with System 1208/1328 was determined on a walking traverse from Gwarawon village to Saidor station in Madang Province, and was extrapolated along the 1600 m contour. This system was distinguished from System 1206 on a walking traverse from Gorgiok to Kawieng village.

Notes

This system is distinguished from System 1205/1327 where fallow vegetation is tall grass; from System 1206 where fallow vegetation is tall cane grass or tall woody regrowth; and from System 1208/1328 where fallow periods are shorter and two plantings are made before fallowing.

In the Nankina Valley in Madang Province, the range of fallow types recorded was tall woody regrowth (the most common); short woody regrowth; tall cane grass; and mixed woody regrowth and cane grass. Fallow periods range between two to over 20 years, but most are over 15 years. The number of plantings made before fallow was 1-12. Some people claimed that gardens had been continuously cultivated for 30 years without a fallow, but it is unlikely many gardens are continued past five plantings before fallowing. Common crop sequences are: Chinese taro-sweet potato-vegetables; Chinese taro-vegetables; Chinese taro-sweet potato. There is little garden segregation. Within gardens, crops such as Chinese taro, sweet potato, taro and vegetables may be interplanted or grown in separate plots. Household gardens are important and typically contain tobacco, banana, potato, corn, beans, spring onion, taro and amaranthus.

Sweet potato vines and weeds are placed in piles or in a row along the contour. Vegetables, sweet potato, and Chinese taro are planted in the organic matter. In old sweet potato gardens, the organic matter is covered with soil to form mounds and sweet potato is planted. The practice is said to be traditional and said to increase soil fertility and crop yield. Soil is tilled completely between crops, but not before the first planting. Gardens are protected from pigs by live *Cordyline* fences and ditches. Sweet potato is planted in mounds 80-100 cm in diameter and 10-30 cm high.

A detailed ethnobotanical study by Kocher Schmid (1991) at Nokopo village in the Yupna Valley in Morobe Province provides information on crop species. At Nokopo, Kocher Schmid (1991) found taro was decreasing in importance, largely because the forest fallows were disappearing in the face of increased cultivation and 'uncontrolled burning'. Of 1261 gardens surveyed by her at Nokopo, 75 per cent were sweet potato gardens, only 6 per cent yam gardens and 4 per cent taro gardens. Of some interest are the figures Kocher Schmid (1991, 101-102) presents for the numbers of pigs being raised at Nokopo. She finds a pig:person ratio of 3.9:1, which is as high or higher than the ratios in most systems in the Highlands proper. During field visits in 1991 and 1993 to Kawieng and Teptep villages (System 1327) where the agriculture is considerably more intensive, the large number of pigs and the pig management practices, which this ratio presumes, were not apparent. Thus a question remains over the place of pigs in this system.

There is considerable potential for the production of fruit, including oranges (below 1600 m), passionfruit and tree tomato. Arabica coffee and fresh food (choko tips, potato, oranges and passionfruit) is flown from Nankina airstrip to Saidor and Madang.

National Nutrition Survey 1982/83

42 families from 1 village were asked in November 1982 what they had eaten the previous day. 93 per cent reported eating sweet potato, 60 per cent Chinese taro, 36 per cent banana, 29 per cent taro, 2 per cent cassava and none yam, sago or coconut. None reported eating rice. None reported eating fresh fish. This is similar to the crop pattern, except for the relatively high consumption of banana and taro.

Main References

Kocher Schmid, C. 1991 *Of People and Plants: A Botanical Ethnography of Nokopo Village, Madang and Morobe Provinces, Papua New Guinea*. Basler Beiträge zur Ethnologie, Band 33, Ethnologisches Seminar der Universität und Museum für Völkerkunde, Basel.

Other References

None.

System Summary

In this subsystem, tall woody regrowth fallows, more than 15 years old, are cut and burnt. Only one planting is made before fallowing. Chinese taro is the most important crop; other crops are banana, sweet potato, potato and taro. Within gardens, Chinese taro and sweet potato are sometimes segregated from other crops. Sweet potato and potato are planted in small mounds. Composting is not done in this subsystem.

Extends across provincial border to System(s) 1207

Altitude range (m) 1600-2000 **Slope** Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	Chinese taro
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Chinese taro, Potato, Sweet potato, Taro (Colocasia)
OTHER VEGETABLES	Bean (common), Cabbage, Bean (winged), Choko tips, Corn, Ferns, Highland pitpit, Lowland pitpit, Pumpkin tips, Spring onion
FRUITS	Marita pandanus, Orange, Passionfruit (yellow), Sugarcane, Tree tomato
NUTS	Karuka (planted)
NARCOTICS	Betel nut (highland), Betel pepper (highland), Tobacco

FALLOW & CROPPING PERIOD

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

GARDEN SEGREGATION

GARDEN SEGREGATION	None
CROP SEGREGATION	Minor
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 Coffee Arabica	Minor
2 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	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 DOCUMENTATION

Notes

This subsystem is distinguished on the basis of differences in the most important crops and the cropping interval.

Districts 5 Upper Ramu
Population 0

Subsystem Extent 100 %
Population density 0 persons/sq km

Area (sq km) 15
Population absent 0 %

System Summary

Located on the northern fall of the Bismarck Range in Eastern Highlands Province and extending a short distance into Madang Province. Gardens are made in tall woody regrowth, more than 15 years old, which is cut and burnt. Sweet potato is the most important crop; other crops are banana and cassava. Typically two (but occasionally up to five) plantings are made before fallow. The soil is usually tilled for the second and subsequent plantings. Sweet potato is planted in small mounds 20-30 cm high and some drains are made in gardens. Gardens are planted seasonally in July-December. Household gardens are common.

Extends across provincial border to System(s) 1109

Altitude range (m) 800-1800 Slope Steep (10-25 degrees)

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Cassava, Sweet potato
OTHER VEGETABLES	Highland pitpit, Corn, Cucumber, Bean (common), Lowland pitpit, Aibika, Amaranthus spp., Chinese cabbage, Pumpkin tips, Rungia
FRUITS	Marita pandanus, Pawpaw, Sugarcane
NUTS	Breadfruit, Pangium edule
NARCOTICS	Betel nut (highland), Betel pepper (highland), 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	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 Coffee Arabica	Minor
2 Fresh food	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	Significant
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Very significant
TILLAGE	Significant
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	Minor
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	Very significant
STAKING OF CROPS	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

In September 1982, flew north by helicopter from Aiyura, and then west along the northern side of the Bismarck Range for 70 km. Aerial observations were made on land use north of Kainantu, north of the Dunantina Valley, east and west of Mt Helwig, north of Mt Otto (Madang Province) and north of the Goroka Gap. Landed twice, and spent several hours in gardens at Abigusa village (north of the Dunantina Valley) in this system and at Safia village (North of Mt Otto) in System 1124.

Boundary definition

The boundaries with the systems to the south (Systems 1101, 1104, 1117 and 1118) and the one to the north (System 1323) were based on aerial observations. The boundary with System 1124/1321 was based on a visit to Safia village and aerial observations.

Notes

This system was distinguished from Systems 1101, 1104, 1117 and 1118 where fallow vegetation is short or tall grass. System 1323 is a banana based system. This system is similar to System 1124/1321, but there only one planting is made before fallowing. This system is very similar to that used in the upper Bundi area of Madang Province to the west (System 1322). It differs in that, in this system, the soil is tilled for second and subsequent sweet potato plantings; and drains that run up the slope are dug in some gardens. In the Bundi area, soil erosion control is achieved by soil retention fences.

A study of trade in the Bena Gap area in 1970-71 showed extensive movements of goods, including agricultural produce, across ecological boundaries between Systems 1109, 1104 and 1101 (Keil 1974, 46-49, 62-71, 197). Villagers in this system exported produce to people living at higher altitudes on the southern fall of the Bismarck Range in System 1104, and onwards into System 1101. This included marita pandanus fruit and oil, highland betel nut (wild and cultivated), lime, *Pangium edule*, breadfruit and lowland pitpit. In return they received pigs and other items. They also traded processed *Pangium edule* nuts and lime northwards across the Ramu River into System 1313 in Madang Province.

Some Arabica coffee and some fresh food are sold. Butterflies were farmed at Lihona village in the late 1970s and early 1980s, but this had ceased by the late 1980s.

National Nutrition Survey 1982/83

No villages from this system were included in the survey.

Main References

None.

Other References

Haantjens, H.A., J.R. McAlpine, E. Reiner, R.G. Robbins and J.C. Saunders 1970 Lands of the Goroka-Mount Hagen area, Papua-New Guinea. Land Research Series No. 27, Commonwealth Scientific and Industrial Research Organization, Melbourne.

Keil, D.E. 1974 The inter-group economy of the Nekematigi, Eastern Highlands District, New Guinea. PhD thesis, Northwestern University, Evanston.

Districts 5 Upper Ramu
Population 776

Subsystem Extent 75 %
Population density 17 persons/sq km

Area (sq km) 46
Population absent 6 %

System Summary

Located in the Middle Ramu and upper Markham River Valleys, in a broad intermontane trough, vegetated mainly in short grasses and savanna and extending marginally into Eastern Highlands as System 1123 and Madang Province as System 1331. The system extends from the plains onto steep hill country, most of which is forested, but some of which is grass covered. Two subsystems are identified on the basis of different crops and fallow vegetation. For the entire system, the most important crops are banana and sweet potato; yam (*D. alata*) is an important crop; coconuts are an important food; other crops are taro, cassava, yam (*D. esculenta*) and Chinese taro. In this subsystem, short grass fallows, 5-6 years old, are cleared, the grass dug up and burnt. Banana and sweet potato are the most important crops; coconut is an important food; other crops are taro, cassava, yam (*D. esculenta* and *D. alata*) and Chinese taro. Two plantings are made before fallowing, but up to 3 plantings may be made. Sweet potato and sometimes small amounts of yam (*D. alata*) are planted first. Triploid banana is the second and only subsequent planting, but continues to produce for 7-10 years before fallowing. Sweet potato is also grown in separate gardens on well drained alluvial flats and river terraces. Sweet potato is planted in small mounds. Peanuts are planted as a cash crop and between sweet potato plantings. Tractors are used to prepare land before planting banana, sweet potato and peanuts.

Extends across provincial border to System(s) 1123-1201

Altitude range (m) 200-450 Slope Flat (<2 degrees)

CROPS

STAPLES DOMINANT	Banana, Sweet potato
STAPLES SUBDOMINANT	Coconut
STAPLES PRESENT	Banana, Cassava, Chinese taro, Coconut, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Corn, Cucumber, Lowland pitpit, Peanuts, Pumpkin tips, Tulip, Bean (snake), Spring onion
FRUITS	Mango, Marita pandanus, Orange, Pawpaw, Pineapple, Sugarcane, Watermelon
NUTS	Breadfruit
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Short grass
SHORT FALLOW	None
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	2 plantings
R VALUE	50 (medium)

GARDEN SEGREGATION

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

SOIL FERTILITY MAINTENANCE

LEGUME ROTATION	Significant
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	Very significant
2 Fresh food	Very significant
3 Cattle	Minor
4 Chillies	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	Minor
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Significant
TILLAGE	Significant
MECHANIZATION	Significant
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	None
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	None
SEASONAL SEC'DARY CROPS	None

OTHER DOCUMENTATION

Survey description

Boundary definition

The boundary with System 1202/1313 was defined by a road traverse from the Madang-Lae Highway to Tauta mission and extrapolated along the edge of the Finisterre Mountains and the Markham and Ramu plains; that with System 1203 by a road traverse from the Highlands Highway to Wantoat mission; that with System 1224 by road traverses from Watarais to Lae, and from Lae to Wau; that with System 1226 from visits by air to Langimar, Engati, Imani and Yasuru airstrips. The boundary with Eastern Highlands System 1109 was determined from aerial observations in 1982 and Saunders (1993).

Notes

This system is characterised by two contrasting subsystems: one is located on the almost flat, grass covered plains and terraces of the Markham and Ramu Valleys, where banana and sweet potato are the most important crops, and the other is restricted to steep, mostly forested, foothills and mountains on either side of the plains, where yam (*D. alata*) is the most important crop.

This system is distinguished from System 1202/1313 in the mountains to the north where fallow vegetation is tall woody regrowth; and from System 1203 in the Wantoat Valley where fallow vegetation is short woody regrowth and sweet potato and Chinese taro are the most important crops. It is distinguished from System 1224 in the lower Markham and Watut Valleys where banana is the most important crop; and from System 1226 south across the Markham River, where the fallow period is longer, sweet potato only is the most important crop and banana is not important. It is distinguished from System 1109 where fallow vegetation is tall woody regrowth and sweet potato is the most important crop.

On flats adjacent to rivers and streams and in other well watered places, triploid banana are grown intensively for up to 10 years after the first planting. Sweet potato is grown mainly in separate gardens but may also be planted immediately before the planting of bananas. In the second subsystem, yam (*D. alata*) is planted in gardens on steep slopes. Sweet potato is a second planting.

There is a drier period from June-September and a wetter period from November-March. Accounts of droughts and associated famines are related in oral histories. However there is very little seasonality to agricultural activities in this subsystem, based as it is upon the continuous production of bananas, and the cultivation of sweet potato.

The main changes which have taken place in this system in the last 50 years are those associated with the increasing importance of sweet potato and cassava; the lessening importance of taro; the cultivation of peanuts; the use of tractors to plough gardens before planting; and the moves that some groups have made from settlements near the valley sides to settlements in the centre of the valley, along the highway.

An assessment of degree of change is drawn from two sources. The first is observations made by Read (1948), who lived in the Ngarawapum villages, now the census units of Gainarun, Maiamzariang, Taufmura and Gutsuap, northwest of Kaiapit station, between September 1944 to May 1945. The second is from the 1947 Nutrition Survey Expedition (Hipsley and Clements 1950) which surveyed food and agriculture at Kaiapit village. Garden observations were made at Waritsian village, between Ngarawapum and Kaiapit, and at Kaiapit village in 1991.

In 1944, as in 1991, the most important foods were banana and sweet potato (Read 1948, 109). Coconuts were also eaten daily. Supplementary crops were breadfruit, pawpaw, melons, pineapple, tomato, cucumber and greens. Read observed that yams were 'culturally' considered to be more important than banana, but in order of the amount consumed, banana and sweet potato were clearly more important than taro and yams. However, even though more sweet potato and taro than yams were eaten, people expressed 'little liking for them as food' (Read 1948, 233). In 1947 the main crops were judged to be, in order of importance, banana, sweet potato, taro, cassava and yams (Hipsley and Clements 1950, 79).

More labour was allocated to banana production than to the production of all other crops. Between October 1944 and November 1944, and 12 January 1945 and 2 February 1945 at Taufmura village, Read (1948, 156) recorded 52 days of work by 6 men. Of the total time spent in agricultural work, bananas absorbed 62 per cent, yam and taro 20 per cent and sweet potato 15 per cent. In 1991, taro was much less important and was grown almost solely inland in the forest fallow gardens of Subsystem 2. The 1947 survey estimated an area of 21 ha in banana gardens at Kaiapit, 3.2 ha of yam

Notes continued

gardens in woody regrowth fallows on hill slopes and 1.6 ha in grass fallows on hill slopes. The survey comments that woody regrowth hill slope gardens had been reduced from 8 ha 'in recent years', but no further explanation is given (Hipsley and Clements 1950, 84).

Read (1948, 197) estimated banana garden fallows as 5-10 years old and the 1947 survey as 3-10 years. In 1944 Read (1948, 212) estimated the oldest producing banana gardens at Ngarawapum were 7 years old. Banana garden preparation in 1947 involved burning the short grass, and the planting of banana suckers directly into holes. Greens, lowland pitpit, sugarcane, beans, cucumber and pumpkin were planted after the bananas had become established. The bananas were maintained for an estimated 5-7 years. At Waritsian in 1991, grass fallows were dug up and the grass was spread on the surface to dry. It was then burnt. Banana gardens were interplanted with sweet potato and cassava. The sweet potato and cassava were harvested after 6-10 months and the bananas maintained for 7-10 years.

Weeding is important in early stages of the garden. Fruit is protected to maturity from birds and bats by wrapping with dry banana leaves tied with vine. A wooden ladder is used to climb to the fruit. Banana gardens are not fenced. In 1944, men used magic to help the bananas grow fast, to protect them from disease and insects and to protect from other men's magic. Read believed taro magic had been lost and that magic was almost never used to grow sweet potato, except for magic associated with bringing rain during dry periods.

The 1947 survey (Hipsley and Clements 1950, 84) estimated an average 0.4 ha of land was under cultivation per household and 0.08 ha per person. The survey counted 1600 coconut bearing palms and 30 breadfruit trees in the village. Seasonal flooding and garden damage at Kaiapit, caused by the nearby Maniang River, observed in 1991, were also evident in 1947 (Hipsley and Clements 1950, 41).

Banana gardens, observed in 1991, south of the Madang-Lae Highway near the Markham River were drained with substantial ditches. But at Ngarawapum in 1944, Read (1948, 55) saw people diverting streams into banana gardens by damming them, as a crude form of irrigation. This is thought to be an unusual practice.

In 1991, tractors were used to plough land prior to planting sweet potato, bananas and peanuts. Sweet potato gardens were planted up to three times, with plantings of peanuts occurring between the sweet potato plantings. Peanuts produce within 3 months, their labour demands fit well with yam growing, and they have consequently become the most important cash crop in the system.

In 1944, domestic pigs were hand fed but free ranging. Hunting for pigs and cassowary in the mountains was an important male activity, but did not yield as much meat as the catching of small animals, rats and bandicoots, on the grass plains. Then, the annual burning of the grass at the opening of the hunting season was organised between nearby villages and associated with a special ceremony.

An anthropometric survey at Kaiapit in 1967 established that Kaiapit people were the tallest measured in Papua New Guinea up to that time, and that growth rates from birth to age 20 years were the fastest then observed. There had been an increase in the rate of growth in weight in children under 3 years between 1959 and 1967 which was associated with 'the virtual disappearance of the formerly common protein-calorie malnutrition' (Malcom 1969, 45).

The main sources of cash in 1991 were the sale of betel nut, peanuts, fresh food and coconuts at roadside markets along the highway and at the Ramu Sugar market, and from small scale cattle ranching. Minor quantities of chillies are sold. People in this system have been subject to more than 70 years of only partially successful attempts by colonial governments to persuade them to produce cash crops. An agricultural experiment station was established at Sangan in 1925. Work was carried out on cotton, peanuts, sorghum, rice, sugarcane, corn, coffee, sisal and kenaf (Blackburn and Aland 1973, 175-218). Peanuts, corn and cabbages were distributed to villagers. At about the same time, Lutheran missionaries introduced coffee, cocoa, citrus trees and cattle (Holzknecht 1979). Peanuts had become an important food by 1947 (Hipsley and Clements 1950). The Department of Agriculture began buying peanuts in 1952. By 1959 production was over 1000 tonnes per year. In the mid-1960s, the Atzera Rural Progress Society was established as a peanut-buying cooperative. Peanuts were exported to Australia in the shell, then hulled, and later roasted and salted. A peanut butter factory was opened in 1976 (Holzknecht 1979, 7).

Notes continued

Morobe Province is the most important beef-producing region in PNG, accounting for 43 per cent of the national herd in the mid 1970s (Brunton 1980). A high proportion of these cattle are in the Markham Valley. The smallholder cattle population in the valley in 1976 was estimated to be 10,200 head (Brunton 1980, 55-59). There has been a decline in cattle numbers over the past 20 years. Some villages also receive payments from Ramu Sugar for the lease of land for commercial sugarcane growing.

National Nutrition Survey 1982/83

No villages from this system were included in the survey.

Main References

Hipsley, E.H. and F.W. Clements 1950 Report of the New Guinea Nutrition Survey Expedition 1947. Canberra, Department of External Territories.

Holzknrecht, H.A. 1979 The history of agriculture in the Markham Valley. Unpublished paper, History of Agriculture Project, Department of History, University of Papua New Guinea, Port Moresby.

Read, K.E. 1948 The relationship between food production and social structure in simple societies. PhD thesis, University of London, London.

Other References

Blackburn, K. and F.P. Aland 1973 Aspects of agronomy and animal production. In Knight, M.J. (ed), Land Resources and Agricultural Potential of the Markham Valley (10 Parts). Research Bulletin No. 14. Port Moresby, Land Utilisation Section, Department of Agriculture, Stock and Fisheries, 175-220.

Brunton, P.D. 1980 Agricultural credit in Papua New Guinea. In, The Evaluation of Agricultural Loans: A Case Study of Development Bank Financed Cattle Projects in the Markham Valley of Papua New Guinea. Canberra, Australian National University, 25-64.

Holzknrecht, H.A. 1974 Anthropological research and associated findings in the Markham Valley of Papua New Guinea. Research Bulletin No. 15, Department of Agriculture, Stock and Fisheries, Port Moresby.

Knight, M.J. 1973 Land Resources and Agricultural Potential of the Markham Valley (10 Parts). Research Bulletin No. 14, Land Utilisation Section, Department of Agriculture, Stock and Fisheries, Port Moresby.

Malcolm, L.A. 1969 Growth and development of the Kaiapit children of the Markham Valley, New Guinea. American Journal of Physical Anthropology 31, 39-52.

Read, K.E. 1946 Social organisation in the Markham Valley. Oceania 17, 2, 93-118.

Read, K.E. 1947 Effects of the Pacific War in the Markham Valley, New Guinea. Oceania 18, 2, 95-116.

Read, K.E. 1950 The political system of the Ngarawapum. Oceania 20, 3, 185-223.

Vance, P. 1974 Peanuts in the Markham Valley. Science in New Guinea 2, 1, 85-89.

System Summary

This subsystem is located in hill country adjacent to the Ramu and Markham plains. Most gardens are cleared from tall woody regrowth, 10-15 years old. Fallow vegetation is cut, dried and burnt. A minority of gardens are cleared from grass fallows, 5-10 years old. In this subsystem yam (*D. alata*) is the most important crop; other crops are sweet potato, taro, banana, Chinese taro, cassava and yam (*D. esculenta*). A second planting, usually sweet potato, occurs in most gardens. Yam are planted seasonally in May-June. Sweet potato are planted in small mounds. Some yam (*D. alata*) are staked.

Extends across provincial border to System(s) 1123-1201

Altitude range (m) 200-450 **Slope** Flat (<2 degrees)

CROPS

STAPLES DOMINANT	Yam (<i>D. alata</i>)
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>), Yam (<i>D. esculenta</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Corn, Cucumber, Lowland pitpit, Peanuts, Pumpkin tips, Tulip, Bean (snake), Spring onion
FRUITS	Mango, Marita pandanus, Orange, Pawpaw, Pineapple, Sugarcane, Watermelon
NUTS	Breadfruit, Coconut
NARCOTICS	Betel nut (lowland), Betel pepper (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Tall 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	None
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	Very significant
2 Fresh food	Very significant
3 Cattle	Minor
4 Chillies	Minor

OTHER AGRONOMIC PRACTICES

Water Management:	
DRAINAGE	None
IRRIGATION	None
Soil Management:	
PIGS PLACED IN GARDENS	None
BURN FALLOW VEGETATION	Significant
TILLAGE	None
MECHANIZATION	None
DEEP HOLING	None
MULCHING	None
SOIL RETENTION BARRIERS	None
Mounding Techniques:	
VERY SMALL MOUNDS	None
SMALL MOUNDS	Minor
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	Very significant
SEASONAL SEC'DARY CROPS	Very significant

OTHER DOCUMENTATION

Survey description

In October 1991, road traverses from Madang Province into Morobe Province in the Ramu and Markham Valleys along the Madang-Lae Highway and traverses to the north off the highway, with garden observations at Tauta (in Madang Province), Wantoat, Rumpa, Yankowan, Waritsian, Wankun and Kaiapit villages (4 days).

Boundary definition

The boundary with System 1313 was based on a traverse from the Madang-Lae highway to Tauta mission and extrapolated along the edge of the Finisterre Mountains and the Ramu plain.

Notes

In terms of area, it is estimated that the gardens in this subsystem occupy about half of the total area of land in cultivation in the whole system, but in terms of production of food, they are less important than the banana and sweet potato gardens in Subsystem 1. They are located in steep hill country which borders to the plains and are similar to those in adjacent System 1202, but there yam (*D. alata*) is not an important crop and taro is more important.

In this subsystem, the great majority of hillside gardens are yam (*D. alata*) gardens. A minority of gardens are planted in sweet potato. Most gardens are cleared from tall woody regrowth. A minority are made on grass covered hill sides. In these gardens, the grass is dug up with a sharp spade or a bush knife, left on the surface to dry and later burnt. In the forest fallow gardens, vegetation is cut down and burnt. In most gardens, only one planting is made before fallowing. Where a second planting occurs, it is usually sweet potato.

Gardens are cleared and planted from August. The main yam harvest occurs between May-June.

Yams are interplanted with taro, a particular banana known as 'red' banana, corn, cucumber and greens. Care is taken not to break yam shoots before planting. The yam vines are not staked, but are lifted off the soil surface by about 50 cm to 100 cm, by small forked sticks which are placed underneath them. Then they are trained up the hillslope. Yam tubers may be left in the ground for some time after they mature, but eventually they are carefully dug out and carried back to the villages.

In 1944 Read (1948, 217) observed 6 types of yams, but he did not identify their species. At Ngarawapum in 1944, all yam gardens were located on hillsides. Forested land and grass land were used to plant different yam varieties. People said yams needed a 'cool place' to grow well, in contrast to the hot plains. Yam gardens were also planted with banana, corn, cucumber and greens. Men commonly had yams planted in 3 different garden sites.

Gardens in this subsystem are usually fenced.

Districts 5 Upper Ramu
Population 0

Subsystem Extent 100 %
Population density 0 persons/sq km

Area (sq km) 33
Population absent 0 %

System Summary

Located north of the Sepik-Wahgi Divide, mainly on the southern side of the Jimi Valley. In the upper Jimi region, there is a small extension into Madang Province. The 1990 Population Census map classifies the wider region as a National Park. No people censused in Madang Province occupy these areas. They are outliers of System 0907 and are probably occupied occasionally, or seasonally, by people from this system in the Western Highlands Province. Gardens are cleared from short woody fallows, 5-15 years old. Cut vegetation is dried and burnt. Sweet potato is the most important crop; other crops are taro, banana, cassava, yam (*D. alata*) and Chinese taro. Only one planting is made before fallowing. The soil is not tilled, and planting is by dibble. Sweet potato is usually planted separately from the other crops. Gardens are commonly cleared and planted between August and October. Below 1500 m, arboriculture is important, particularly plantings of marita pandanus and tulip, and also including breadfruit and *Ficus* species. Household gardens are common. Pig husbandry is important.

Extends across provincial border to System(s) 0907

Altitude range (m) 600-2200 Slope Multiple classes

CROPS

STAPLES DOMINANT	Sweet potato
STAPLES SUBDOMINANT	None
STAPLES PRESENT	Banana, Cassava, Chinese taro, Sweet potato, Taro (<i>Colocasia</i>), Yam (<i>D. alata</i>)
OTHER VEGETABLES	Aibika, Amaranthus spp., Bean (common), Corn, Highland pitpit, Kumu musong, Pumpkin tips, Rungia, Tulip, Bean (lima)
FRUITS	Marita pandanus, Pawpaw, Sugarcane
NUTS	Breadfruit, Karuka (planted)
NARCOTICS	Betel nut (lowland), Tobacco

FALLOW & CROPPING PERIOD

FALLOW TYPE	Short woody regrowth
SHORT FALLOW	None
LONG FALLOW PERIOD	5-15 years
CROPPING PERIOD	1 planting
R VALUE	0 (very low)

GARDEN SEGREGATION

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

SOIL FERTILITY MAINTENANCE

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

CASH EARNING ACTIVITIES

1 Animal skins	Minor
2 Cardamom	Minor
3 Coffee Arabica	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	Minor
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	Minor
FALLOW CUT ONTO CROPS	None
SEASONAL MAIN CROPS	Significant
SEASONAL SEC'DARY CROPS	Significant

OTHER DOCUMENTATION

Survey description

In August 1982, a vehicle traverse on the Banz-Tabibuga station road to the end of the road, and by foot to Koinambe mission (half day). In December 1990, a helicopter traverse from Mt Hagen to the Jimi Valley and back to Mt Hagen, with brief stops at Koinambe mission and Togban community school. The upper Jimi Valley was not visited during this survey, but was extensively surveyed during the 1987 Rapid Rural Appraisal (Joughin and Thistleton 1987). In the western part of the system, neither the Rulna mission area nor the Ganz River Valley were visited. The Madang Province part of this system was not visited.

Boundary definition

These three areas near the Madang Province border with the northeastern corner of the Western Highlands Province were assigned to System 0906/1332 on the grounds that they are used only by people from that system (C. Healey, pers. comm.). The boundary with System 0902 was determined from a road traverse from Banz township to Tabibuga station. The boundary with System 0905 was based on aerial observation and evidence from Dabrowski (1991), and drawn at the Sepik-Wahgi Divide. The boundary with System 0908 was determined on a road traverse from Banz to Tabibuga and Koinambe mission. It was extrapolated by reference to the regrowth vegetation boundary mapped by Saunders (1993). To the east, this system was distinguished from Madang Province System 1322 on the basis of traverses in the Bundi area.

Notes

From the air, and on the ground, this system contrasts sharply with the much more intensive agriculture immediately to the south in the Wahgi Valley (Systems 0906, 0902 and 0905). The characteristic square beds, cane grass fallows and repeated plantings of the Wahgi systems are all absent north of the Sepik-Wahgi Divide in this system. To the north across the Jimi River, System 0908 is of a similar low intensity (a single planting only before a long fallow of 5-15 years), but it differs in having several important staple crops.

There are no in-depth studies of agriculture from this system, though much information from System 0908 is relevant. Following identification of the Jimi Valley as an area of poor nutrition in the 1983 National Nutrition Survey, a rapid rural appraisal was carried out to assess agriculture and investigate possible interventions (Joughin and Thistleton 1987). These interventions have generally had little effect (Crittenden et al. 1989).

The wide altitude range covered by this system means that altitude is a significant source of variation in such factors as the crop composition of gardens (more sweet potato at higher altitudes), access to tree crops (less marita pandanus and breadfruit at higher altitudes) and seasonal planting (less significant at higher altitudes).

Near Rulna mission in the early 1980s, gardens were used for 3-4 years, with long fallows of low woody vegetation for 8-12 years (Dabrowski 1991, 38). Marita pandanus and breadfruit were important foods in October-November, and seeds of *Pangium edule* were apparently gathered (Dabrowski, 1991, 39, 211). Many households cared for captured cassowaries. Boron deficiency was common in casuarina trees between Banz and Tabibuga in 1982.

Arabica coffee has been the major source of cash income for most villagers since the mid 1970s. During 1975-76, Heaney (1989, 107-113) surveyed the coffee holdings of 31 growers at Karap village and reported a mean 0.09 ha per grower. He estimated mean annual coffee income per grower at K77, with other sources, such as pigs, raising this to over K200. In the early 1980s near Rulna mission, the main sources of cash were Arabica coffee and chilli (Dabrowski 1991, 465). In 1987, in the Jimi Valley generally, cash incomes were estimated at K40 per person per year, with the major sources being Arabica coffee, cardamom, fresh food sales, pigs and gold (Joughin and Thistleton, 1987, 6, 23).

National Nutrition Survey 1982/83

There are no resident villages in this system in Madang Province.

Main References

Joughin, J. and B. Thistleton 1987 A rapid rural appraisal in the Jimi Valley, Western Highlands Province, Papua New Guinea. Discussion Paper 87/3. Department of Agriculture and Livestock, Port Moresby.

Other References

- Clarke, W.C. 1977 A change of subsistence staple in prehistoric New Guinea. In Leakey, C.L.A. (ed), Proceedings of the Third Symposium of the International Society for Tropical Root Crops, Ibadan, Nigeria, 2-9th December, 1973. Ibadan, The International Society for Tropical Root Crops in collaboration with the International Institute of Tropical Agriculture, 159-163.
- Crittenden, R., D. Archibald, K.O. Tiekou, A. Bush, W. Gwaiseuk, A. Iorive, D. Kwamillon and S. Sivasupiramaniam 1989 Report on an Internal Evaluation of Phase One of the Smallholder Market Access and Food Supply Project (1988-1992). Port Moresby, Department of Agriculture and Livestock.
- Dabrowski, W.Z. 1991 A line to heaven: the Gamagai religious imagination. PhD thesis, Australian National University, Canberra.
- Gorecki, P. 1989 Prehistory of the Jimi Valley. In Gorecki, P.P. and D.S. Gillieson (eds), A Crack in the Spine: Prehistory and Ecology of the Jimi-Yuat Valley, Papua New Guinea. Townsville, James Cook University, 130-187.
- Heaney, W.H. 1989 Circular labor migration and entrepreneurship in the Wahgi Valley, Papua New Guinea. PhD thesis, Columbia University, New York.
- Ploeg, A. 1975 Spontaneous rural resettlement in and near the Chimbu District in 1972-73. Discussion Paper No. 5, New Guinea Research Unit, Australian National University, Port Moresby and Canberra.
- Temon, B. 1991 Roadside price movements and marketing efficiency in selected areas of the Western Highlands. Designing Monitoring Systems for Smallholder Agriculture in Papua New Guinea, Working Paper No. 20, Australian Centre for International Agricultural Research, Canberra.

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 $R = (\text{Number of years of cultivation} \times 100) / (\text{Number of years of cultivation} + \text{Number of years of long fallow})$, (Ruthenberg 1980, 15)

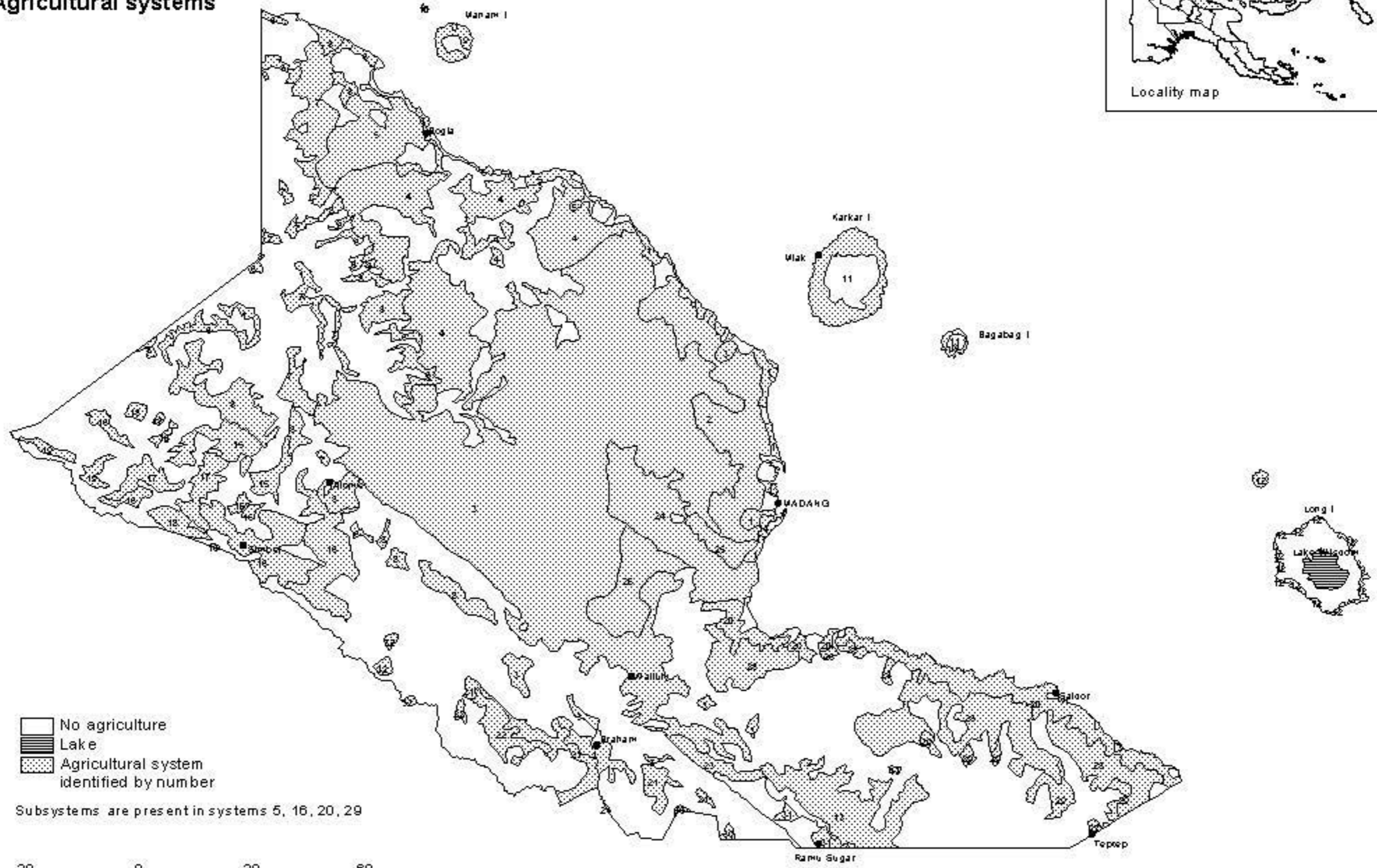
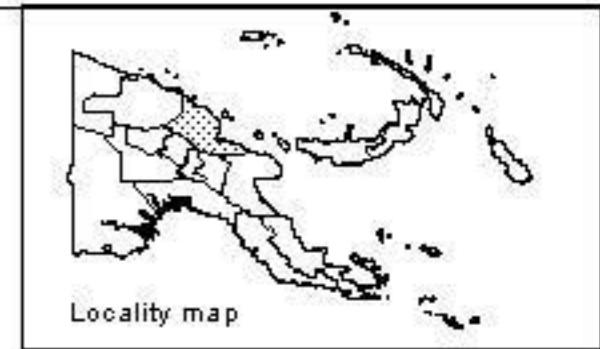
Map title	Notes
7. Garden and crop segregation	Separation of crops into different gardens or into different plots within a garden (4 classes). A combination of Fields 28 and 29. For both fields, 'nil' and 'minor or insignificant' are defined as 'absent'; and 'significant' and 'very significant' as 'present'. 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.

MADANG PROVINCE Agricultural systems



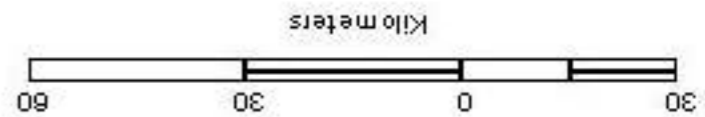
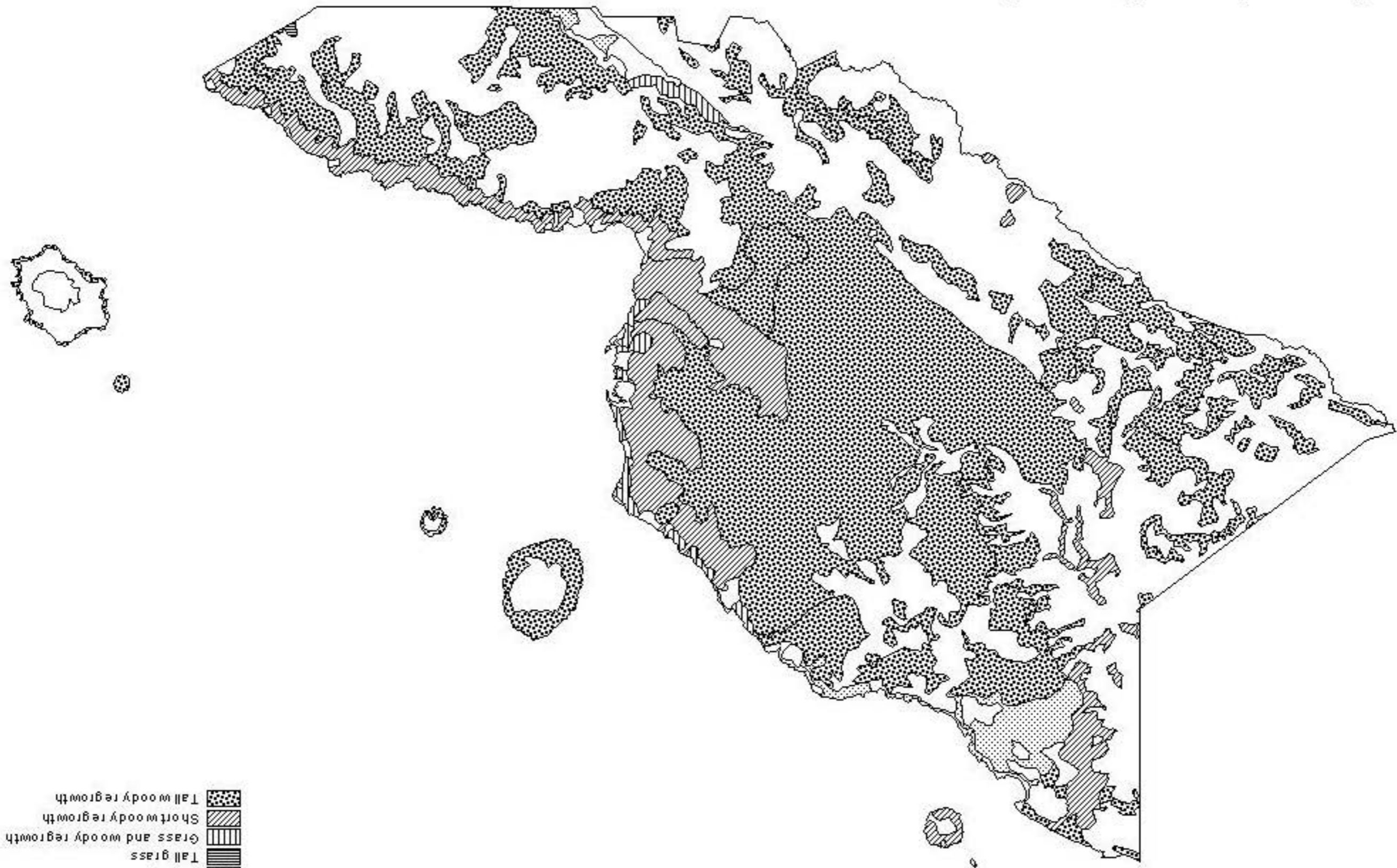
-  No agriculture
-  Lake
-  Agricultural system identified by number

Subsystems are present in systems 5, 16, 20, 29



Fallow vegetation

- Short grass
- Tall grass
- Grass and woody regrowth
- Short woody regrowth
- Tall woody regrowth

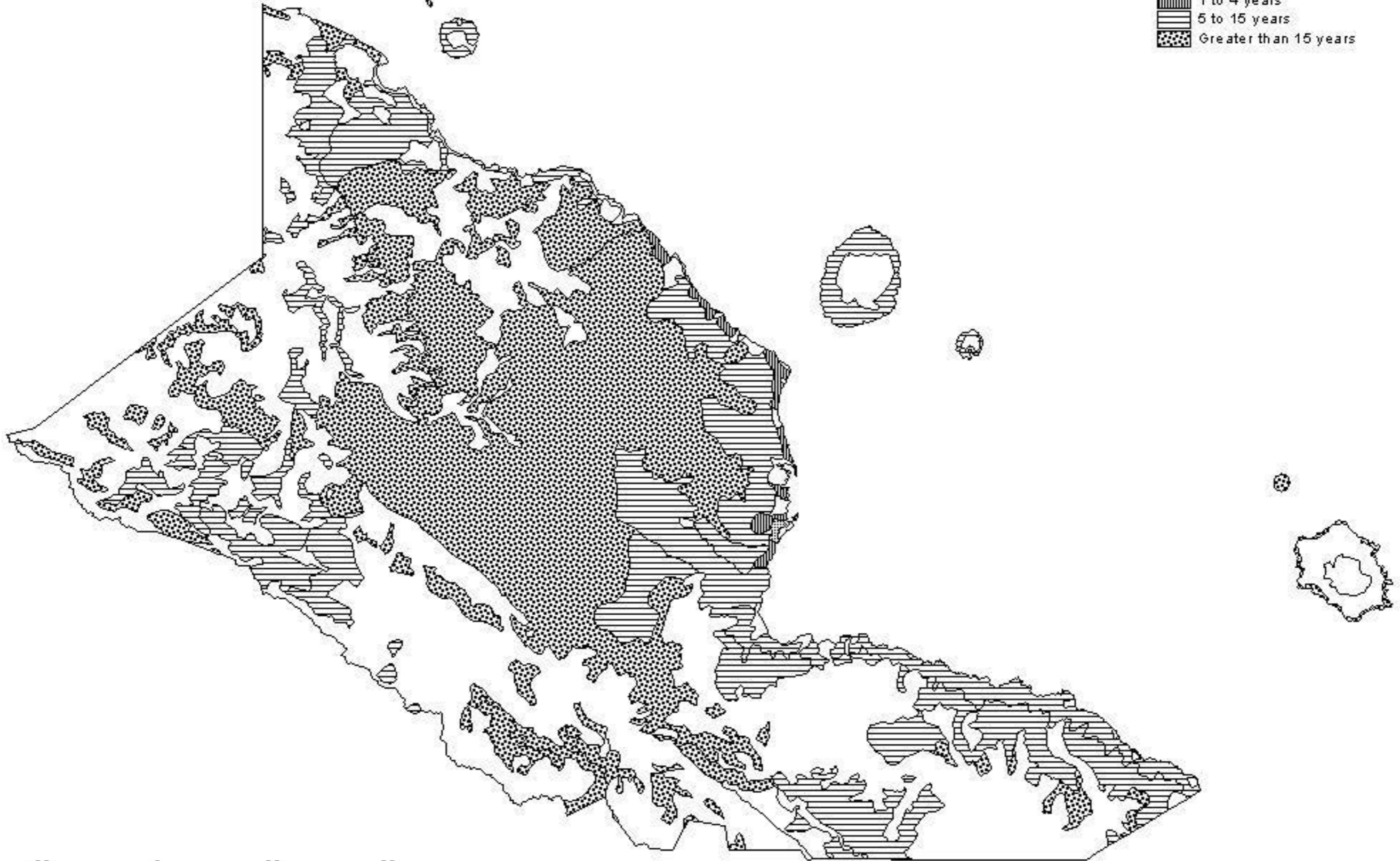


MADANG PROVINCE

MADANG PROVINCE





Long fallow period

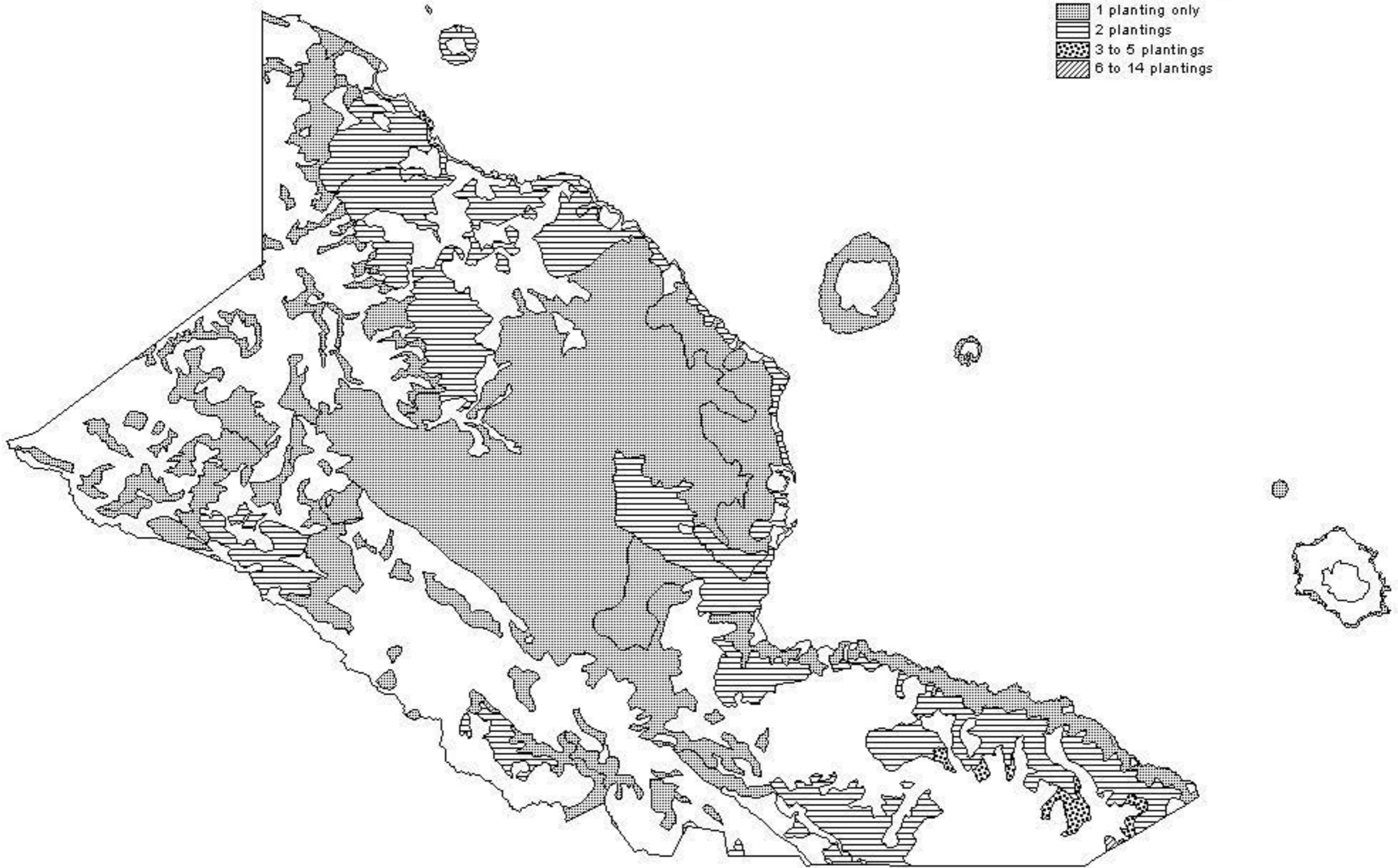
- Long fallow not used
- 1 to 4 years
- 5 to 15 years
- Greater than 15 years



MADANG PROVINCE

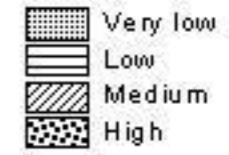
Number of plantings before fallow

-  1 planting only
-  2 plantings
-  3 to 5 plantings
-  6 to 14 plantings



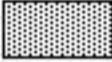






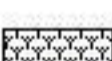



MADANG PROVINCE

Intensity of land use



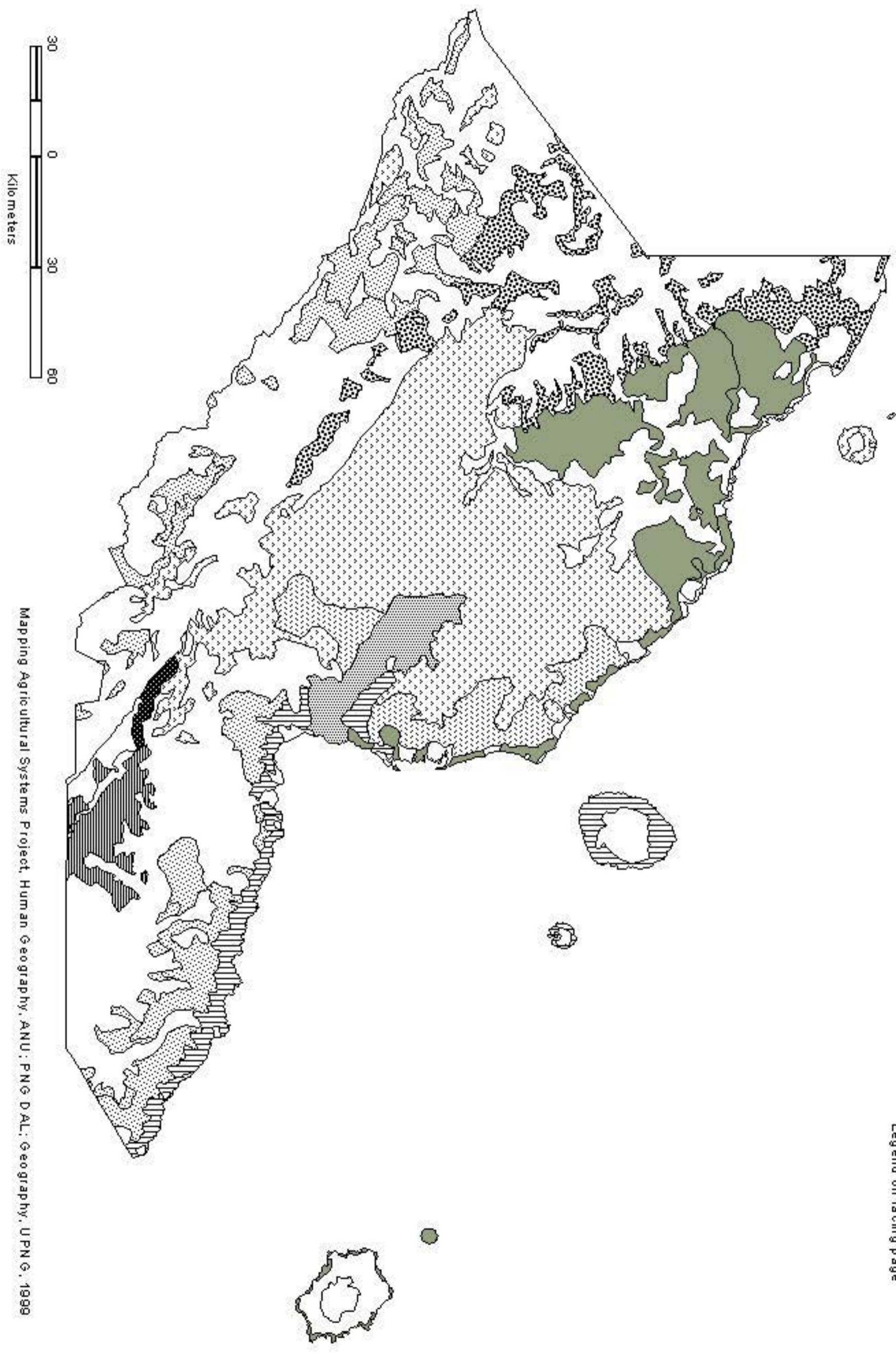
MADANG PROVINCE Crop combinations

	None	Banana/chinese taro/coconut/taro/yam (D. esculenta)
	None	Banana/chinese taro/coconut/taro
	Banana	None
	Banana/chinese taro	Taro/yam (D. esculenta)
	Banana/sweet potato	Taro
	Banana/sweet potato	Coconut
	Cassava/sweet potato	Banana/coconut/taro
	Chinese taro/taro	Banana/coconut/sweet potato
	Sago	Banana/sweet potato/taro
	Sago	Coconut
	Sweet potato	None
	Sweet potato	Banana/taro
	Sweet potato	Chinese taro/taro
	Sweet potato	Chinese taro
	Sweet potato	Potato
	Sweet potato/taro	Banana/chinese taro
	Sweet potato/taro	Banana
	Sweet potato/taro	Banana/cassava/coconut
	Sweet potato/yam (D. esculenta)	Banana/coconut/taro
	Taro/yam (D. esculenta)	Coconut/sago/yam (D. alata)
	Taro/yam (D. esculenta)	Banana/cassava/sweet potato
	Taro/yam (D. esculenta)	Banana/chinese taro/sweet potato
	Taro/yam (D. esculenta)	Banana/chinese taro/coconut

MADANG PROVINCE

Crop combinations

Legend on facing page

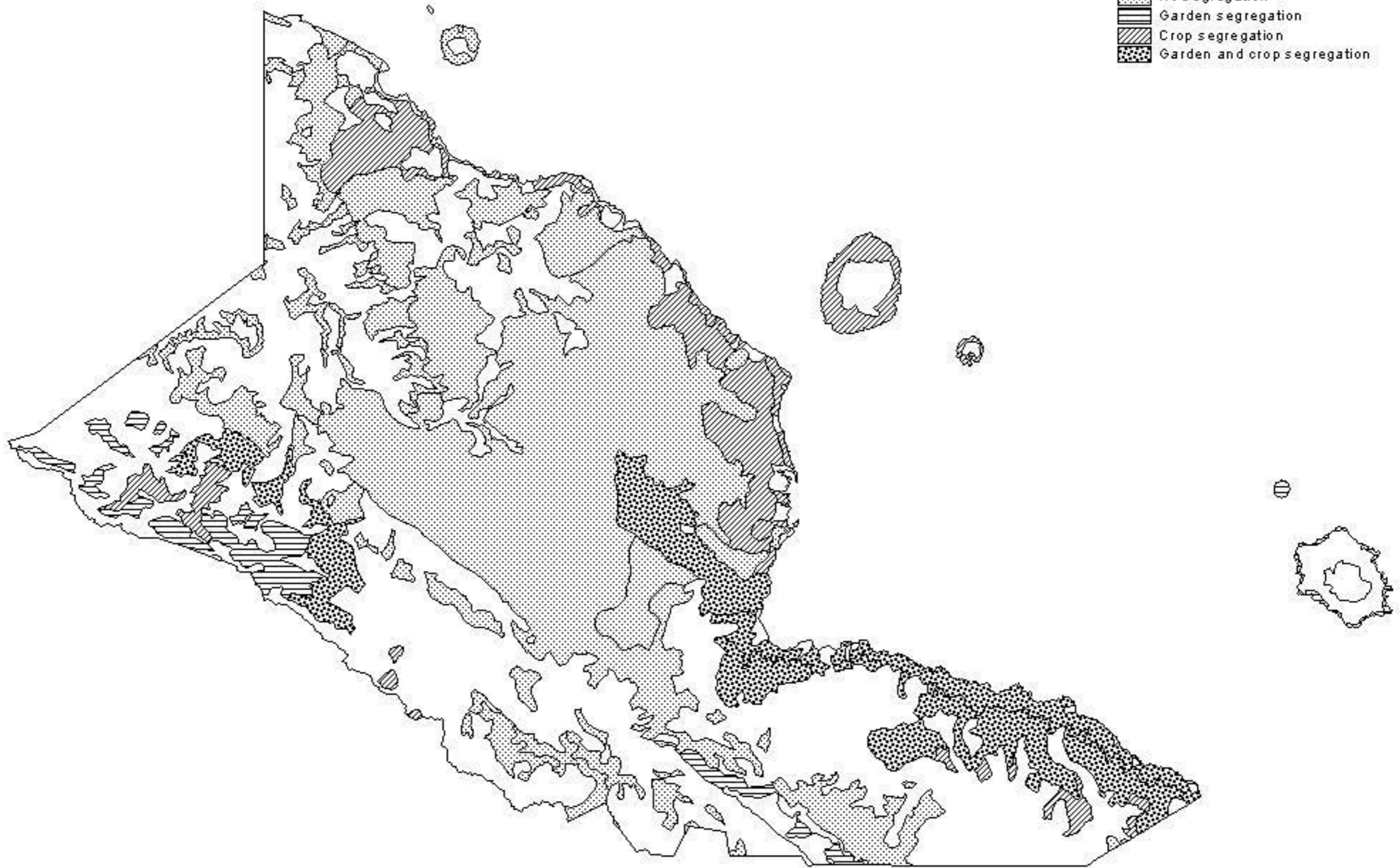


Mapping Agricultural Systems Project, Human Geography, ANU; PNG DAL; Geography, UPNG, 1999

MADANG PROVINCE

Garden and crop segregation

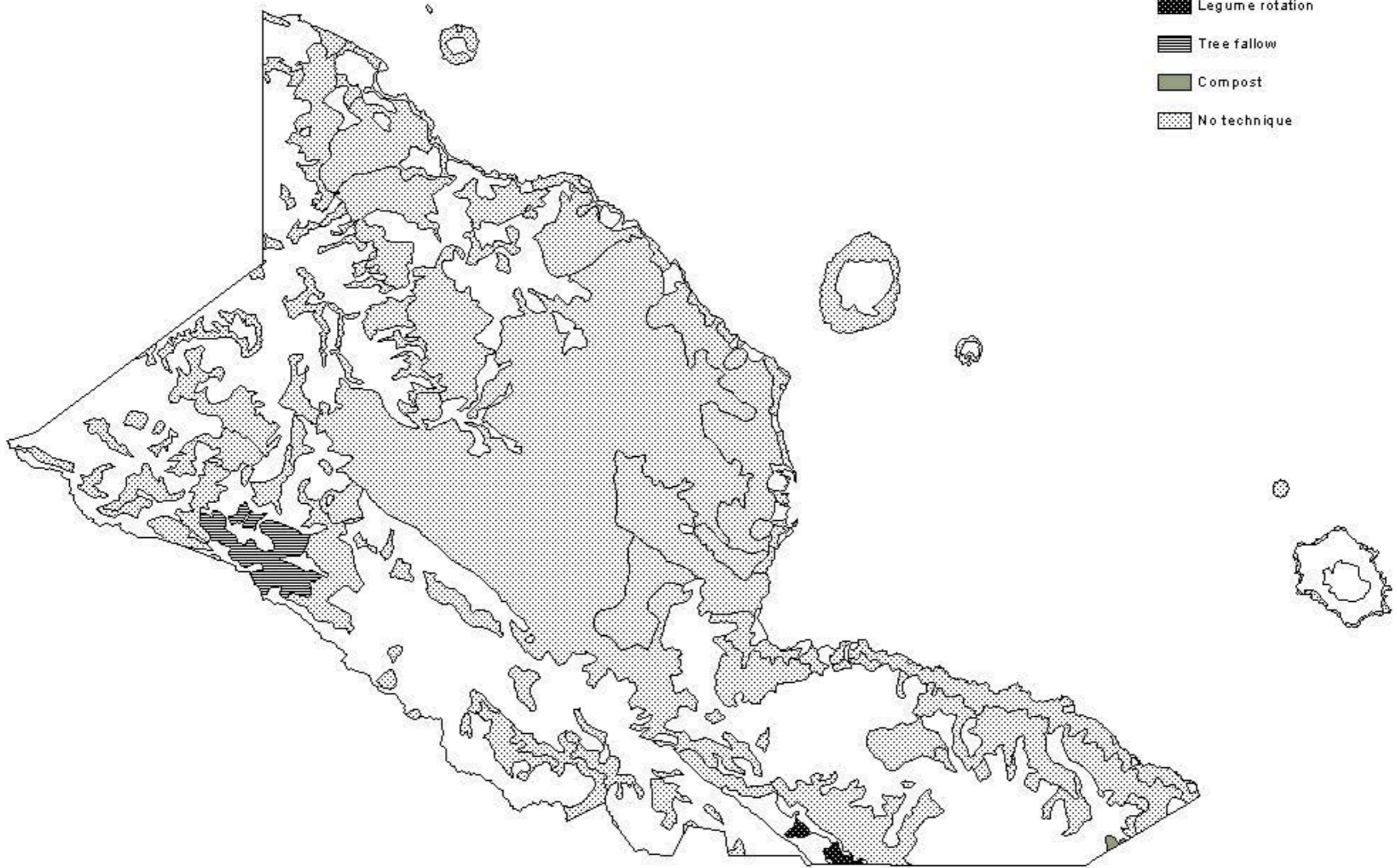
- No segregation
- Garden segregation
- Crop segregation
- Garden and crop segregation



MADANG PROVINCE

Soil fertility maintenance

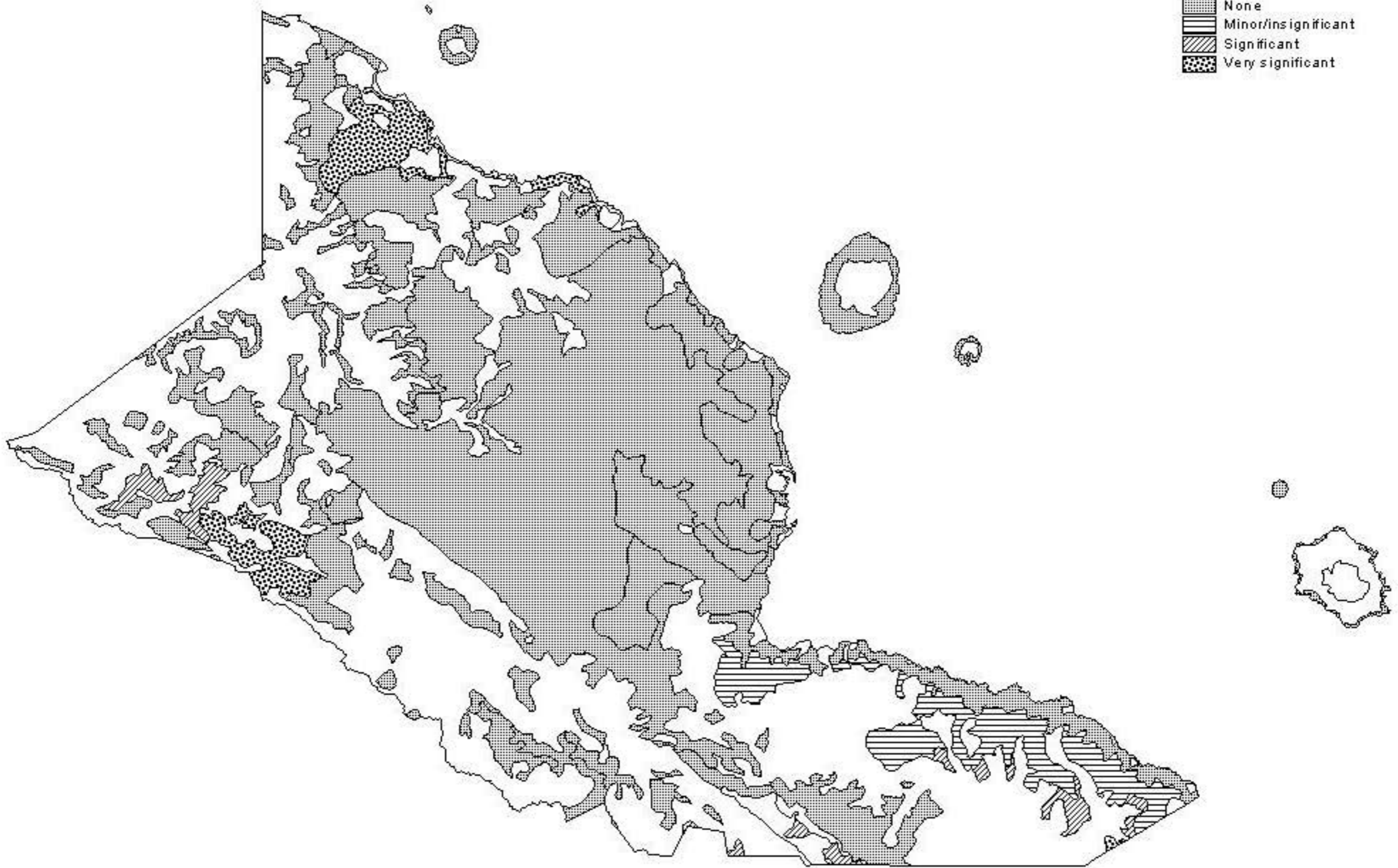
- Legume rotation
- Tree fallow
- Compost
- No technique



MADANG PROVINCE



Soil tillage

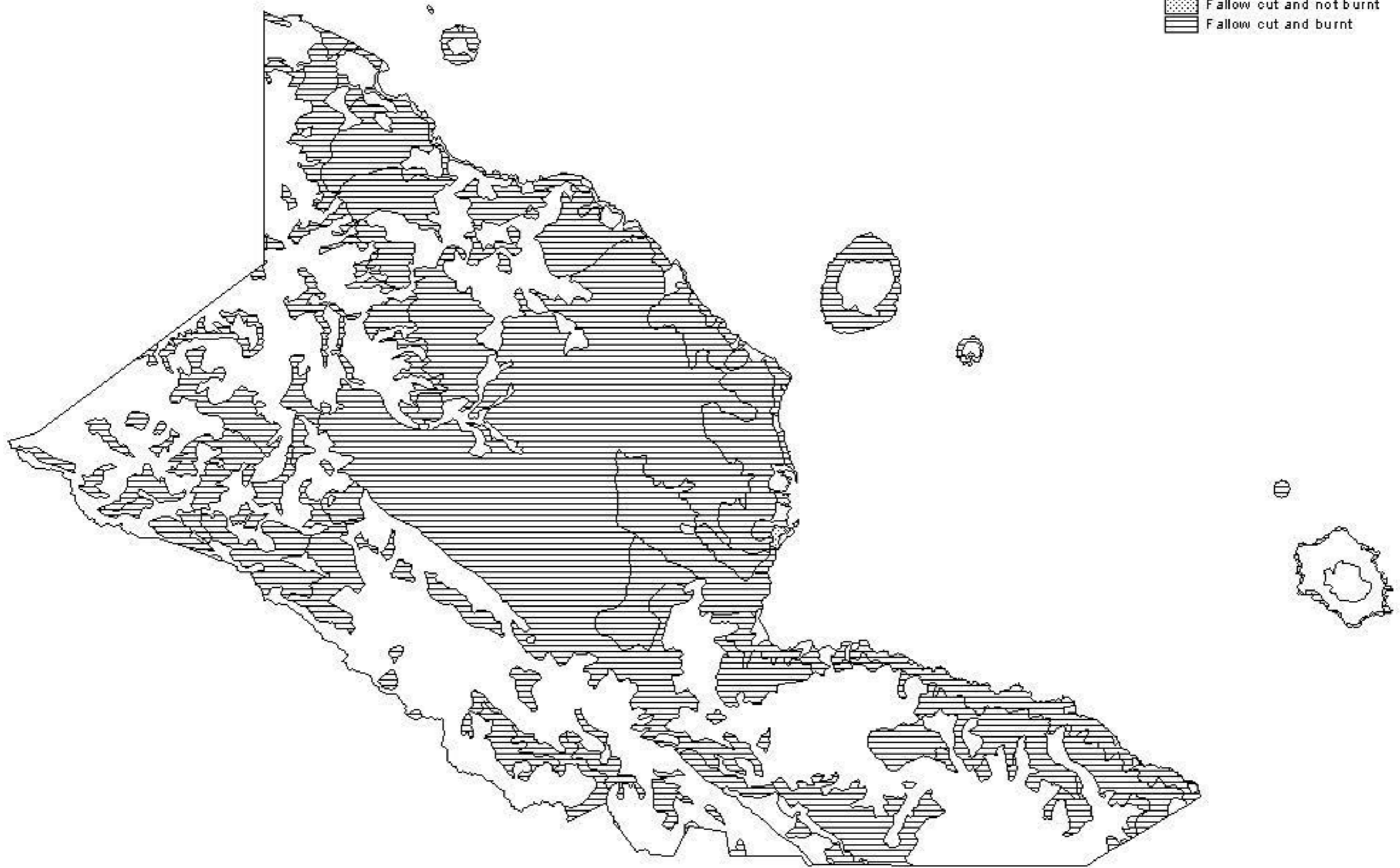
- None
- Minor/insignificant
- Significant
- Very significant



MADANG PROVINCE





Fallow clearing practices

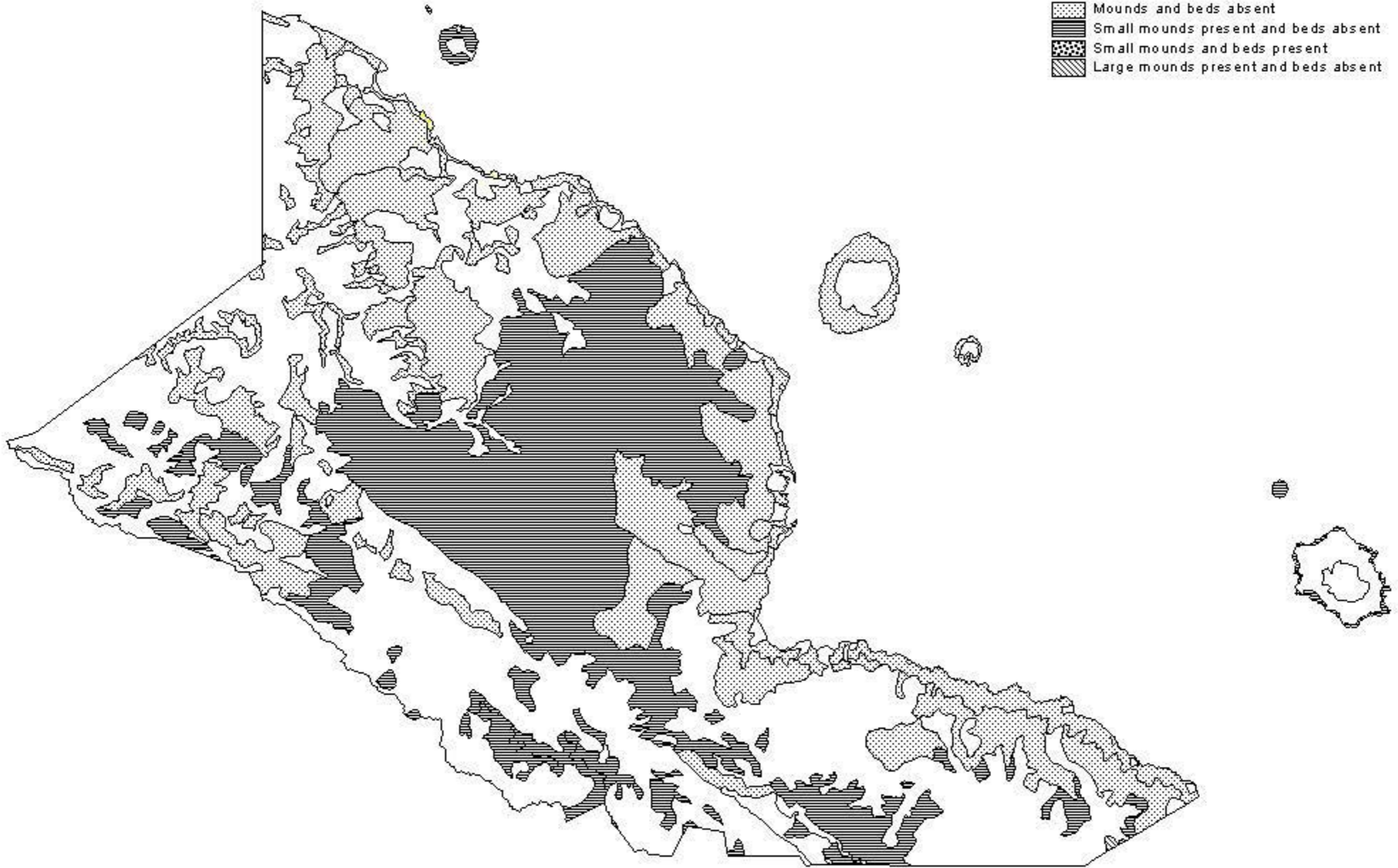
-  Fallow cut and not burnt
-  Fallow cut and burnt



MADANG PROVINCE

Soil mounds and beds

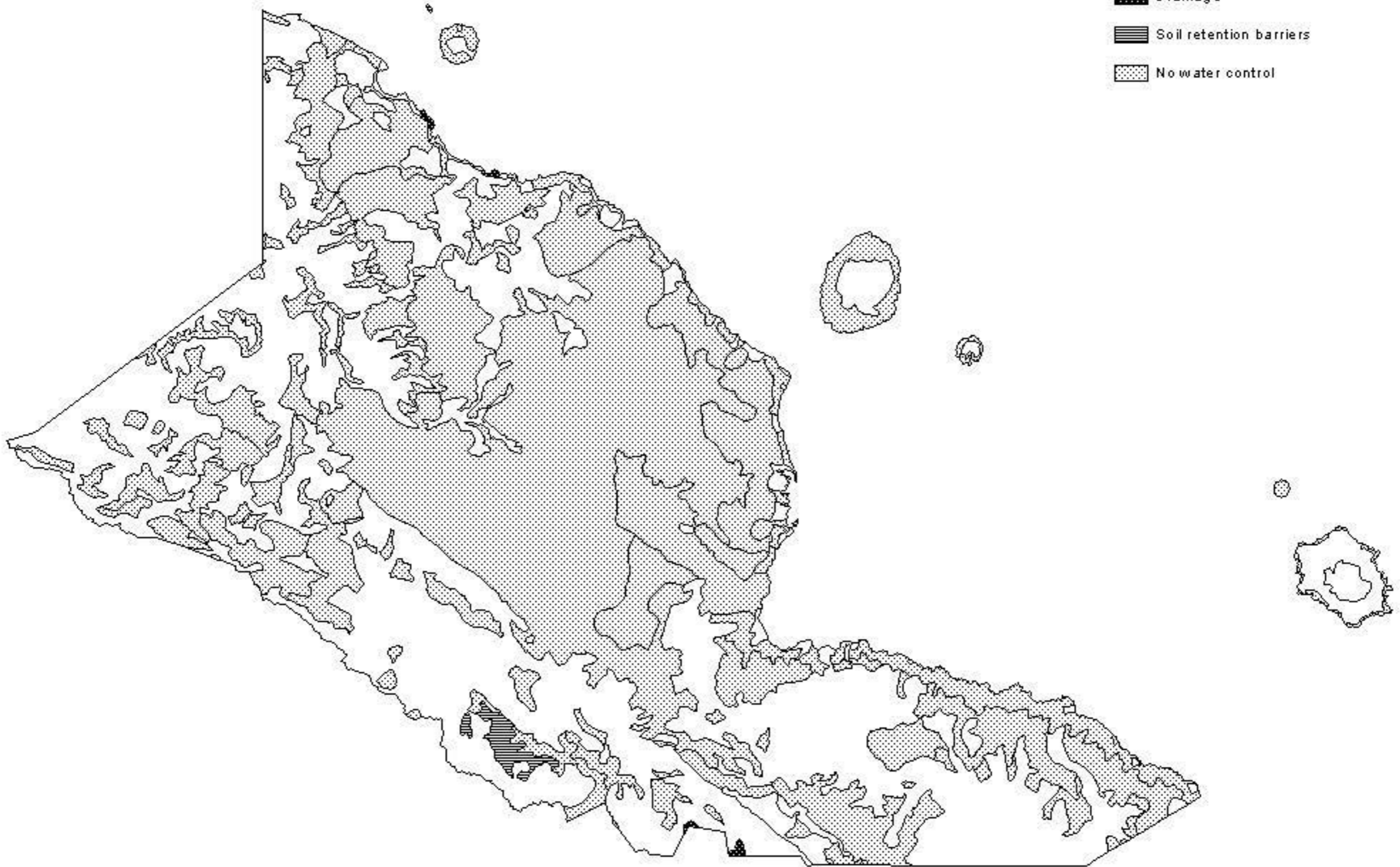
-  Mounds and beds absent
-  Small mounds present and beds absent
-  Small mounds and beds present
-  Large mounds present and beds absent



MADANG PROVINCE









Water management techniques

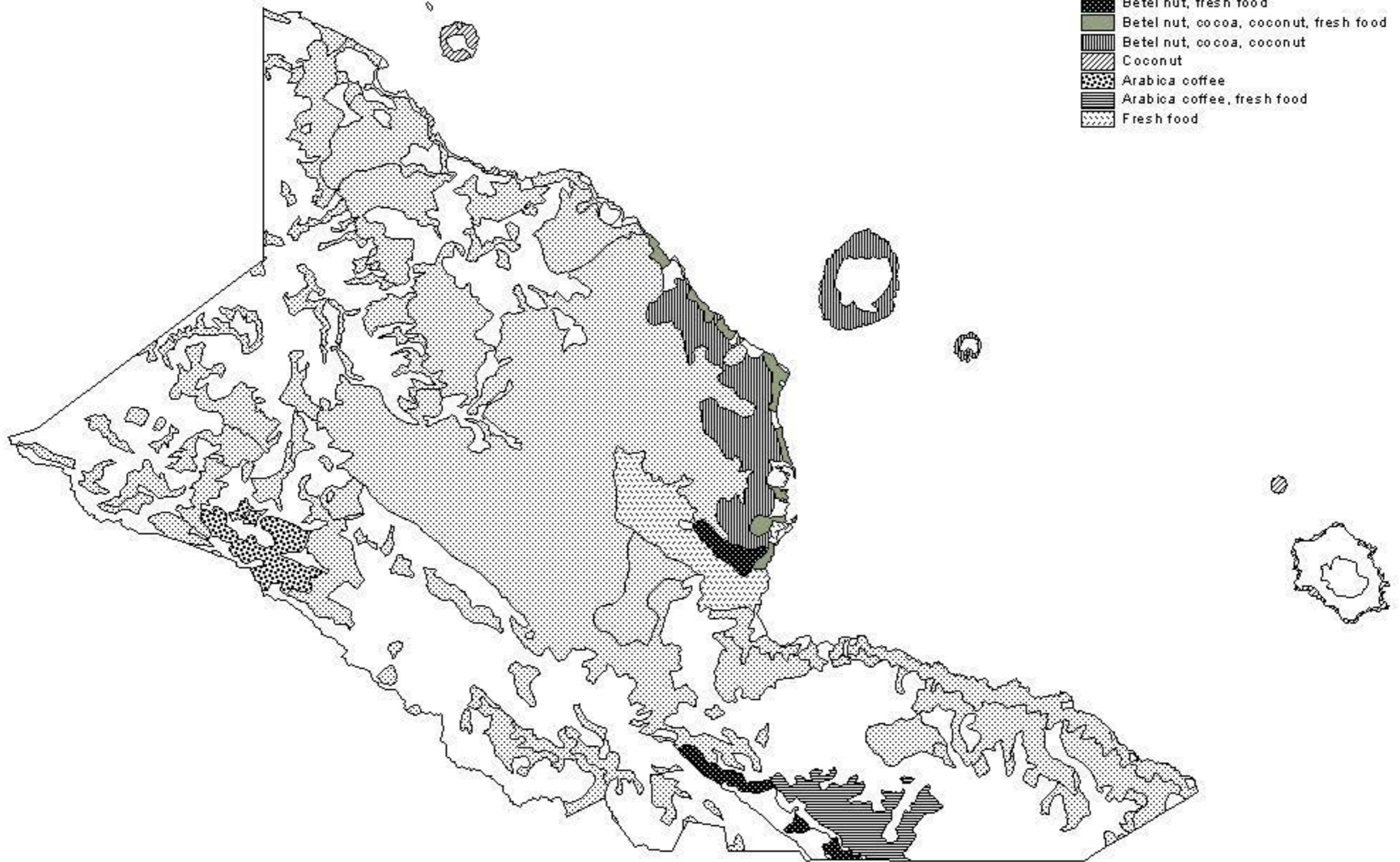
- Drainage
- ▨ Soil retention barriers
- ▤ No water control



MADANG PROVINCE



Cash income activities

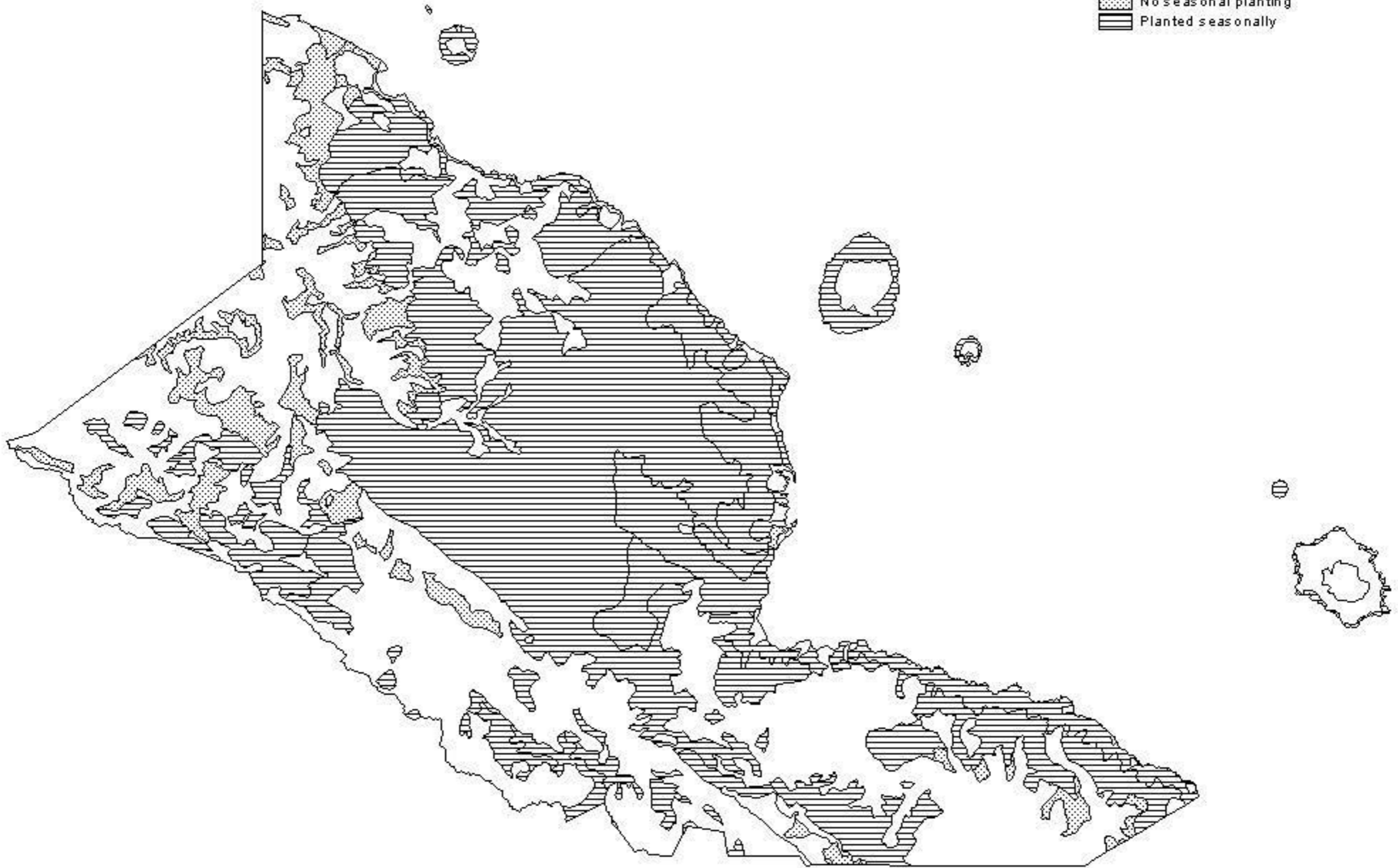
-  None
-  Betel nut, fresh food
-  Betel nut, cocoa, coconut, fresh food
-  Betel nut, cocoa, coconut
-  Coconut
-  Arabica coffee
-  Arabica coffee, fresh food
-  Fresh food



MADANG PROVINCE

Seasonality of main food crops

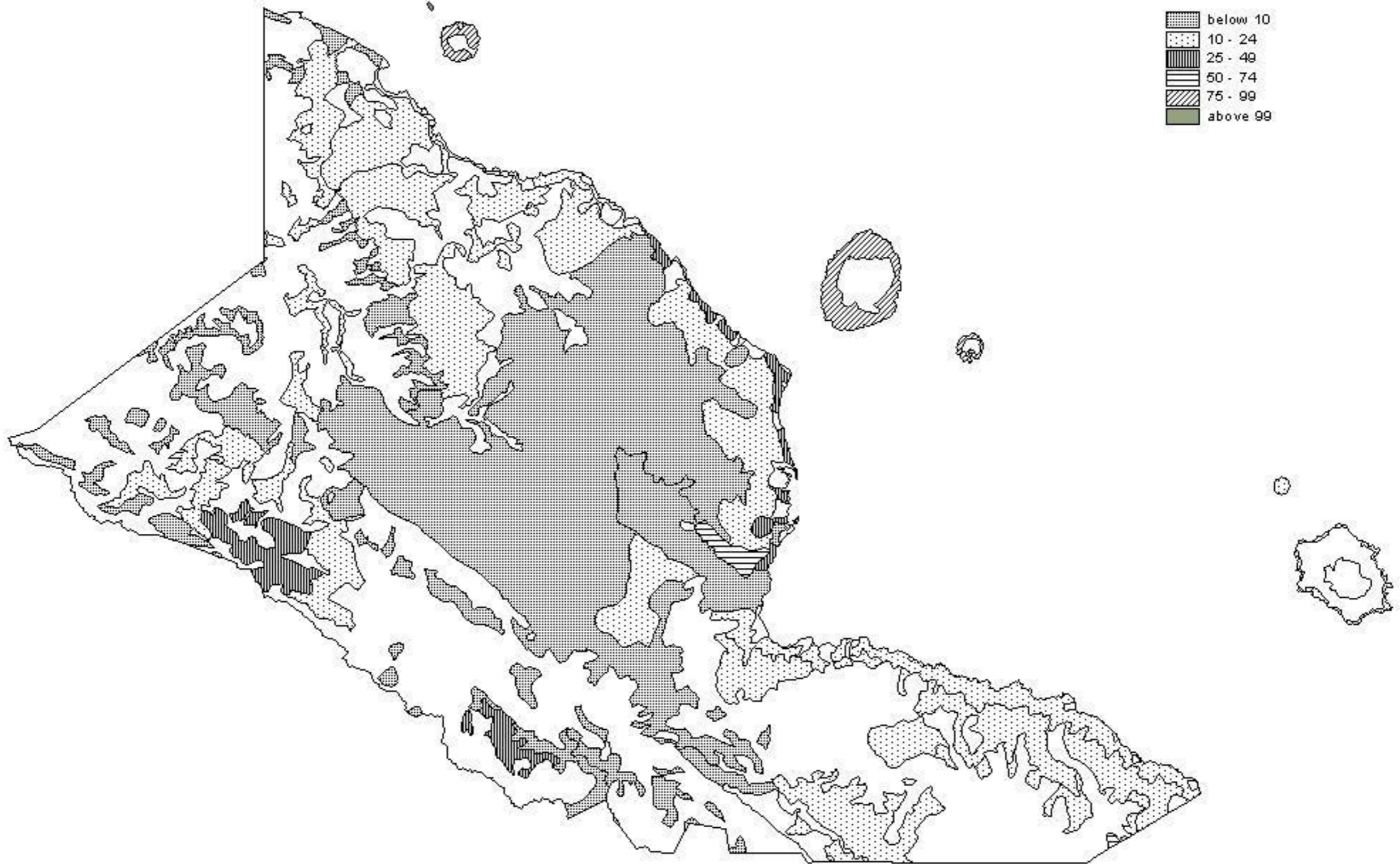
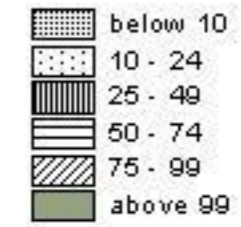
-  No seasonal planting
-  Planted seasonally



MADANG PROVINCE

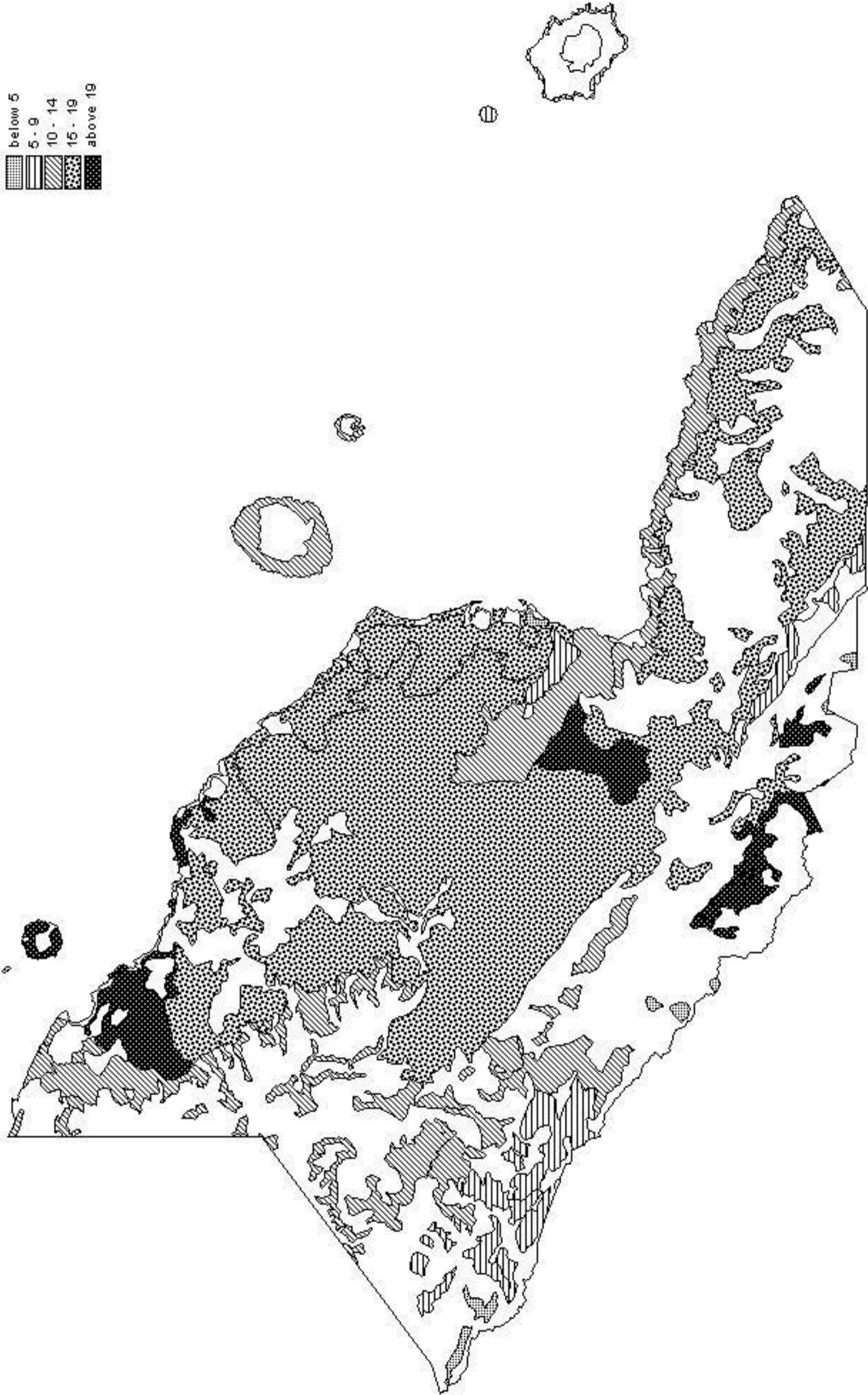
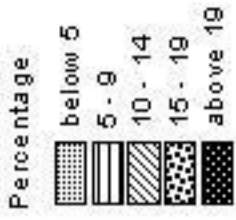
Population density

Persons per square kilometre



MADANG PROVINCE

Population absent



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: 13 Madang**

System	Sub sys	No. of subsys	Subsys extent	Same sys oth prov	Districts	Census Divisions
1301	1	1	4		2-3	09-10-13-14-15-16-26
1302	1	1	4		2	09-10-13-14-15-16-18
1303	1	1	4		2-3-4-5	07-08-09-10-11-12-13-14-15-16-17-18
1304	1	1	4		3	25-26-27-28-29-32-33-34-35
1305	1	2	2		3	25-26-27-29-30
1305	2	2	2		3	25-26-27-29-30
1306	1	1	4		3	25-29
1307	1	1	4		3-4	30-31-32-37-38
1308	1	1	4	1419	3-4	30-31-32-33-35-37-38-44
1309	1	1	4		3	24
1310	1	1	4		3	24
1311	1	1	4		6	21-22-23
1312	1	1	4		1	01
1313	1	1	4	1202	5	51
1314	1	1	4		2	10
1315	1	1	4	0908	4	37-39-41-42-43-44
1316	1	3	2	0910	4	40-41-42-43
1316	2	3	1	0910	4	40-41-42-43
1316	3	3	1	0910	4	40-41-42-43
1317	1	1	4		4	39-40
1318	1	1	4	0909	4	39-40
1319	1	1	4		4	39
1320	1	2	3	1209	1-2	04-05-06-07-08
1320	2	2	1	1209	1-2	04-05-06-07-08
1321	1	1	4	1124	5	45-49
1322	1	1	4		5	45
1323	1	1	4		5	49-50
1324	1	1	4		2	08-10-11-12-20
1325	1	1	4		2	10
1326	1	1	4		2-5	12-46-47-48
1327	1	1	4	1205	1	02
1328	1	1	4	1208	1-2	02-03-04-05-06-07-08
1329	1	2	2	1207	1	03-04-05-06
1329	2	2	2	1207	1	03-04-05-06
1330	1	1	4	1109	5	45-49-50
1331	1	2	3	1123-1201	5	50
1331	2	2	1	1123-1201	5	50
1332	1	1	4	0907	5	

KEY

Subsys Subsystem
 Same sys Same system in
 oth prov other province

AGRICULTURAL SYSTEM DATA LISTING - CODES

Province: 13 Madang

System	Sub sys	Area km ²	Population			Altitude range m		Slope	Fallows		
			Total	Abs	Den	Low	High		Veg	Sht	Per
1301	1	173	7998	15	46	0	40	2	3	0	1
1302	1	764	7375	18	10	40	350	3	4	0	2
1303	1	6226	19077	17	3	350	1000	5	5	0	3
1304	1	1456	15088	18	10	40	350	3	5	0	3
1305	1	467	6520	25	14	40	200	3	1	0	2
1305	2	0	0	0	0	40	200	3	4	0	2
1306	1	13	740	23	57	10	20	2	1	1	2
1307	1	567	8457	12	15	10	50	1	4	0	2
1308	1	1002	7583	12	8	10	200	2	5	0	3
1309	1	56	4885	20	87	10	900	3	4	0	2
1310	1	2	339	17	170	10	100	4	3	0	1
1311	1	267	20924	15	78	0	450	5	5	0	2
1312	1	63	997	9	16	0	150	2	5	0	3
1313	1	455	6096	17	13	600	1400	4	5	0	2
1314	1	14	0	0	0	20	40	2	3	0	0
1315	1	503	6292	10	13	200	1900	3	5	0	2
1316	1	318	8801	9	28	1500	2100	5	5	0	2
1316	2	0	0	0	0	1500	2100	5	5	0	3
1316	3	0	0	0	0	1500	2100	5	1	0	2
1317	1	192	4600	9	24	1600	2100	3	5	0	2
1318	1	178	1548	7	9	600	1600	5	5	0	3
1319	1	64	250	0	4	300	1800	5	5	0	3
1320	1	579	8498	12	15	10	300	5	4	0	2
1320	2	0	0	0	0	10	300	5	1	0	2
1321	1	237	1383	25	6	600	1400	4	5	0	3
1322	1	140	3844	23	27	1400	2200	4	5	0	3
1323	1	87	566	7	7	100	300	2	3	0	3
1324	1	598	4577	13	8	20	150	2	4	0	2
1325	1	95	4718	7	50	40	100	3	4	0	2
1326	1	320	4599	28	14	150	650	5	5	0	2
1327	1	11	555	11	50	2000	2600	2	2	2	2
1328	1	1094	11341	19	10	300	1600	2	5	1	2
1329	1	147	3097	16	21	1600	2000	3	5	2	3
1329	2	0	0	0	0	1600	2000	3	5	0	3
1330	1	15	0	0	0	800	1800	3	5	0	3
1331	1	46	776	6	17	200	450	1	1	0	2
1331	2	46	776	6	17	200	450	1	5	0	2
1332	1	33	0	0	0	600	2200	5	4	0	2

KEY

Subsys Subsystem

Area km² Area of System

Population

Total Resident population 1980

Abs Absent population (%)

Den Population density (persons/km²)

Fallows

Veg Type of Fallow vegetation

Sht Short fallows

Per Long fallow period

AGRICULTURAL SYSTEM DATA LISTING - CODES

Province: 13 Madang

System	Sub sys	Staple crops			Narcotic crops
		Most import	Important	Present	
1301	1	13-15	02-05-06	02-04-05-06-09-11-13-14-15	2-4-5
1302	1	05-13	02-06-11	02-04-05-06-09-11-13-14-15	2-4-5
1303	1	11-13	02-05	02-04-05-09-11-13-14-15	2-4-5
1304	1	13-15	02-05-11	02-04-05-09-11-13-14-15	2-4-5
1305	1	13-15	02-04-11	02-04-05-09-11-13-15	2-4-5
1305	2	13-15	02-04-11	02-04-05-09-11-13-15	2-4-5
1306	1	11-15	02-06-13	02-04-05-06-09-11-13-15	2-4-5
1307	1	09	06	02-04-05-06-09-11-13-14	2-4-5
1308	1	09	02-11-13	02-04-05-09-11-13-14-15	2-4-5
1309	1	11-13	02-04-06	02-04-05-06-11-13-15	2-4-5
1310	1	04-11	02-06-13	02-04-05-06-11-13	2-4-5
1311	1	00	02-05-06-13	02-05-06-11-13-15	2-4-5
1312	1	13-15	06-09-14	02-04-05-06-09-11-13-14-15	2-4-5
1313	1	02-11	13	02-04-05-08-09-11-13-14	2-4-5
1314	1	00	00	02-04-05-11-13-14-15	2-4-5
1315	1	11	02-13	02-04-05-11-13-14-15	2-4-5
1316	1	11	02-13	02-04-05-11-13-14	5
1316	2	11	00	02-04-05-11-13-14	5
1316	3	11	00	02-04-05-11-13-14	5
1317	1	11	00	02-05-11-13-14	5
1318	1	11-13	02	02-04-05-11-13-14	2-5
1319	1	11	02-13	02-04-05-09-11-13	2-3-4-5
1320	1	00	02-05-06-13	02-04-05-06-09-11-13-14-15	2-4-5
1320	2	15	02-06-13	02-04-05-06-09-11-13-14-15	2-4-5
1321	1	11	00	02-04-05-09-11-13-14-15	2-4-5
1322	1	11	00	02-04-05-11-13	1-3-5
1323	1	02	00	02-04-05-09-11-13-15	2-4-5
1324	1	02-05	13-15	02-04-05-09-11-13-14-15	2-4-5
1325	1	00	02-05-06-13-15	02-04-05-06-09-11-13-14-15	2-4-5
1326	1	05-13	02-04-11	02-04-05-09-11-13-14	2-4-5
1327	1	11	08	02-05-08-11	1-3-5
1328	1	11	05-13	02-05-11-13-14-15	1-2-3-4-5
1329	1	11	05	02-05-08-11-13	1-3-5
1329	2	05	00	02-05-08-11-13	1-3-5
1330	1	11	00	02-04-11	1-3-5
1331	1	02-11	06	02-04-05-06-11-13-14-15	2-4-5
1331	2	14	00	02-04-05-11-13-14-15	2-4-5
1332	1	11	00	02-04-05-11-13-14	2-5

KEY

Subsys Subsystem

AGRICULTURAL SYSTEM DATA LISTING - CODES

Province: 13 Madang

System	Sub sys	Vegetable crops	Fruit crops	Nut crops
1301	1	01-02-09-16-17-21-23-27	07-12-13-15-16-17-23-35	01-06-10
1302	1	01-02-05-09-16-17-21-23-27	07-08-12-13-15-16-23-35	01-06-10
1303	1	01-02-03-05-09-16-21-23-27	07-08-12-13-15-17-23-35	01-04-06
1304	1	01-02-05-09-10-16-21-23-27	07-08-12-13-15-16	01-04-06
1305	1	01-09-21	07-08-12-13-15	01-04
1305	2	01-02-05-09-16-17-21-23-27	07-08-12-13-15	01-04
1306	1	01-09-16-17-27	07-12-13-15-35	01-06-13
1307	1	01-09-21-23-27	07-12-13-15-17-35	01-06
1308	1	01-09-11-16-21-23-27	07-08-12-13-15-17	01-04
1309	1	01-09-16-21-23-27	07-12-13-15-17-35	01-06-15
1310	1	01-09-23-27	07-15	01-06
1311	1	01-23-09-21-15-28-02-11-16	15-16-07-35-12-28	01-06-10-15
1312	1	01-02-03-05-09-10-15-16-19-21	05-07-09-12-13-15-17-35	01-06-07-15
1313	1	01-02-03-08-09-10-13-16-21-28	07-08-12-15	01-04-06-08
1314	1	01-02-04-09-16-17-19-21-27	07-12-13-15-23-35	01-04
1315	1	01-08-09-10-13-15-16-21-22-23	07-08-12-13-15	01-08-09
1316	1	04-08-09-13-16-19-21-22-29-30	01-08-11-15	03-08-09-14
1316	2	04-08-09-13-16-19-21-22-29-30	01-08-11-15	03-08-09-14
1316	3	04-08-09-13-16-19-21-22-29-30	01-08-11-15	03-08-09-14
1317	1	03-08-09-13-16-17-18-21-22-28	01-11-12-15	09
1318	1	05-09-10-16-21-34-23	07-08-12-15	01-11
1319	1	02-05-09-10-13-16-17-19-20-22	05-07-08-12-15-16-17-28	01-08-11-15
1320	1	01-02-04-05-09-10-16-21-23-27	07-08-12-13-15-16-28-35	01-06-07-11
1320	2	01-02-04-05-09-10-16-21-23-27	07-08-12-13-15-16-28-35	01-06-07-11
1321	1	01-02-08-09-16-19-21-22-23-27	07-08-12-13-15-17	01-11
1322	1	01-02-03-05-08-09-10-13-21-22	08-12-15	08
1323	1	01-02-03-08-09-16-19-21-23	07-08-12-13-15-17	01-04-06
1324	1	01-02-04-05-08-09-10-16-21-27	07-08-12-13-15-16-35	01-04-06
1325	1	01-09-10-15-16-21-23-27	07-08-12-13-15-16-17-35	01-06-10
1326	1	01-02-04-09-10-16-19-21-27	07-08-12-13-15-17-23-35	01-04-06
1327	1	03-06-08-09-13-18-21-26-28	01-09-11-15	08-09
1328	1	01-02-06-08-09-16-19-21-27-37	07-08-09-12-13-15	01-04-09-11
1329	1	03-06-05-08-09-11-13-16-21-28	08-09-11-15-31	08
1329	2	03-06-05-08-09-11-13-16-21-28	08-09-11-15-31	08
1330	1	13-09-10-03-16-01-02-07-21-22	08-12-15	01-11
1331	1	01-02-09-10-16-19-21-23-27-28	07-08-09-12-13-15-17	01
1331	2	01-02-09-10-16-19-21-23-27-28	07-08-09-12-13-15-17	01-04
1332	1	01-02-03-09-13-15-21-22-23-33	08-12-15	01-08

KEY

Subsys Subsystem

AGRICULTURAL SYSTEM DATA LISTING - CODES

Province: 13 Madang

System	Sub sys	Segregation		Crop Seq	Gard types		Soil fertility maintenance techniques							
		Gar	Crp		Mix	H'ld	Leg	Tre	Com	Man	Isl	Sil	Fer	
1301	1	0	3	1	0	1	0	0	0	0	0	0	1	0
1302	1	0	2	0	0	1	0	0	0	0	0	0	0	0
1303	1	0	1	0	0	1	0	0	0	0	0	0	1	0
1304	1	0	1	2	0	1	0	0	0	0	0	0	0	0
1305	1	0	2	2	0	1	0	0	0	0	0	0	1	0
1305	2	0	0	2	0	1	0	0	0	0	0	0	0	0
1306	1	0	3	2	0	1	0	0	1	0	0	0	0	0
1307	1	0	0	0	0	1	0	0	0	0	0	0	2	0
1308	1	0	0	1	0	1	0	0	0	0	0	0	1	0
1309	1	0	1	2	0	1	0	0	0	0	0	0	0	0
1310	1	0	1	2	0	1	0	0	0	0	0	0	0	0
1311	1	0	2	0	0	1	0	0	0	0	0	0	0	0
1312	1	3	1	0	0	0	0	0	0	0	0	0	1	0
1313	1	1	0	0	0	1	0	0	0	0	0	0	0	0
1314	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1315	1	2	2	0	0	1	0	1	0	0	0	0	0	0
1316	1	2	1	2	0	3	0	3	0	0	0	0	0	0
1316	2	0	1	0	0	3	0	1	0	0	0	0	0	0
1316	3	0	1	0	0	3	0	1	0	0	0	0	0	0
1317	1	1	2	0	0	1	0	1	0	0	0	0	0	0
1318	1	3	1	0	0	1	0	1	0	0	0	0	0	0
1319	1	3	1	0	0	2	0	0	0	0	0	0	0	0
1320	1	2	2	0	0	1	0	0	0	0	0	0	0	0
1320	2	0	3	0	0	1	0	0	0	0	0	0	1	0
1321	1	1	1	0	0	2	0	0	0	0	0	0	0	0
1322	1	1	1	0	0	2	0	0	0	0	0	0	0	0
1323	1	3	1	0	0	1	0	0	0	0	0	0	1	0
1324	1	2	2	0	0	1	0	0	0	0	0	0	0	0
1325	1	0	1	3	0	1	0	0	0	0	0	0	0	0
1326	1	0	1	0	0	1	0	0	0	0	0	0	0	0
1327	1	1	1	0	0	2	0	0	2	0	0	0	0	0
1328	1	2	2	2	0	1	1	0	0	0	0	0	0	0
1329	1	1	2	2	0	2	0	0	1	0	0	0	0	0
1329	2	0	1	0	0	2	0	0	0	0	0	0	0	0
1330	1	1	1	0	0	2	0	0	0	0	0	0	0	0
1331	1	3	0	2	0	1	2	0	0	0	0	0	0	0
1331	2	0	0	2	0	1	0	0	0	0	0	0	0	0
1332	1	1	2	0	1	3	0	1	1	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: 13 Madang

System	Sub sys	Management techniques											
		Water		Soil						Fallow		Other	
		Irr	Drn	Pig	Till	Hol	Bar	Mul	Mec	Brn	Cut	Fen	Stk
1301	1	0	0	0	0	0	0	0	0	3	0	1	2
1302	1	0	0	0	0	0	1	0	0	3	0	2	1
1303	1	0	0	0	0	0	1	0	0	3	0	2	1
1304	1	0	0	0	0	0	0	0	0	3	0	2	2
1305	1	0	1	0	3	0	1	0	0	3	0	2	2
1305	2	0	0	0	0	0	1	0	0	3	0	2	2
1306	1	0	3	0	3	0	0	0	0	2	0	3	2
1307	1	0	0	0	0	0	0	0	0	2	0	0	1
1308	1	0	0	0	0	0	0	0	0	3	0	1	1
1309	1	0	0	0	0	0	0	0	0	3	0	2	0
1310	1	0	0	0	2	0	2	0	0	2	0	1	0
1311	1	0	0	0	0	0	0	0	0	3	0	2	1
1312	1	1	0	0	0	0	0	0	0	3	0	1	0
1313	1	0	0	0	0	0	1	0	0	3	0	1	1
1314	1	0	0	0	0	0	0	0	0	0	0	0	0
1315	1	0	0	0	0	0	0	0	0	3	0	3	1
1316	1	1	1	2	3	0	1	0	0	3	0	3	1
1316	2	0	1	0	1	0	1	0	0	3	0	3	1
1316	3	0	1	2	3	0	1	0	0	3	0	3	1
1317	1	0	1	0	2	0	0	0	0	3	0	2	1
1318	1	0	0	0	0	0	0	0	0	3	0	2	1
1319	1	0	0	0	0	0	0	0	0	3	0	3	0
1320	1	0	0	0	0	0	0	0	0	3	1	2	2
1320	2	0	0	0	2	0	0	0	0	3	0	2	3
1321	1	0	0	0	0	0	1	0	0	3	0	3	1
1322	1	0	0	0	0	0	2	0	0	3	0	2	1
1323	1	0	0	0	0	0	0	0	0	3	0	3	1
1324	1	0	0	0	0	0	1	0	0	3	0	2	1
1325	1	0	0	0	0	0	0	0	0	3	0	3	2
1326	1	0	0	0	0	0	1	0	0	3	0	3	1
1327	1	0	1	2	3	0	0	0	0	2	0	2	1
1328	1	0	0	0	1	0	0	0	0	3	0	3	1
1329	1	0	0	0	2	0	0	0	0	2	0	3	1
1329	2	0	0	0	0	0	0	0	0	3	0	3	1
1330	1	0	2	0	2	0	1	0	0	3	0	3	1
1331	1	0	1	0	2	0	0	0	2	2	0	0	0
1331	2	0	0	0	0	0	0	0	0	2	0	2	1
1332	1	0	0	0	0	0	1	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: 13 Madang

System	Sub sys	Management techniques						Crop planting seasonality		Cropping intensity	R value
		Soil mounds				Garden beds		Maj	Min		
		Vsm	Sm	Md	Lge	Sq	Lg				
1301	1	0	1	0	0	0	0	2	2	2	40
1302	1	0	1	0	0	0	0	2	2	1	9
1303	1	0	2	0	0	0	0	2	2	1	5
1304	1	0	1	0	0	0	0	2	2	2	9
1305	1	0	1	0	0	0	1	2	2	2	17
1305	2	0	1	0	0	0	0	2	2	2	17
1306	1	0	3	0	0	0	3	2	2	3	40
1307	1	0	0	0	0	0	0	0	3	1	9
1308	1	0	1	0	0	0	0	0	1	1	5
1309	1	0	2	0	0	0	0	2	2	2	17
1310	1	0	2	0	0	0	0	2	2	3	57
1311	1	1	1	0	0	0	0	2	2	1	9
1312	1	0	3	0	0	0	0	2	2	1	5
1313	1	2	0	0	0	0	0	2	2	2	17
1314	1	0	0	0	0	0	0	0	0	0	0
1315	1	3	0	0	0	0	0	2	2	1	9
1316	1	0	0	0	0	0	0	2	2	2	17
1316	2	0	0	0	0	0	0	0	2	1	5
1316	3	0	0	0	0	0	0	0	2	2	17
1317	1	0	0	0	0	0	0	1	1	1	9
1318	1	3	0	0	0	0	0	2	2	1	5
1319	1	0	0	0	0	0	0	0	0	1	5
1320	1	0	1	0	0	0	0	2	2	1	9
1320	2	0	2	0	0	0	0	3	3	1	9
1321	1	0	3	0	0	0	0	2	2	1	5
1322	1	0	3	0	0	0	0	2	2	2	9
1323	1	0	1	0	0	0	0	2	2	1	20
1324	1	0	1	0	0	0	0	2	2	2	17
1325	1	0	1	0	0	0	0	2	2	2	17
1326	1	0	1	0	0	0	0	2	2	1	9
1327	1	0	0	3	0	0	0	0	0	4	50
1328	1	0	1	0	0	0	0	2	2	2	17
1329	1	0	2	0	0	0	0	0	1	3	17
1329	2	0	1	0	0	0	0	0	0	1	9
1330	1	1	3	0	0	0	0	2	2	2	9
1331	1	0	2	0	0	0	0	0	0	2	50
1331	2	0	1	0	0	0	0	3	3	2	17
1332	1	3	0	0	0	0	0	2	2	1	0

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: 13 Madang

System	Sub sys	Cash income sources											
		An	Bet	Crd	Cat	Chi	Coc	Cnt	CfA	CfR	Crc	Fwd	Fsh
1301	1	0	2	0	0	0	2	2	0	0	0	0	0
1302	1	0	1	0	0	0	2	2	0	0	0	1	0
1303	1	0	1	0	0	0	0	0	0	0	0	0	0
1304	1	0	1	0	0	0	1	1	0	0	0	0	0
1305	1	0	1	0	0	0	1	1	0	0	0	0	0
1305	2	0	1	0	0	0	1	1	0	0	0	0	0
1306	1	0	0	0	0	0	0	2	0	0	0	0	0
1307	1	0	1	0	0	0	0	0	0	0	1	0	1
1308	1	0	1	0	0	0	0	0	0	0	0	0	1
1309	1	0	1	0	0	0	0	2	0	0	0	0	1
1310	1	0	0	0	0	0	0	0	0	0	0	0	1
1311	1	0	2	0	0	0	2	3	0	0	0	0	0
1312	1	0	1	0	0	0	0	2	0	0	0	0	0
1313	1	0	1	0	0	0	0	0	2	0	0	0	0
1314	1	0	0	0	0	0	0	0	0	0	0	0	0
1315	1	1	0	0	0	0	0	0	1	0	0	0	0
1316	1	0	0	0	1	0	0	0	2	0	0	0	0
1316	2	0	0	0	1	0	0	0	2	0	0	0	0
1316	3	0	0	0	1	0	0	0	2	0	0	0	0
1317	1	0	0	0	0	0	0	0	1	0	0	0	0
1318	1	1	0	0	0	0	0	0	1	0	0	0	0
1319	1	1	0	0	0	0	0	0	0	0	0	0	0
1320	1	0	1	0	0	0	0	1	0	0	0	0	0
1320	2	0	1	0	0	0	0	1	0	0	0	0	0
1321	1	1	0	1	0	0	0	0	0	0	0	0	0
1322	1	1	0	0	0	0	0	0	1	0	0	0	0
1323	1	0	2	0	0	0	1	0	0	0	0	0	0
1324	1	0	1	0	0	0	1	1	0	0	0	1	0
1325	1	0	2	0	0	0	1	0	0	0	0	0	0
1326	1	0	1	0	0	0	1	0	0	1	0	0	0
1327	1	0	0	0	0	0	0	0	1	0	0	0	0
1328	1	0	1	0	0	0	1	0	0	0	0	0	0
1329	1	0	0	0	0	0	0	0	1	0	0	0	0
1329	2	0	0	0	0	0	0	0	1	0	0	0	0
1330	1	0	0	0	0	0	0	0	1	0	0	0	0
1331	1	0	3	0	1	1	0	0	0	0	0	0	0
1331	2	0	3	0	1	1	0	0	0	0	0	0	0
1332	1	1	0	1	0	0	0	0	1	0	0	0	0

KEY

Subsys Subsystem

Cash Income Sources

An Animal skins
 Bet Betel nut
 Crd Cardamom
 Cat Cattle

Chi Chillie
 Coc Cocoa
 Cnt Coconut
 CfA Coffee Arabica

CfR Coffee Robusta
 Crc Crocodile
 Fwd Firewood
 Fsh Fish

AGRICULTURAL SYSTEM DATA LISTING - CODES

Province: 13 Madang

System	Sub sys	Cash income sources										
		Fod	Op	Pot	Pyr	Ric	Rub	Shp	Tea	Tob	Ot1	Ot2
1301	1	2	0	0	0	0	0	0	0	0	0	0
1302	1	1	0	0	0	0	0	0	0	1	0	0
1303	1	1	0	0	0	0	0	0	0	0	0	0
1304	1	1	0	0	0	0	0	0	0	0	0	0
1305	1	1	0	0	0	0	0	0	0	0	0	0
1305	2	1	0	0	0	0	0	0	0	0	0	0
1306	1	1	0	0	0	0	0	0	0	0	0	0
1307	1	0	0	0	0	0	0	0	0	0	0	0
1308	1	1	0	0	0	0	0	0	0	0	0	0
1309	1	1	0	0	0	0	0	0	0	0	0	0
1310	1	0	0	0	0	0	0	0	0	0	0	0
1311	1	1	0	0	0	0	0	0	0	1	0	0
1312	1	0	0	0	0	0	0	0	0	0	0	0
1313	1	2	0	0	0	0	0	0	0	1	0	0
1314	1	2	0	0	0	0	0	0	0	0	1	0
1315	1	1	0	0	0	0	0	0	0	0	0	0
1316	1	1	0	0	0	0	0	0	0	0	0	0
1316	2	1	0	0	0	0	0	0	0	0	0	0
1316	3	1	0	0	0	0	0	0	0	0	0	0
1317	1	0	0	0	0	0	0	0	0	0	0	0
1318	1	0	0	0	0	0	0	0	0	0	0	0
1319	1	0	0	0	0	0	0	0	0	0	0	0
1320	1	1	0	0	0	0	0	0	0	0	0	0
1320	2	1	0	0	0	0	0	0	0	0	0	0
1321	1	1	0	0	0	0	0	0	0	0	0	0
1322	1	1	0	0	0	0	0	0	0	0	0	0
1323	1	2	0	0	0	0	0	0	0	0	0	0
1324	1	2	0	0	0	0	0	0	0	1	0	0
1325	1	2	0	0	0	0	0	0	0	0	0	0
1326	1	1	0	0	0	0	0	0	0	0	0	0
1327	1	1	0	0	0	0	0	0	0	1	0	0
1328	1	0	0	0	0	0	0	0	0	0	0	0
1329	1	1	0	0	0	0	0	0	0	0	0	0
1329	2	1	0	0	0	0	0	0	0	0	0	0
1330	1	1	0	0	0	0	0	0	0	0	0	0
1331	1	3	0	0	0	0	0	0	0	0	0	0
1331	2	3	0	0	0	0	0	0	0	0	0	0
1332	1	1	0	0	0	0	0	0	0	0	0	0

KEY

Subsys Subsystem

Cash Income Sources

Fod Fresh food

Op Oil Palm

Pot Potato

Pyr Pyrethrum

Ric Rice

Rub Rubber

Shp Sheep

Tea Tea

Tob Tobacco

Ot1 Other 1

Ot2 Other 2

AGRICULTURAL SYSTEM DATA LISTING - CODES

Province: 13 Madang

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
1301	1	04 80	-	4	BJA	07 91	-	4	BJA	04 94	-	3	BJA
1302	1	07 91	-	3	BJA	04 93	-	3	BJA	- -	-	-	-
1303	1	10 91	-	2	BJA	- -	-	-	-	- -	-	-	-
1304	1	07 91	-	3	BJA	- -	-	-	-	- -	-	-	-
1305	1	07 91	-	3	BJA	- -	-	-	-	- -	-	-	-
1305	2	07 91	-	3	BJA	- -	-	-	-	- -	-	-	-
1306	1	07 91	-	3	BJA	- -	-	-	-	- -	-	-	-
1307	1	07 91	-	1	BJA	- -	-	-	-	- -	-	-	-
1308	1	07 91	-	2	A/B	- -	-	-	-	- -	-	-	-
1309	1	07 91	-	3	BJA	- -	-	-	-	- -	-	-	-
1310	1	07 91	-	2	BJA	- -	-	-	-	- -	-	-	-
1311	1	07 91	-	3	RMB	- -	-	-	-	- -	-	-	-
1312	1	- -	-	-	-	- -	-	-	-	- -	-	-	-
1313	1	10 81	-	2	RMB	10 91	-	2	BJA	- -	-	-	-
1314	1	07 91	-	3	BJA	04 94	-	3	BJA	- -	-	-	-
1315	1	08 82	-	3	RMB	12 90	-	2	A/H	07 91	-	4	BHL
1316	1	07 91	-	3	HLN	- -	-	-	-	- -	-	-	-
1316	2	07 91	-	3	HLN	- -	-	-	-	- -	-	-	-
1316	3	07 91	-	3	HLN	- -	-	-	-	- -	-	-	-
1317	1	07 91	-	3	HLN	- -	-	-	-	- -	-	-	-
1318	1	- -	-	-	-	- -	-	-	-	- -	-	-	-
1319	1	- -	-	-	-	- -	-	-	-	- -	-	-	-
1320	1	10 91	-	3	BJA	11 91	-	2	MPL	- -	-	-	-
1320	2	10 91	-	3	BJA	11 91	-	2	MPL	- -	-	-	-
1321	1	10 84	-	3	RMB	07 91	-	3	A/S	- -	-	-	-
1322	1	10 84	-	3	RMB	07 91	-	3	A/S	- -	-	-	-
1323	1	10 91	-	3	A/S	- -	-	-	-	- -	-	-	-
1324	1	10 91	-	4	BJA	- -	-	-	-	- -	-	-	-
1325	1	03 80	-	3	BJA	07 91	-	2	BJA	04 94	-	-	BJA
1326	1	03 80	-	4	BJA	09 91	-	3	BJA	- -	-	-	-
1327	1	10 91	-	3	B/L	12 93	-	3	BJA	- -	-	-	-
1328	1	10 91	-	2	MPL	10 91	-	3	RMB	- -	-	-	-
1329	1	10 91	-	3	RMB	10 91	-	2	MPL	- -	-	-	-
1329	2	10 91	-	3	RMB	10 91	-	2	MPL	- -	-	-	-
1330	1	09 82	-	2	RMB	- -	-	-	-	- -	-	-	-
1331	1	10 91	-	3	BJA	- -	-	-	-	- -	-	-	-
1331	2	10 91	-	3	BJA	- -	-	-	-	- -	-	-	-
1332	1	08 82	-	2	RMB	- -	-	-	-	- -	-	-	-

KEY

Subsys	Subsystem	A/H	B.J. Allen/R.L. Hide
		BHL	R.M. Bourke/ R.L. Hide/M.P. Levett
		BJA	B.J. Allen
		B/L	R.M. Bourke/M.P. Levett
Sv tp	Survey type	RMB	R.M. Bourke
Sv in	Surveyor initials	MPL	M.P. Levett
		A/S	B.J. Allen/G. Sem
		A/B	B.J. Allen/R.M. Bourke
		HLN	R.L. Hide/M.P. Levett/I.S. Majnep/ T. Nen

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: 13 Madang

Village		Population	System	Village		Population	System
DISTRICT	1 Rai Coast			39	WINDILUK	105	1328
Division	1 Long Island			40	YAGOMI	151	1320
	1 BOK	324	1312	Division	5 Mot		
	2 KAUT	180	1312	1	AIYAWANG	187	1328
	3 MALALA	313	1312	2	AMUN	113	1320
	4 MATAFUNA	180	1312	3	ASANG	112	1328
Division	2 Yupna			4	BAGALAWA	69	1329
	10 KWEMBUM	132	1329	5	BILIAU	184	1328
	13 TEPTep	282	1327	6	BILONG	232	1328
	15 WANDABONG	305	1328	7	BUSAKA	63	1328
	16 WASIKOKOP	273	1327	8	DAMOIN	115	1320
Division	3 Nankina			9	GABUMI	59	1328
	1 BAMBU	544	1329	10	GALEK	150	1320
	2 GUMBAION	267	1329	11	GUHUNGOR	96	1328
	3 GWARAWON	415	1329	12	KIAMBAUI	84	1328
	4 MAMBIT	93	1328	13	KOIAKU	103	1328
	5 MEBU	222	1328	14	KOKING	120	1328
	6 MIOK	283	1329	15	KUMBURUNKU	225	1328
	7 TARIKNAM	53	1328	16	LUSUANG	51	1328
	8 TEPMAWON	284	1329	17	MAIBANG	152	1320
	9 YAUANGOBA	201	1329	18	MASI	104	1328
Division	4 Warup			19	MATOKO	209	1328
	1 BAGEN	79	1320	20	MAUWERERE	270	1328
	2 BANDIT	60	1320	21	MUNIANA	112	1328
	3 BARU	75	1320	22	RAMBA	90	1328
	4 BONGA	165	1320	23	REITE	127	1328
	5 BULGEBI	21	1328	24	SARI	68	1328
	6 BWANA	237	1328	25	SERiang	101	1320
	7 DABAN	30	1328	26	SIBOG	153	1328
	8 DELBANGAT	64	1328	27	SILALING	73	1328
	9 FAIGURUP	127	1320	28	SINDAMA	126	1328
	10 FANGGER	85	1320	29	SINGOR	84	1320
	11 GABUTAMON	323	1329	30	SISAGEL	53	1320
	12 GALI	118	1320	31	SOR	77	1328
	13 GUIARAK	65	1328	32	SORANG	101	1328
	14 KABUNDANGIN	21	1328	33	SUIT	254	1320
	15 KAKIMA	116	1320	34	SURI	40	1328
	16 KALALIN	80	1320	35	WAB	169	1320
	17 KAPUNGAPANG	138	1328	36	WAIBOL	88	1328
	18 KASU	128	1320	37	WARAI	125	1320
	19 KEPOIAK	62	1328	38	YAMAI	168	1320
	20 KUPDUI	15	1320	39	YAUNIAI	152	1320
	21 MALALAMAI	169	1320	40	YEIMAS	105	1320
	22 MAMGAK	172	1320	41	YOGAYOGA	83	1328
	23 MOAM	114	1329	42	YORI	73	1320
	24 MONARA	52	1328	43	YORKI	192	1328
	25 MULUMIANG	187	1328	44	YORKIA	144	1328
	26 MUR	216	1320	Division	6 Yaganon		
	27 NAMPA-SUANG	118	1320	1	BAGONDA	97	1329
	28 PESANGANA	54	1320	2	BASOR	225	1320
	29 SAWOI	91	1320	3	BAUBO	47	1328
	30 SEL	247	1320	4	BIDUA	66	1320
	31 SEURE	179	1320	5	BOTOTO	138	1328
	32 SOMEK	166	1328	6	BUDAMU	107	1328
	33 SUBURA	155	1320	7	DEIN	42	1320
	34 TALMIRO	72	1320	8	DIMAN	78	1328
	35 TAPEN	435	1328	9	DOGINGO	85	1328
	36 UMBOLDI	86	1328	10	DUMUN	34	1328
	37 WATANG	95	1320	11	FORGUAN	101	1328
	38 WILWILAN	73	1320	12	FUNYUNDE	329	1328

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER

Province: 13 Madang

Village	Population	System	Village	Population	System		
13	GANGLAU	58	1320	20	KWATO	130	1328
14	GOGOU	61	1320	21	LALOK	311	1320
15	GUHU	253	1328	22	MABELUKU	49	1328
16	GUTI	53	1328	23	MALE	227	1320
17	KARAKARA	56	1328	24	PULABU	37	1328
18	KUBIGAM	128	1329	25	RERAU	204	1320
19	KUBUK	35	1320	26	SAIPA	87	1303
20	KULILAU	19	1320	27	TUMBU	65	1328
21	KUREI	97	1328	28	WENGE	69	1328
22	KWONGO	299	1328	29	WUIA	129	1320
23	LAMTUB	117	1320	30	YABIE	32	1303
24	MEIBU	249	1328	31	YAULA	60	1328
25	MINDIRI	104	1320	32	YOKOPI	36	1303
26	ONGO	110	1328	Division 9 North Ambenob			
27	ORINMA	346	1328	1	ABAR	65	1302
28	SAKORILA	91	1328	2	ALUAK	75	1302
29	SARAKIRI	198	1328	4	BAITETA	91	1302
30	SEGI	69	1328	5	BIDIMAI	63	1303
31	SIMIDIDI	284	1328	6	BUDIP	135	1302
32	SINANGE	95	1328	7	BUDAD	76	1301
33	SITABA	160	1328	8	BUTELGUT	82	1303
34	WADO	90	1328	9	GARIGUT	59	1302
35	WANGETO	240	1329	10	GEGERI	61	1303
36	YUNGENDAM	113	1328	11	GUHUP	88	1303
DISTRICT 2 Madang				12	H Aidurem	118	1302
Division 7 Kabenau				13	HAIMO	59	1302
1	ARAWUM	69	1320	14	HAPURPI	80	1303
2	BANG	212	1328	15	HAVEN	100	1302
3	BANGRI	60	1328	16	HIPONDIK	91	1302
4	BIBI	88	1320	17	ITAPI	65	1303
5	GUR	53	1328	18	KAMBA	363	1302
6	KUL	177	1320	19	KAURIS	172	1302
7	KUMISANGER	173	1320	20	LAPTING	76	1302
8	KWANJE	76	1303	21	MABENOB	180	1302
9	MARAKUM	113	1320	22	MALAMAL	108	1301
10	RIMBA	111	1320	23	MANEP	6	1303
11	SEKWANAM	95	1320	24	MEBAT	212	1302
12	SONGUM	144	1320	25	MIS	225	1301
13	YANGULAM	94	1320	26	MUKURU	103	1303
Division 8 Bogadjim				27	NAKE	26	1303
1	AIYAU	155	1328	28	NOBANOB	507	1302
2	ALIBU	152	1328	29	RIWO	780	1301
3	ASUI	40	1328	31	SEK	298	1301
4	ATO	138	1324	32	SIAR	510	1301
5	BAIPA	17	1303	33	SILIBOB	120	1302
6	BALAIA	70	1320	35	WANGAR	64	1302
7	BAUAK	240	1328	Division 10 South Ambenob			
8	BOIMBI	42	1328	1	AGURU	404	1325
9	BOM	462	1320	2	AIHA	207	1325
10	BONGU	432	1320	3	AIYAP	155	1325
11	BUAI	153	1328	4	AMELE	176	1325
12	BURAM	138	1328	5	BAFULU	152	1325
13	DAUMONIA	24	1328	6	BAHOR	104	1301
14	DUDUELA	158	1324	7	BALIMA	105	1324
15	ERIMA	239	1324	8	BANUP	371	1325
16	JAMJAM	119	1320	9	BARAHEIM	265	1302
17	JILIM	196	1328	10	BAU	187	1325
18	KALIKU	99	1320	11	BAUK	136	1303
19	KULEL	69	1328	12	BEMAHAL	165	1325
				13	BILBIL	304	1301

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER
Province: 13 Madang

Village	Population	System	Village	Population	System
14 BILIA	0	1301	Division 12 Transgogol		
15 DALAM	325	1325	1 AMAIMON	78	1324
16 DOGIA	82	1324	2 ATU	49	1326
17 DOLONU	80	1302	3 BAISRIK	155	1303
18 EFU	384	1325	4 BARUM	169	1324
19 FORAN & SISSIAK	0	1314	5 BEMAL	252	1326
20 FULUMU	349	1303	6 BEMARI	38	1324
21 GUMAN	151	1325	7 BERIN	233	1324
22 HAIYA	101	1325	8 BUROA	111	1324
23 HILU	165	1302	9 BURU	155	1324
24 HUDINI	134	1325	10 DERIN	228	1324
25 KESUP	0	1314	11 GARINAM	150	1326
26 KOROG 1	139	1302	12 GOMURU	142	1303
27 KOROG 2	101	1302	13 GONUA	352	1324
28 KRANKET	755	1301	14 JAL	48	1326
29 MARAGA	147	1324	15 JOBTO	154	1326
30 MIRHANAK	88	1325	16 KRAMASARIK	56	1303
31 MIRKUK	126	1302	17 KUYONBON	204	1324
32 MOILSEHU	191	1325	18 MAIR	154	1326
33 OHU	380	1302	19 OUBA	168	1326
34 OHURU	216	1325	20 OUPAN	117	1324
35 OMURU	263	1325	21 SAKWARI	105	1326
36 OPI	64	1302	22 SIHAN	133	1324
37 ORD	136	1301	23 TADUP	86	1324
38 PANIM	146	1301	24 TEBINSARIK	110	1303
39 SAH	141	1325	25 USU	66	1326
40 SALUGU	151	1325	26 WABUSARIK	129	1303
41 SEIN	156	1325	27 WAGUM	196	1324
42 SO	113	1301	28 WAGUMA	47	1324
43 SUAHA	125	1302	29 WEHEGELo	65	1326
44 UMUIN	220	1301	30 BAMSOS	139	1303
45 UMUN	314	1325	31 YAGI	151	1303
46 URUGUN	85	1302	Division 13 Sek Rempu		
47 WAGUK	74	1325	1 ANHABAK	69	1302
49 YAHIL	55	1301	2 ASIWO	26	1303
50 YELSO	212	1325	3 BADIMFOK	34	1303
Division 11 Gal Utu			4 BAGILDIK	85	1301
1 ASIKAN	81	1324	5 BALABAK	82	1302
2 ARAR	48	1303	6 BALBE	35	1302
3 AUTABAK	87	1303	7 BOMASA	183	1301
4 BAIMAK	135	1303	8 DEDA	109	1301
5 BARIK	41	1303	9 KAWE	157	1301
6 GAL 1	78	1303	10 MAIK	48	1303
7 GAL 2	69	1303	11 SEMPI	126	1301
8 GILOLO	43	1324	12 SIGU	88	1302
9 GUMALU	277	1324	Division 14 Saker Garus		
10 GUTEB	62	1303	1 ABAB	124	1303
11 LAGAHA	101	1303	2 ARONIS	388	1302
12 LOWO	30	1324	3 BEMDIK	105	1303
13 MALOLO	61	1324	4 BILAKURA	39	1303
14 MATEPI	86	1303	5 BUBNO	152	1303
15 MAWAN	94	1324	6 BUDUM	184	1303
16 MEGINAM	101	1303	8 BURBURA	62	1302
17 SANIPI	35	1303	9 DUDULA	201	1302
18 SILAUL	151	1324	10 ELEBE	83	1303
19 SILOPI	144	1303	11 GARUP	338	1302
20 UTU	195	1324	12 KUDAS	50	1301
21 WANIF	75	1303	13 KURUM	168	1302
			14 LIKSAL	157	1301

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER

Province: 13 Madang

Village		Population	System	Village		Population	System
15	MATUKAR	219	1301	6	MEGIRANU 1	186	1303
16	SAULIS	126	1302	7	MEGIRANU 2	135	1303
17	UDISIS	262	1301	8	MUNIMATAMAN	53	1303
18	WASAB	94	1302	9	MUSITA	62	1303
19	WASABAMAL	239	1302	10	SELAUSI	108	1303
20	YOIDIK	166	1302	11	SENGRUSENGRU	40	1303
21	MOSIMO	66	1303	12	SILEIBI	56	1303
22	BANAP	80	1301	13	WABRIATAU	102	1303
Division	15 Megiar			14	WANUMA	249	1303
1	BARANIS	320	1301	15	YABSAU	95	1303
2	BASKEN	278	1303	16	YERIA	74	1303
3	DIMIR	501	1303	Division	20 Kosilanta		
4	GAMENKIN	109	1303	1	ABAIYA	80	1303
5	IMBARB	132	1302	2	BAI	112	1324
6	KARKUM	281	1301	3	BARATA	53	1303
7	MALAS	93	1301	4	BOBORANA	30	1303
8	MEGIAR	372	1301	5	DAWA	24	1324
9	MIRAP	415	1301	6	EBENAN	84	1303
10	NOM	120	1301	7	GULKUBRANA	86	1303
11	SARANG	466	1302	8	IDIMAKUMA	137	1303
12	TOKAIN	262	1301	9	IKARINAGRA	70	1303
Division	16 Bunabun			10	ILEBEGUMA	75	1303
1	AREGEREK	70	1302	11	ILIMA	27	1303
2	ASIMBIN	73	1301	12	ILLEMAMKUTU	25	1303
3	BEPOUR	139	1303	13	IVAP	75	1324
5	BUNABUN	256	1301	14	KAGI	34	1324
7	EMBOR	139	1303	15	KOMIARUM	52	1303
8	MAKINTON	186	1303	16	KOSILANTA	84	1303
9	MURUKINAM	198	1301	17	MAGILA	97	1303
10	PERENE	322	1303	18	MAGILAN	175	1303
11	REINDUK	77	1303	19	MARITAMBU	67	1324
12	SEREMBEN	66	1303	20	MUGUNURAMBU	21	1324
13	SARISAWU	121	1302	21	MURUPI	9	1324
14	SOBEROM	106	1303	22	MUSIVANGA	45	1324
15	TAVULTAE	61	1301	23	ORONGA	87	1324
16	YAURE	168	1303	24	PARAWEN	44	1303
Division	17 Inland Bunabun			25	SAMOSA	34	1324
1	HINIHON	186	1303	26	SEVOI	22	1303
2	HENENGABE	261	1303	27	SIMUKU	18	1324
3	KATEKOT	77	1303	28	SOLI	31	1324
4	MABET	109	1303	29	TARINA	45	1303
5	MESEKOR	219	1303	30	UKURIGUMA	61	1303
6	TINAMI	68	1303	31	WAMA	72	1324
7	WANAMBRE	181	1303	32	YARAWATA	40	1303
Division	18 Avisan			DISTRICT	3 Bogia		
1	ABASAKUR 1	292	1303	Division	24 Manam Coastal		
2	ABASAKUR 2	144	1302	1	ABARIA	217	1309
3	AVARTAMUR	70	1303	2	BALIAU	892	1309
4	EVECHIL	146	1302	3	BOKURE	256	1309
6	KOGUMAN	223	1302	4	BOISA ISLAND	339	1310
7	KUKURMASAK	81	1303	5	BORDA	428	1309
8	KUMBUMBA	94	1303	6	BUDUA	128	1309
9	MUTUVAL/KAUNGAVA	125	1303	7	DANGALE	330	1309
10	POROSAE	130	1303	8	DUGULABA 1&2	604	1309
Division	19 Wanuma			10	IASSA	437	1309
1	ARIMATAU	168	1303	11	JOGARI	411	1309
2	ATITAU	102	1303	12	KOLANG	235	1309
3	KAMAMBU	105	1303	13	KULUGUMA	447	1309
4	KAWOT	116	1303	14	MADAURI	133	1309
5	KUMBUNA	25	1303				

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER
Province: 13 Madang

Village		Population	System	Village		Population	System
15	WAIA	243	1309	Division	27	Mugumat-Yakiba	
16	WARIS	124	1309	1	DONGWANAM	136	1304
Division	25	Bogia Coastal		2	DUMADUM	168	1304
1	AIDIBAL	117	1304	3	EVWARAME	48	1304
2	AMBANA	134	1305	4	GUM	45	1304
3	BABANGAUA	87	1305	5	GURUBE	112	1304
4	BIMAT	79	1306	6	KONGNAN	40	1305
6	BONAPUTA	114	1305	7	MOSIAMANOT	173	1304
7	BUBUM	40	1304	8	MORESAPA	152	1304
8	BWANAVAB	70	1304	9	MUGUMAT 1	167	1304
9	DAGOI	37	1305	10	MUGUMAT 2	192	1304
10	DALUA	44	1304	12	PARIAKANAM	50	1304
11	DUGUMOR	103	1304	13	ROUMIRAP	86	1304
12	KAUKOMBA	105	1305	14	SANARVAT	80	1304
13	LILAU	85	1305	15	SIRIKIN 1&2	501	1304
14	MILALIMUDA	54	1304	16	TURUPARD	120	1304
15	MOAB	73	1305	17	TURUTAPA	92	1304
16	SABERO	37	1304	18	WADAGINAM	470	1304
17	SIRIAR	50	1305	19	WAGADAP	68	1304
18	TOBENAM	92	1305	20	WAGIMUNDA	165	1304
19	WANARU	72	1304	21	YAKIBA	145	1304
20	WANGOR	85	1305	22	YAVERA	69	1304
21	WEDARO	87	1304	23	SUVAT	104	1304
22	YAMBAYAMBA	72	1305	Division	28	Tangu	
23	SUARU	241	1306	1	AMUK	300	1304
Division	26	Ulingan		2	ANDEAMARUP	210	1304
1	ABABIGAB	68	1304	3	BEIAMP	421	1304
2	AKETA	187	1304	4	DUAPMANG	288	1304
3	ALISUAP	58	1304	5	GIAR	234	1304
4	AMINTEN	132	1305	6	MANGIGIM	293	1304
5	BEIDUP	99	1305	7	SIRIN	188	1304
6	BUSIP	101	1305	8	WASAMB	111	1304
7	EREIBADAS	60	1304	Division	29	Makarup	
8	EREIVANUM	129	1304	1	ABEGANI	280	1305
9	GUGUBAR	152	1304	2	ABER	394	1304
10	KORAK	154	1301	3	ADUI	149	1304
11	MALALA	135	1305	4	APINGAN 1	101	1305
12	MANUNGWAR	108	1304	5	APINGAN 2	98	1305
13	MAWAK	61	1304	6	AREP	173	1304
14	MEDIBUR	199	1305	7	ARIANGON	359	1304
15	MEIWOK	135	1301	8	ARIAP	91	1305
16	MERIMAN	146	1305	9	ARINGEN	235	1305
17	MISIBURA	106	1304	10	BEKUN	36	1305
18	MORO	112	1305	11	BUIAIKULU	204	1306
19	MUAKA	74	1304	12	DIMUK	169	1305
20	PAPUR	73	1304	13	DINAM	276	1305
21	RARIN	127	1305	14	GORAK	119	1305
22	RURUNAT	191	1305	15	GUN 1	83	1305
23	SARAMUN	189	1304	16	GUN 2	93	1305
24	SIKOR	177	1304	17	IGAMUK	83	1304
25	SIMBINI	119	1304	18	IGOS	146	1305
26	SUSURI	188	1304	19	IKEMIN	146	1305
27	TAMAGOT	113	1304	20	IRUARI	196	1305
28	TARIGAPA	163	1304	21	ISENGEN	152	1304
29	TOTO	137	1304	22	ISUNG	191	1304
30	ULATABUN	125	1304	23	KAMASINA	216	1306
31	UWUNIPI	157	1304	24	MAKARUP	149	1305
32	WABA	117	1304	25	MARI	115	1304
33	YEIPAMIR	96	1304	26	MASAWARA	88	1305
				27	NAUPI 1	65	1305

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER

Province: 13 Madang

Village		Population	System	Village		Population	System
28	NAUPI 2	83	1305	8	PAUVRIT	65	1308
29	NIAPAK	84	1305	10	RENG	196	1308
30	PUK	205	1304	11	ROMKUN	185	1307
31	RUGUSAK 2	107	1305	12	SOKUMU	115	1304
32	SEPA	146	1305	13	UMBO	96	1308
33	WANAM	71	1305	14	WOKAM	101	1308
34	WAREKAM	111	1304	15	ZUKIN	204	1307
35	WAREMIS	217	1305	17	BIRAK	21	1307
36	WASANGABANG	240	1305	Division	33 Josephstaal		
Division	30 Hansa Bay			1	AMBOK	205	1304
1	AKUKUM	103	1305	2	ARAMANT	137	1304
2	AWAR	276	1308	3	AVUNAMAKAI	107	1304
3	BANANG	55	1305	4	BOGEN	191	1308
4	BIRAP	187	1307	5	EVUAR	115	1304
5	DAMANGGIP	279	1307	6	GUTEPUK	149	1304
6	GIRI 1	189	1307	7	IANGARET	88	1308
7	GIRI 2	189	1307	8	IKUNDUN	117	1304
8	GWAIA	270	1307	9	INGAVAIA	126	1308
9	IKU	135	1305	10	ISARIKAN	200	1308
10	KOMINUNG	188	1307	11	ITUTANG	141	1304
12	MAKERE	47	1305	12	MAKAPAI	42	1304
13	MINU	62	1307	13	MANDUGAR/SUMUN	110	1304
14	NUBIA	65	1305	14	MISIVINDI	105	1308
15	PIR 1	111	1307	15	MINDIVI	117	1304
16	PIR 2	35	1307	16	MUTUNGU	131	1308
17	RUGUSAK	92	1305	17	OIUMKUIN/AYAT	125	1308
18	SANGAN	62	1305	18	OSUM	92	1308
19	SEPEN 1	179	1308	19	PONDOMA	113	1304
20	SEPEN 2	79	1308	20	PORPOR	55	1304
21	SISIMANGUN	86	1305	21	SUANJAMBI	93	1304
22	TEMNU	145	1307	22	TANGUAT	128	1304
23	TIAP	117	1305	23	TAMANDAPUR	81	1304
24	TONGBUR	112	1305	24	ONGEI	95	1308
25	TUNG	177	1307	25	UTAR	76	1304
26	WAKEMA	111	1305	26	UVORAI	206	1304
27	WARINUNG	97	1307	27	WAIUTANG	125	1304
Division	31 Lower Ramu			28	WAITITANGU/GIRIMBOK108		1304
1	BAK	276	1307	29	YIGEBUGOR	51	1308
3	BOTBOT	125	1308	Division	34 Siluwa		
4	BULIVA	208	1307	1	ARIMBUGOR/MOIE	123	1304
5	DAIDEM	201	1308	2	BANGASAV	153	1304
6	DAMUR	59	1308	3	IABARANGA	91	1304
7	DONGON	200	1308	4	IAMAMUK	100	1303
8	GABUN	199	1308	5	IBUBUE	72	1303
9	GALEK	68	1308	6	INASI	92	1303
10	GAMEI	141	1308	7	INSINSIBI	79	1303
11	GOINBANG	201	1307	8	KANGARANGATE	108	1303
12	KABUK	112	1307	9	KISILA	157	1304
13	MANGAI	103	1307	10	KOKOPOGASA	60	1304
14	MARINGIS	222	1308	11	SAMBANGASAV	64	1304
15	TARINGI	199	1308	13	SIMBAR	93	1304
16	UNKENANG	90	1308	14	SISILIKA	139	1303
17	KAIAN	340	1308	15	TINTIGINEI	154	1304
Division	32 Andarum			17	GAIRA	52	1304
1	ANDARUM	125	1304	Division	35 Urawin		
2	AVUNKUN	120	1308	1	AI-ANDONK	39	1303
3	BARIT	107	1304	2	ARAGINAM	77	1308
4	BANGAPELA	221	1307	3	AMJAIBIBU	145	1304
5	DAKIT	135	1307	4	ANGABA	54	1304
7	LAPTU	146	1308	6	INDAVAI	50	1308

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER

Province: 13 Madang

Village	Population	System	Village	Population	System		
7	IVARAI	56	1308	32	SIMBAIWIWI	25	1303
8	KAIBUGU	123	1303	33	ULIANGUPI	9	1303
9	KATIATI	190	1304	34	WAWAPI	90	1303
10	KIMBUGOR	157	1304	Division	38 Rao Breri		
11	KUNDEGENDE	216	1304	2	ASKUNKA	217	1307
12	MARANGET	80	1308	3	BAMFU	83	1308
13	MAUMIKU	48	1303	5	BROKOTO	93	1308
14	MAVUNDI	131	1304	6	BUMBERA	177	1308
15	NIKSAPAI	54	1304	7	BUNUNGOM	148	1308
16	TEVARI	45	1303	8	CHUNGREBU	109	1307
17	TURAGERE	87	1308	9	DIBU	216	1307
18	USIMBUGOR	221	1304	10	DJAM	123	1307
19	WOGUVUNT	52	1308	11	GOKTO	165	1308
DISTRICT	4 Middle Ramu			12	GONMO	25	1308
Division	36 Angamu-Kumaran			13	GRENGABU	207	1307
1	ANDUGUS	40	1303	14	GUASINGI	178	1307
2	ANIMINIKIN	124	1303	15	IGANA	107	1307
3	ASMISIN	58	1303	16	JABIS	74	1308
4	GALISAKAN	93	1303	17	JITIBU	170	1307
5	GAUM	78	1303	18	JOGOI	129	1308
6	KWARINGIRI	75	1303	19	JONGITA	170	1308
7	LAE	43	1303	20	KOMINIMUNG	197	1307
8	MANGE	111	1303	21	KRAGABU	208	1307
9	SINGEP	57	1303	22	KWANGA	393	1307
10	UMERUM	90	1303	23	LIMBUBU	192	1307
11	USERUK	155	1303	24	LITIBU	147	1308
12	WABU	38	1303	25	MELETO	54	1308
Division	37 Aiome-Angau-Anor			26	MISINKI	245	1307
1	AIANGAT	25	1303	27	MOIBU	130	1307
2	AKAVANGU	43	1303	28	NABRINGI	65	1308
3	AKURUKAI	90	1303	29	NAGRUBU	55	1308
4	ANGAMARVIN	59	1315	30	NAMBABU	67	1307
5	ANYAGOIM	15	1315	31	NANIKESO	26	1308
6	ANIMUNK	243	1315	32	NARESA	152	1307
7	APANAM	38	1315	33	NODABU	304	1307
8	ASAPI	38	1303	35	PAKINGABU	167	1307
9	ASTANGU	64	1303	36	REBU	117	1307
10	ATEMBLE	39	1303	37	ROMKUN	257	1307
11	ATIAPE	62	1307	39	SABU	118	1307
12	ATSUVATAPI	24	1303	40	SUTUBU	329	1307
13	AWAM	56	1303	41	ZUMBA	111	1307
14	DOBARAT	130	1308	42	VIMVITABU	230	1307
15	IPOKONDOR	90	1303	43	WABESI	90	1308
16	IPORAITZ	124	1308	44	WATABU	126	1307
17	IRAGARAT	319	1308	45	WENGABU	130	1307
18	IRARAPI	49	1303	46	WOBU	173	1308
19	IRIVAIS	64	1303	951	MUI	177	1308
20	ISOWAK	42	1303	952	PELLA	80	1308
21	ITARANGU	136	1303	953	TOVIAN	104	1308
22	IVAGRIPI	56	1303	Division	39 Western Schraders		
23	IWAM	57	1303	1	ANGA BERE	196	1318
24	KONDOR	75	1315	2	ARADIMP	309	1317
25	KURAKEM	77	1308	3	DANGU	93	1318
26	LONGAR	30	1303	4	DUNDULOMP	127	1315
27	MOTOKON	33	1308	5	FAINJUR	206	1315
28	NAMBINJ	45	1303	6	FANKFANK	161	1318
29	PARAPASAM	59	1303	7	FITAKO	145	1318
30	PASINKAP	103	1303	8	GEBRAU	526	1317
31	PUNGAMBU	58	1303	9	GOMP	158	1317
				10	GUBAINE	335	1317

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER

Province: 13 Madang

Village	Population	System	Village	Population	System
11 KEIBAM	202	1315	4 KANAINJ	669	1315
12 SANGAPI	322	1317	5 KOMARAGA	183	1315
13 TINGI	162	1317	6 KUAK	47	1315
14 WULIM	167	1317	7 KUPI	91	1308
15 YAHL	74	1318	8 MANYINBAI	103	1315
16 YENT	22	1318	9 TUNGAGA	138	1315
17 YUMP	197	1318			
Division 40 Kaironk			DISTRICT 5 Upper Ramu		
1 AINONK	596	1317	Division 45 Bundi		
2 ARAPAN	202	1316	1 ARANAM	99	1322
3 ARENAMP	270	1318	2 BAUI	183	1322
4 BILUM	321	1317	3 BOGAI	266	1321
5 FUNDUM	259	1316	4 BONONI	304	1322
6 FUNGOI	474	1316	5 BRAHMAN	255	1303
7 KAIRONK	660	1316	6 BUNDIKARA	333	1322
8 SALEMP	522	1317	7 DAGAMBARU	155	1322
9 SANGUVAK	530	1317	8 DIDINONGOI	51	1322
10 WOMUK	652	1317	9 EMEGARI	341	1321
11 WOWO	390	1318	10 FAITA	84	1303
Division 41 Asai			12 GOGUBAGU	168	1322
1 AIGRAM	195	1315	13 GUIEBI	262	1322
2 ARUNK	268	1316	14 ISABI	113	1321
3 GALAI	285	1315	15 KARAMUKE	460	1322
4 GIRINGIRI	265	1316	16 KARISOKARA	274	1322
5 KANDUM	446	1316	17 KINDARUPA	232	1322
6 KARAP	67	1315	18 KURINOGOBU	237	1322
7 KEREIVEN	399	1316	19 MARUM	125	1322
8 KURUMDEK	397	1316	20 MOKINANGI	245	1322
9 MURIKI	157	1316	22 OMKWISI	98	1321
10 TINAM	218	1316	23 PISINGAMI	77	1321
11 YAMBUNGLIN	250	1316	24 PROMISI	68	1321
12 YOMNIGI	264	1316	25 PUPUNERI	194	1322
Division 42 Simbai			26 MENDI	194	1321
1 BABAIMP	599	1316	28 TAUYA	193	1303
2 GABUN	512	1316	29 TERI	38	1303
3 GONGRAU	218	1316	30 TUGUMA	61	1321
4 KAKOPI	175	1316	31 YAIKORO	43	1322
5 KAMPANYING	237	1316	32 YANDERA	479	1322
6 KOKI	566	1316	Division 46 Igoi-Sop		
7 KUIB	208	1316	1 ARIMORI	87	1326
8 KUMBRUF	908	1316	2 BANAM	76	1303
9 MIAMI	242	1316	3 BEIRE	181	1326
10 NUGUNT	744	1316	4 BIGEI	101	1303
11 TSUNGUP	619	1315	5 BIL	88	1303
Division 43 Mareng			6 DANARU	134	1303
1 BANK	359	1315	7 DUNUBA	67	1303
2 FOGAIKUMPF	173	1315	8 GARALIGUT	131	1303
3 GAI	300	1315	9 IGOI	81	1303
4 GUNTS	276	1315	10 KALAFULUM	28	1303
5 KINIMBONG	421	1315	11 KEPSAU	44	1326
6 MONDO	177	1315	12 KIKIREI	50	1303
7 NIMBRA	285	1315	13 KOMAS	244	1326
8 SINGINAI	114	1315	14 MUSAK	42	1303
9 TSANGAMP	177	1315	15 SEPU	60	1303
10 TSEMBIUMP	133	1316	16 USINO	342	1303
11 TSEMBAGA	220	1315	Division 47 Bagasin		
Division 44 Gainj			1 AIGUT	63	1303
1 AINGDAI	235	1315	2 AMASUA	136	1326
2 AMBISIBA	284	1315	3 ANIMINIK	105	1303
3 FOREGA	66	1308	4 AUPIO	85	1303

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER

Province: 13 Madang

Village	Population	System	Village	Population	System
5 BEGESIN	110	1326	7 SANKIAN	257	1331
6 BAISOP	114	1326	Division 51 Naho Rawa		
8 BOKWA	93	1326	1 BAKOKONA	311	1313
9 EIONIMEK	196	1326	2 BARIM	399	1313
10 ENSARUP	71	1326	3 BERINGE/NANGOIYA	60	1313
11 GASUA	102	1303	4 BORO	62	1313
12 GASUAL	110	1303	5 BUTEMU	320	1313
13 INOMTOP	103	1326	6 DAMANTE	106	1313
14 KONENGUL	80	1326	7 GOILO	238	1313
15 KUNDUK	65	1303	8 GOMUMU	531	1313
16 NEGIRI	303	1303	9 GONGEIA	169	1313
17 OWORU	169	1326	10 GUMBARAMI	235	1313
18 SAI	75	1326	11 GURIA	202	1313
19 SANAWAI	208	1326	12 GURUMBO	97	1313
20 URIRAI	111	1326	13 KIKIPEI	200	1313
Division 48 Sumau-Garia			14 MORO	355	1313
1 BIRIBIRIE	52	1303	15 MORORO	94	1313
2 EWEIWA	111	1326	16 MUNGO NAHO	149	1313
3 IBINORO	190	1326	17 MUNGO RAWA	166	1313
4 IGURUE	113	1303	18 NININGO	352	1313
5 INAM	55	1326	19 SAGASAGA	68	1313
6 NUGU	87	1303	20 SARANGA	352	1313
7 POINE	174	1326	21 SENEI	117	1313
8 PUKSAK	101	1303	22 SERENGO	270	1313
9 SUMAU	148	1326	23 SEWE	328	1313
10 TABABU	124	1326	24 SIMBO	210	1313
11 TOTOPA	258	1326	25 SISIMBA	138	1313
12 URIA	162	1326	26 SUNUKAI	176	1313
13 MOPO	144	1326	28 WALI	80	1313
14 NARU	123	1303	29 WAMUNTE	311	1313
15 WAPUT	123	1303			
Division 49 Urigina-Kesawai			DISTRICT 6 Karkar		
1 ALEVETI	165	1321	Division 21 Waskia		
2 ASAS	120	1303	1 APARE	151	1311
5 KESA	117	1303	2 BANGME	416	1311
6 KESAWAI	244	1323	3 BUSON	147	1311
7 KETUBA	87	1303	4 DAILDIGU	190	1311
8 KORIGEI	97	1303	5 DIMER	363	1311
9 KORIGINA	45	1303	6 DOROKATAM	181	1311
10 KORONA	88	1303	7 GIAL	497	1311
11 KOROPA	156	1303	8 KAUL 1	542	1311
12 MATA LOI	94	1303	9 KAUL 2	280	1311
13 ONGORU	108	1303	10 KAUL 3	539	1311
14 PERI	34	1303	11 KAUL 4&5	269	1311
15 RAIBANA	63	1303	12 KAVIAK	406	1311
16 SANA	43	1303	13 KENG	356	1311
17 SAUSI	128	1303	14 KINIM	239	1311
18 URIA	96	1303	15 KOROPAK	314	1311
19 URIGINA 1	77	1303	16 KUBURNE	153	1311
20 URIGINA 2	116	1303	17 KULKUL	157	1311
21 WIAI	40	1303	18 KURUMLANG	108	1311
22 YAKUMBU	147	1303	19 KURUMTAUR	168	1311
23 WAIMERIBA	61	1303	20 LANGLANG	165	1311
Division 50 Dumpu-Kaigulan			21 MAPOR	367	1311
1 ABIKAL	56	1323	22 MARANGIS	266	1311
2 BEMBE	91	1323	23 MATER	245	1311
3 BOPIRUMPUN	162	1331	24 MOM 1, 2 AND 3	356	1311
4 BUMBU	159	1331	25 NARER	571	1311
5 DUMPU	175	1323	26 NGOR	171	1311
6 MUSUAM	198	1331	27 SANGANA	431	1311

6.1 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN CENSUS ORDER
Province: 13 Madang

Village		Population	System	Village		Population	System
28	SIKENTIKA	230	1311	15	KUMORIA 1 AND 2	613	1311
29	TARAK	144	1311	16	KURUM	502	1311
30	TUGUTUGU	275	1311	17	LILLOI	499	1311
31	URARA	171	1311	18	MANGAR 1	264	1311
32	URUGEN	807	1311	19	MANGAR 2	136	1311
Division	22 Takia			20	MARUP 1	581	1311
1	BAFOR	446	1311	21	MARUP 2	399	1311
2	BIU	350	1311	22	MOBAN	298	1311
3	BOROMAN	645	1311	23	MULUK	221	1311
4	DANGSAI	203	1311	24	PAIN	172	1311
5	DAUP	176	1311	25	PATILO	395	1311
6	DID	508	1311	26	ULUN 1&2	361	1311
7	DUMAD	371	1311	27	WADAU	227	1311
8	GAMOG	365	1311	28	WAKON	254	1311
9	KATOM	232	1311	29	WARAT	100	1311
10	KAVAILO	242	1311	30	YAGADUN	503	1311
11	KEVASOP	452	1311	Division	23 Bagabag		
12	KILDEN	329	1311	1	BADILU	240	1311
13	KUBAM	151	1311	2	MATIU 1	205	1311
14	KUDUK	494	1311	3	MATIU 2	315	1311

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER
Province: 13 Madang

Village	Dist	Div	Unit	System	Village	Dist	Div	Unit	System
ABAB	2	14	1	1303	ARAPAN	4	40	2	1316
ABABIGAB	3	26	1	1304	ARAR	2	11	2	1303
ABAIYA	2	20	1	1303	ARAWUM	2	7	1	1320
ABAR	2	9	1	1302	AREGEREK	2	16	1	1302
ABARIA	3	24	1	1309	ARENAMP	4	40	3	1318
ABASAKUR 1	2	18	1	1303	AREP	3	29	6	1304
ABASAKUR 2	2	18	2	1302	ARIANGON	3	29	7	1304
ABEGANI	3	29	1	1305	ARIAP	3	29	8	1305
ABER	3	29	2	1304	ARIMATAU	2	19	1	1303
ABIKAL	5	50	1	1323	ARIMBUGOR/MOIE	3	34	1	1304
ADUI	3	29	3	1304	ARIMORI	5	46	1	1326
AGURU	2	10	1	1325	ARINGEN	3	29	9	1305
AI-ANDONK	3	35	1	1303	ARONIS	2	14	2	1302
AIANGAT	4	37	1	1303	ARUNK	4	41	2	1316
AIDIBAL	3	25	1	1304	ASANG	1	5	3	1328
AIGRAM	4	41	1	1315	ASAPI	4	37	8	1303
AIGUT	5	47	1	1303	ASAS	5	49	2	1303
AIHA	2	10	2	1325	ASIKAN	2	11	1	1324
AINGDAI	4	44	1	1315	ASIMBIN	2	16	2	1301
AINONK	4	40	1	1317	ASIWO	2	13	2	1303
AIYAP	2	10	3	1325	ASKUNKA	4	38	2	1307
AIYAU	2	8	1	1328	ASMISIN	4	36	3	1303
AIYAWANG	1	5	1	1328	ASTANGU	4	37	9	1303
AKAVANGU	4	37	2	1303	ASUI	2	8	3	1328
AKETA	3	26	2	1304	ATEMBLE	4	37	10	1303
AKUKUM	3	30	1	1305	ATIAPE	4	37	11	1307
AKURUKAI	4	37	3	1303	ATITAU	2	19	2	1303
ALEVETI	5	49	1	1321	ATO	2	8	4	1324
ALIBU	2	8	2	1328	ATSUVATAPI	4	37	12	1303
ALISUAP	3	26	3	1304	ATU	2	12	2	1326
ALUAK	2	9	2	1302	AUPIO	5	47	4	1303
AMAIMON	2	12	1	1324	AUTABAK	2	11	3	1303
AMASUA	5	47	2	1326	AVARTAMUR	2	18	3	1303
AMBANA	3	25	2	1305	AVUNAMAKAI	3	33	3	1304
AMBISIBA	4	44	2	1315	AVUNKUN	3	32	2	1308
AMBOK	3	33	1	1304	AWAM	4	37	13	1303
AMELE	2	10	4	1325	AWAR	3	30	2	1308
AMINTEN	3	26	4	1305					
AMJAIBIBU	3	35	3	1304	BABAIMP	4	42	1	1316
AMUK	3	28	1	1304	BABANGAU	3	25	3	1305
AMUN	1	5	2	1320	BADILU	6	23	1	1311
ANDARUM	3	32	1	1304	BADIMFOK	2	13	3	1303
ANDEAMARUP	3	28	2	1304	BAFOR	6	22	1	1311
ANDUGUS	4	36	1	1303	BAFULU	2	10	5	1325
ANGA BERE	4	39	1	1318	BAGALAWA	1	5	4	1329
ANGABA	3	35	4	1304	BAGEN	1	4	1	1320
ANGAMARVIN	4	37	4	1315	BAGILDIK	2	13	4	1301
ANHABAK	2	13	1	1302	BAGONDA	1	6	1	1329
ANIMINIK	5	47	3	1303	BAHOR	2	10	6	1301
ANIMINIKIN	4	36	2	1303	BAI	2	20	2	1324
ANIMUNK	4	37	6	1315	BAIMAK	2	11	4	1303
ANYAGOIM	4	37	5	1315	BAIPA	2	8	5	1303
APANAM	4	37	7	1315	BAISOP	5	47	6	1326
APARE	6	21	1	1311	BAISRIK	2	12	3	1303
APINGAN 1	3	29	4	1305	BAITETA	2	9	4	1302
APINGAN 2	3	29	5	1305	BAK	3	31	1	1307
ARADIMP	4	39	2	1317	BAKOKONA	5	51	1	1313
ARAGINAM	3	35	2	1308	BALABAK	2	13	5	1302
ARAMANT	3	33	2	1304	BALAI	2	8	6	1320
ARANAM	5	45	1	1322	BALBE	2	13	6	1302

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER
Province: 13 Madang

Village	Dist	Div	Unit	System	Village	Dist	Div	Unit	System
BALIAU	3	24	2	1309	BOBORANA	2	20	4	1303
BALIMA	2	10	7	1324	BOGAI	5	45	3	1321
BAMBU	1	3	1	1329	BOGEN	3	33	4	1308
BAMFU	4	38	3	1308	BOIMBI	2	8	8	1328
BAMSOS	2	12	30	1303	BOISA ISLAND	3	24	4	1310
BANAM	5	46	2	1303	BOK	1	1	1	1312
BANANG	3	30	3	1305	BOKURE	3	24	3	1309
BANAP	2	14	22	1301	BOKWA	5	47	8	1326
BANDIT	1	4	2	1320	BOM	2	8	9	1320
BANG	2	7	2	1328	BOMASA	2	13	7	1301
BANGAPELA	3	32	4	1307	BONAPUTA	3	25	6	1305
BANGASAV	3	34	2	1304	BONGA	1	4	4	1320
BANGME	6	21	2	1311	BONGU	2	8	10	1320
BANGRI	2	7	3	1328	BONONI	5	45	4	1322
BANK	4	43	1	1315	BOPIRUMPUN	5	50	3	1331
BANUP	2	10	8	1325	BORDA	3	24	5	1309
BARAHEIM	2	10	9	1302	BORO	5	51	4	1313
BARANIS	2	15	1	1301	BOROMAN	6	22	3	1311
BARATA	2	20	3	1303	BOTBOT	3	31	3	1308
BARIK	2	11	5	1303	BOTOTO	1	6	5	1328
BARIM	5	51	2	1313	BRAHMAN	5	45	5	1303
BARIT	3	32	3	1304	BROKOTO	4	38	5	1308
BARU	1	4	3	1320	BUAI	2	8	11	1328
BARUM	2	12	4	1324	BUBNO	2	14	5	1303
BASKEN	2	15	2	1303	BUBUM	3	25	7	1304
BASOR	1	6	2	1320	BUDAD	2	9	7	1301
BAU	2	10	10	1325	BUDAMU	1	6	6	1328
BAUAK	2	8	7	1328	BUDIP	2	9	6	1302
BAUBO	1	6	3	1328	BUDUA	3	24	6	1309
BAUI	5	45	2	1322	BUDUM	2	14	6	1303
BAUK	2	10	11	1303	BUIAIKULU	3	29	11	1306
BEGESIN	5	47	5	1326	BULGEBI	1	4	5	1328
BEIAMP	3	28	3	1304	BULIVA	3	31	4	1307
BEIDUP	3	26	5	1305	BUMBERA	4	38	6	1308
BEIRE	5	46	3	1326	BUMBU	5	50	4	1331
BEKUN	3	29	10	1305	BUNABUN	2	16	5	1301
BEMAHAL	2	10	12	1325	BUNDIKARA	5	45	6	1322
BEMAL	2	12	5	1326	BUNUNGOM	4	38	7	1308
BEMARI	2	12	6	1324	BURAM	2	8	12	1328
BEMBE	5	50	2	1323	BURBURA	2	14	8	1302
BEMDIK	2	14	3	1303	BUROA	2	12	8	1324
BEPOUR	2	16	3	1303	BURU	2	12	9	1324
BERIN	2	12	7	1324	BUSAKA	1	5	7	1328
BERINGE/NANGOIYA	5	51	3	1313	BUSIP	3	26	6	1305
BIBI	2	7	4	1320	BUSON	6	21	3	1311
BIDIMAI	2	9	5	1303	BUTELGUT	2	9	8	1303
BIDUA	1	6	4	1320	BUTEMU	5	51	5	1313
BIGEI	5	46	4	1303	BWANA	1	4	6	1328
BIL	5	46	5	1303	BWANAVAB	3	25	8	1304
BILAKURA	2	14	4	1303					
BILBIL	2	10	13	1301	CHUNGREBU	4	38	8	1307
BILIA	2	10	14	1301					
BILIAU	1	5	5	1328	DABAN	1	4	7	1328
BILONG	1	5	6	1328	DAGAMBARU	5	45	7	1322
BILUM	4	40	4	1317	DAGOI	3	25	9	1305
BIMAT	3	25	4	1306	DAIDEM	3	31	5	1308
BIRAK	3	32	17	1307	DAILDIGU	6	21	4	1311
BIRAP	3	30	4	1307	DAKIT	3	32	5	1307
BIRIBIRIE	5	48	1	1303	DALAM	2	10	15	1325
BIU	6	22	2	1311	DALUA	3	25	10	1304

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER
Province: 13 Madang

Village	Dist	Div	Unit	System	Village	Dist	Div	Unit	System
DAMANGGIP	3	30	5	1307	FAITA	5	45	10	1303
DAMANTE	5	51	6	1313	FANGGER	1	4	10	1320
DAMOIN	1	5	8	1320	FANKFANK	4	39	6	1318
DAMUR	3	31	6	1308	FITAKO	4	39	7	1318
DANARU	5	46	6	1303	FOGAIKUMPF	4	43	2	1315
DANGALE	3	24	7	1309	FORAN & SISSIAK	2	10	19	1314
DANGSAI	6	22	4	1311	FOREGA	4	44	3	1308
DANGU	4	39	3	1318	FORGUAN	1	6	11	1328
DAUMONIA	2	8	13	1328	FULUMU	2	10	20	1303
DAUP	6	22	5	1311	FUNDUM	4	40	5	1316
DAWA	2	20	5	1324	FUNGOI	4	40	6	1316
DEDA	2	13	8	1301	FUNYUNDE	1	6	12	1328
DEIN	1	6	7	1320					
DELBANGAT	1	4	8	1328	GABUMI	1	5	9	1328
DERIN	2	12	10	1324	GABUN	3	31	8	1308
DIBU	4	38	9	1307	GABUN	4	42	2	1316
DID	6	22	6	1311	GABUTAMON	1	4	11	1329
DIDINONGOI	5	45	8	1322	GAI	4	43	3	1315
DIMAN	1	6	8	1328	GAIRA	3	34	17	1304
DIMER	6	21	5	1311	GAL 1	2	11	6	1303
DIMIR	2	15	3	1303	GAL 2	2	11	7	1303
DIMUK	3	29	12	1305	GALAI	4	41	3	1315
DINAM	3	29	13	1305	GALEK	1	5	10	1320
DJAM	4	38	10	1307	GALEK	3	31	9	1308
DOBARAT	4	37	14	1308	GALI	1	4	12	1320
DOGIA	2	10	16	1324	GALISAKAN	4	36	4	1303
DOGINGO	1	6	9	1328	GAMEI	3	31	10	1308
DOLONU	2	10	17	1302	GAMENKIN	2	15	4	1303
DONGON	3	31	7	1308	GAMOG	6	22	8	1311
DONGWANAM	3	27	1	1304	GANGLAU	1	6	13	1320
DOROKATAM	6	21	6	1311	GARALIGUT	5	46	8	1303
DUAPMANG	3	28	4	1304	GARIGUT	2	9	9	1302
DUDUELA	2	8	14	1324	GARINAM	2	12	11	1326
DUDULA	2	14	9	1302	GARUP	2	14	11	1302
DUGULABA 1&2	3	24	8	1309	GASUA	5	47	11	1303
DUGUMOR	3	25	11	1304	GASUAL	5	47	12	1303
DUMAD	6	22	7	1311	GAUM	4	36	5	1303
DUMADUM	3	27	2	1304	GEBRAU	4	39	8	1317
DUMPU	5	50	5	1323	GEGERI	2	9	10	1303
DUMUN	1	6	10	1328	GIAL	6	21	7	1311
DUNDULOMP	4	39	4	1315	GIAR	3	28	5	1304
DUNUBA	5	46	7	1303	GILOLO	2	11	8	1324
					GIRI 1	3	30	6	1307
EBENAN	2	20	6	1303	GIRI 2	3	30	7	1307
EFU	2	10	18	1325	GIRINGIRI	4	41	4	1316
EIONIMEK	5	47	9	1326	GOGOU	1	6	14	1320
ELEBE	2	14	10	1303	GOGUBAGU	5	45	12	1322
EMBOR	2	16	7	1303	GOILO	5	51	7	1313
EMEGARI	5	45	9	1321	GOINBANG	3	31	11	1307
ENSARUP	5	47	10	1326	GOKTO	4	38	11	1308
EREIBADAS	3	26	7	1304	GOMP	4	39	9	1317
EREIVANUM	3	26	8	1304	GOMUMU	5	51	8	1313
ERIMA	2	8	15	1324	GOMURU	2	12	12	1303
EVECHIL	2	18	4	1302	GONGEIA	5	51	9	1313
EVUAR	3	33	5	1304	GONGRAU	4	42	3	1316
EVWARAME	3	27	3	1304	GONMO	4	38	12	1308
EWIWA	5	48	2	1326	GONUA	2	12	13	1324
					GORAK	3	29	14	1305
FAIGURUP	1	4	9	1320	GRENGABU	4	38	13	1307
FAINJUR	4	39	5	1315	GUASINGI	4	38	14	1307

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER
Province: 13 Madang

Village	Dist	Div	Unit	System	Village	Dist	Div	Unit	System
GUBAINE	4	39	10	1317	INGAVAIA	3	33	9	1308
GUGUBAR	3	26	9	1304	INOMTOP	5	47	13	1326
GUHU	1	6	15	1328	INSINSIBI	3	34	7	1303
GUHUNGOR	1	5	11	1328	IPOKONDOR	4	37	15	1303
GUHUP	2	9	11	1303	IPORAITZ	4	37	16	1308
GUIARAK	1	4	13	1328	IRAGARAT	4	37	17	1308
GUIEBI	5	45	13	1322	IRARAPI	4	37	18	1303
GULKUBRANA	2	20	7	1303	IRIV AIS	4	37	19	1303
GUM	3	27	4	1304	IRUARI	3	29	20	1305
GUMALU	2	11	9	1324	ISABI	5	45	14	1321
GUMAN	2	10	21	1325	ISARIKAN	3	33	10	1308
GUMBAION	1	3	2	1329	ISENGEN	3	29	21	1304
GUMBARAMI	5	51	10	1313	ISOWAK	4	37	20	1303
GUN 1	3	29	15	1305	ISUNG	3	29	22	1304
GUN 2	3	29	16	1305	ITAPI	2	9	17	1303
GUNTS	4	43	4	1315	ITARANGU	4	37	21	1303
GUR	2	7	5	1328	ITUTANG	3	33	11	1304
GURIA	5	51	11	1313	IVAGRIPI	4	37	22	1303
GURUBE	3	27	5	1304	IVAP	2	20	13	1324
GURUMBO	5	51	12	1313	IVARAI	3	35	7	1308
GUTEB	2	11	10	1303	IWAM	4	37	23	1303
GUTEPUK	3	33	6	1304	JABIS	4	38	16	1308
GUTI	1	6	16	1328	JAL	2	12	14	1326
GWAIA	3	30	8	1307	JAMJAM	2	8	16	1320
GWARAWON	1	3	3	1329	JILIM	2	8	17	1328
H Aidurem	2	9	12	1302	JITIBU	4	38	17	1307
HAIMO	2	9	13	1302	JOBTO	2	12	15	1326
HAIYA	2	10	22	1325	JOGARI	3	24	11	1309
HAPURPI	2	9	14	1303	JOGOI	4	38	18	1308
HAVEN	2	9	15	1302	JONGITA	4	38	19	1308
HENENGABE	2	17	2	1303	KABUK	3	31	12	1307
HILU	2	10	23	1302	KABUNDANGIN	1	4	14	1328
HINI HON	2	17	1	1303	KAGI	2	20	14	1324
HIPONDIK	2	9	16	1302	KAIAN	3	31	17	1308
HUDINI	2	10	24	1325	KAIBUGU	3	35	8	1303
IABARANGA	3	34	3	1304	KAIRONK	4	40	7	1316
IAMAMUK	3	34	4	1303	KAKIMA	1	4	15	1320
IANGARET	3	33	7	1308	KAKOPI	4	42	4	1316
IASSA	3	24	10	1309	KALAFULUM	5	46	10	1303
IBINORO	5	48	3	1326	KALALIN	1	4	16	1320
IBUBUE	3	34	5	1303	KALIKU	2	8	18	1320
IDIMAKUMA	2	20	8	1303	KAMAMBU	2	19	3	1303
IGAMUK	3	29	17	1304	KAMASINA	3	29	23	1306
IGANA	4	38	15	1307	KAMBA	2	9	18	1302
IGOI	5	46	9	1303	KAMPANYING	4	42	5	1316
IGOS	3	29	18	1305	KANAINJ	4	44	4	1315
IGURUE	5	48	4	1303	KANDUM	4	41	5	1316
IKARINAGRA	2	20	9	1303	KANGARANGATE	3	34	8	1303
IKEMIN	3	29	19	1305	KAPUNGAPANG	1	4	17	1328
IKU	3	30	9	1305	KARAKARA	1	6	17	1328
IKUNDUN	3	33	8	1304	KARAMUKE	5	45	15	1322
ILEBEGUMA	2	20	10	1303	KARAP	4	41	6	1315
ILIMA	2	20	11	1303	KARISOKARA	5	45	16	1322
ILLEMAMKUTU	2	20	12	1303	KARKUM	2	15	6	1301
IMBARB	2	15	5	1302	KASU	1	4	18	1320
INAM	5	48	5	1326	KATEKOT	2	17	3	1303
INASI	3	34	6	1303	KATIATI	3	35	9	1304
INDAVAI	3	35	6	1308	KATOM	6	22	9	1311

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER
Province: 13 Madang

Village	Dist	Div	Unit	System	Village	Dist	Div	Unit	System
KAUKOMBA	3	25	12	1305	KUBURNE	6	21	16	1311
KAUL 1	6	21	8	1311	KUDAS	2	14	12	1301
KAUL 2	6	21	9	1311	KUDUK	6	22	14	1311
KAUL 3	6	21	10	1311	KUIB	4	42	7	1316
KAUL 4&5	6	21	11	1311	KUKURMASAK	2	18	7	1303
KAURIS	2	9	19	1302	KUL	2	7	6	1320
KAUT	1	1	2	1312	KULEL	2	8	19	1328
KAVAILO	6	22	10	1311	KULILAU	1	6	20	1320
KAVIAK	6	21	12	1311	KULKUL	6	21	17	1311
KAWE	2	13	9	1301	KULUGUMA	3	24	13	1309
KAWOT	2	19	4	1303	KUMBRUF	4	42	8	1316
KEIBAM	4	39	11	1315	KUMBUMBA	2	18	8	1303
KENG	6	21	13	1311	KUMBUNA	2	19	5	1303
KEPOIAK	1	4	19	1328	KUMBURUNKU	1	5	15	1328
KEPSAU	5	46	11	1326	KUMISANGER	2	7	7	1320
KEREIVEN	4	41	7	1316	KUMORIA 1 AND 2	6	22	15	1311
KESA	5	49	5	1303	KUNDEGENDE	3	35	11	1304
KESAWAI	5	49	6	1323	KUNDUK	5	47	15	1303
KESUP	2	10	25	1314	KUPDUI	1	4	20	1320
KETUBA	5	49	7	1303	KUPI	4	44	7	1308
KEVASOP	6	22	11	1311	KURAKEM	4	37	25	1308
KIAMBAN	1	5	12	1328	KUREI	1	6	21	1328
KIKIPEI	5	51	13	1313	KURINOGOBU	5	45	18	1322
KIKIREI	5	46	12	1303	KURUM	2	14	13	1302
KILDEN	6	22	12	1311	KURUM	6	22	16	1311
KIMBUGOR	3	35	10	1304	KURUMDEK	4	41	8	1316
KINDARUPA	5	45	17	1322	KURUMLANG	6	21	18	1311
KINIM	6	21	14	1311	KURUMTAUR	6	21	19	1311
KINIMBONG	4	43	5	1315	KUYONBON	2	12	17	1324
KISILA	3	34	9	1304	KWANGA	4	38	22	1307
KOGUMAN	2	18	6	1302	KWANJE	2	7	8	1303
KOIAKU	1	5	13	1328	KWARINGIRI	4	36	6	1303
KOKI	4	42	6	1316	KWATO	2	8	20	1328
KOKING	1	5	14	1328	KWEMBUM	1	2	10	1329
KOKOPOGASA	3	34	10	1304	KWONGO	1	6	22	1328
KOLANG	3	24	12	1309	LAE	4	36	7	1303
KOMARAGA	4	44	5	1315	LAGAHA	2	11	11	1303
KOMAS	5	46	13	1326	LALOK	2	8	21	1320
KOMIARUM	2	20	15	1303	LAMTUB	1	6	23	1320
KOMINIMUNG	4	38	20	1307	LANGLANG	6	21	20	1311
KOMINUNG	3	30	10	1307	LAPTING	2	9	20	1302
KONDOR	4	37	24	1315	LAPTU	3	32	7	1308
KONENGUL	5	47	14	1326	LIKSAL	2	14	14	1301
KONGNAN	3	27	6	1305	LILAU	3	25	13	1305
KORAK	3	26	10	1301	LILAI	6	22	17	1311
KORIGEI	5	49	8	1303	LIMBUBU	4	38	23	1307
KORIGINA	5	49	9	1303	LITIBU	4	38	24	1308
KOROG 1	2	10	26	1302	LONGAR	4	37	26	1303
KOROG 2	2	10	27	1302	LOWO	2	11	12	1324
KORONA	5	49	10	1303	LUSUANG	1	5	16	1328
KOROPA	5	49	11	1303	MABELUKU	2	8	22	1328
KOROPAK	6	21	15	1311	MABENOB	2	9	21	1302
KOSILANTA	2	20	16	1303	MABET	2	17	4	1303
KRAGABU	4	38	21	1307	MADAURI	3	24	14	1309
KRAMASARIK	2	12	16	1303	MAGILA	2	20	17	1303
KRANKET	2	10	28	1301	MAGILAN	2	20	18	1303
KUAK	4	44	6	1315	MAIBANG	1	5	17	1320
KUBAM	6	22	13	1311	MAIK	2	13	10	1303
KUBIGAM	1	6	18	1329					
KUBUK	1	6	19	1320					

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER
Province: 13 Madang

Village	Dist	Div	Unit	System	Village	Dist	Div	Unit	System
MAIR	2	12	18	1326	MERIMAN	3	26	16	1305
MAKAPAI	3	33	12	1304	MESEKOR	2	17	5	1303
MAKARUP	3	29	24	1305	MIAMI	4	42	9	1316
MAKERE	3	30	12	1305	MILALIMUDA	3	25	14	1304
MAKINTON	2	16	8	1303	MINDIRI	1	6	25	1320
MALALA	1	1	3	1312	MINDIVI	3	33	15	1304
MALALA	3	26	11	1305	MINU	3	30	13	1307
MALALAMAI	1	4	21	1320	MIOK	1	3	6	1329
MALAMAL	2	9	22	1301	MIRAP	2	15	9	1301
MALAS	2	15	7	1301	MIRHANAK	2	10	30	1325
MALE	2	8	23	1320	MIRKUK	2	10	31	1302
MALOLO	2	11	13	1324	MIS	2	9	25	1301
MAMBIT	1	3	4	1328	MISIBURA	3	26	17	1304
MAMGAK	1	4	22	1320	MISINKI	4	38	26	1307
MANDUGAR/SUMUN	3	33	13	1304	MISIVINDI	3	33	14	1308
MANEP	2	9	23	1303	MOAB	3	25	15	1305
MANGAI	3	31	13	1307	MOAM	1	4	23	1329
MANGAR 1	6	22	18	1311	MOBAN	6	22	22	1311
MANGAR 2	6	22	19	1311	MOIBU	4	38	27	1307
MANGE	4	36	8	1303	MOILSEHU	2	10	32	1325
MANGIGIM	3	28	6	1304	MOKINANGI	5	45	20	1322
MANUNGWAR	3	26	12	1304	MOM 1, 2 AND 3	6	21	24	1311
MANYINBAI	4	44	8	1315	MONARA	1	4	24	1328
MAPOR	6	21	21	1311	MONDO	4	43	6	1315
MARAGA	2	10	29	1324	MOPO	5	48	13	1326
MARAKUM	2	7	9	1320	MORESAPA	3	27	8	1304
MARANGET	3	35	12	1308	MORO	3	26	18	1305
MARANGIS	6	21	22	1311	MORO	5	51	14	1313
MARI	3	29	25	1304	MORORO	5	51	15	1313
MARINGIS	3	31	14	1308	MOSIAMANOT	3	27	7	1304
MARITAMBU	2	20	19	1324	MOSIMO	2	14	21	1303
MARUM	5	45	19	1322	MOTOKON	4	37	27	1308
MARUP 1	6	22	20	1311	MUAKA	3	26	19	1304
MARUP 2	6	22	21	1311	MUGUMAT 1	3	27	9	1304
MASAWARA	3	29	26	1305	MUGUMAT 2	3	27	10	1304
MASI	1	5	18	1328	MUGUNURAMBU	2	20	20	1324
MATA LOI	5	49	12	1303	MUI	4	38	951	1308
MATAFUNA	1	1	4	1312	MUKURU	2	9	26	1303
MATEPI	2	11	14	1303	MULUK	6	22	23	1311
MATER	6	21	23	1311	MULUMIANG	1	4	25	1328
MATIU 1	6	23	2	1311	MUNGO NAHO	5	51	16	1313
MATIU 2	6	23	3	1311	MUNGO RAWA	5	51	17	1313
MATOKO	1	5	19	1328	MUNIANA	1	5	21	1328
MATUKAR	2	14	15	1301	MUNIMATAMAN	2	19	8	1303
MAUMIKU	3	35	13	1303	MUR	1	4	26	1320
MAUWERERE	1	5	20	1328	MURIKI	4	41	9	1316
MAVUNDI	3	35	14	1304	MURUKINAM	2	16	9	1301
MAWAK	3	26	13	1304	MURUPI	2	20	21	1324
MAWAN	2	11	15	1324	MUSAK	5	46	14	1303
MEBAT	2	9	24	1302	MUSITA	2	19	9	1303
MEBU	1	3	5	1328	MUSIVANGA	2	20	22	1324
MEDIBUR	3	26	14	1305	MUSUAM	5	50	6	1331
MEGIAR	2	15	8	1301	MUTUNGU	3	33	16	1308
MEGINAM	2	11	16	1303	MUTUVAL/KAUNGAVA	2	18	9	1303
MEGIRANU 1	2	19	6	1303					
MEGIRANU 2	2	19	7	1303	NABRINGI	4	38	28	1308
MEIBU	1	6	24	1328	NAGRUBU	4	38	29	1308
MEIWOK	3	26	15	1301	NAKE	2	9	27	1303
MELETO	4	38	25	1308	NAMBABU	4	38	30	1307
MENDI	5	45	26	1321	NAMBINJ	4	37	28	1303

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER
Province: 13 Madang

Village	Dist	Div	Unit	System	Village	Dist	Div	Unit	System
NAMPA-SUANG	1	4	27	1320	PUKSAK	5	48	8	1303
NANIKESO	4	38	31	1308	PULABU	2	8	24	1328
NARER	6	21	25	1311	PUNGAMBU	4	37	31	1303
NARESA	4	38	32	1307	PUPUNERI	5	45	25	1322
NARU	5	48	14	1303					
NAUPI 1	3	29	27	1305	RAIBANA	5	49	15	1303
NAUPI 2	3	29	28	1305	RAMBA	1	5	22	1328
NEGIRI	5	47	16	1303	RARIN	3	26	21	1305
NGOR	6	21	26	1311	REBU	4	38	36	1307
NIAPAK	3	29	29	1305	REINDUK	2	16	11	1303
NIKSAPAI	3	35	15	1304	REITE	1	5	23	1328
NIMBRA	4	43	7	1315	RENG	3	32	10	1308
NININGO	5	51	18	1313	RERAU	2	8	25	1320
NOBANOB	2	9	28	1302	RIMBA	2	7	10	1320
NODABU	4	38	33	1307	RIWO	2	9	29	1301
NOM	2	15	10	1301	ROMKUN	3	32	11	1307
NUBIA	3	30	14	1305	ROMKUN	4	38	37	1307
NUGU	5	48	6	1303	ROUMIRAP	3	27	13	1304
NUGUNT	4	42	10	1316	RUGUSAK	3	30	17	1305
					RUGUSAK 2	3	29	31	1305
OHU	2	10	33	1302	RURUNAT	3	26	22	1305
OHURU	2	10	34	1325					
OIUMKUIN/AYAT	3	33	17	1308	SABERO	3	25	16	1304
OMKWISI	5	45	22	1321	SABU	4	38	39	1307
OMURU	2	10	35	1325	SAGASAGA	5	51	19	1313
ONGEI	3	33	24	1308	SAH	2	10	39	1325
ONGO	1	6	26	1328	SAI	5	47	18	1326
ONGORU	5	49	13	1303	SAIPA	2	8	26	1303
OPI	2	10	36	1302	SAKORILA	1	6	28	1328
ORD	2	10	37	1301	SAKWARI	2	12	21	1326
ORINMA	1	6	27	1328	SALEMP	4	40	8	1317
ORONGA	2	20	23	1324	SALUGU	2	10	40	1325
OSUM	3	33	18	1308	SAMBANGASAV	3	34	11	1304
OUBA	2	12	19	1326	SAMOSAS	2	20	25	1324
OUPAN	2	12	20	1324	SANA	5	49	16	1303
OWORU	5	47	17	1326	SANARVAT	3	27	14	1304
					SANAWAI	5	47	19	1326
PAIN	6	22	24	1311	SANEPI	2	11	17	1303
PAKINGABU	4	38	35	1307	SANGAN	3	30	18	1305
PANIM	2	10	38	1301	SANGANA	6	21	27	1311
PAPUR	3	26	20	1304	SANGAPI	4	39	12	1317
PARAPASAM	4	37	29	1303	SANGUVAK	4	40	9	1317
PARAWEN	2	20	24	1303	SANKIAN	5	50	7	1331
PARIAKANAM	3	27	12	1304	SARAKIRI	1	6	29	1328
PASINKAP	4	37	30	1303	SARAMUN	3	26	23	1304
PATILO	6	22	25	1311	SARANG	2	15	11	1302
PAUVRIT	3	32	8	1308	SARANGA	5	51	20	1313
PELLA	4	38	952	1308	SARI	1	5	24	1328
PERENE	2	16	10	1303	SARISAWU	2	16	13	1302
PERI	5	49	14	1303	SAULIS	2	14	16	1302
PESANGANA	1	4	28	1320	SAUSI	5	49	17	1303
PIR 1	3	30	15	1307	SAWOI	1	4	29	1320
PIR 2	3	30	16	1307	SEGI	1	6	30	1328
PISINGAMI	5	45	23	1321	SEIN	2	10	41	1325
POINE	5	48	7	1326	SEK	2	9	31	1301
PONDOMA	3	33	19	1304	SEKWANAM	2	7	11	1320
POROSAE	2	18	10	1303	SEL	1	4	30	1320
PORPOR	3	33	20	1304	SELAUSI	2	19	10	1303
PROMISI	5	45	24	1321	SEMPI	2	13	11	1301
PUK	3	29	30	1304	SENEI	5	51	21	1313

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER
Province: 13 Madang

Village	Dist	Div	Unit	System	Village	Dist	Div	Unit	System
SENGRUSENGRU	2	19	11	1303	TABABU	5	48	10	1326
SEPA	3	29	32	1305	TADUP	2	12	23	1324
SEPEN 1	3	30	19	1308	TALMIRO	1	4	34	1320
SEPEN 2	3	30	20	1308	TAMAGOT	3	26	27	1304
SEPU	5	46	15	1303	TAMANDAPUR	3	33	23	1304
SEREMBEN	2	16	12	1303	TANGUAT	3	33	22	1304
SERENGO	5	51	22	1313	TAPEN	1	4	35	1328
SERIANG	1	5	25	1320	TARAK	6	21	29	1311
SEURE	1	4	31	1320	TARIGAPA	3	26	28	1304
SEVOI	2	20	26	1303	TARIKNAM	1	3	7	1328
SEWE	5	51	23	1313	TARINA	2	20	29	1303
SIAR	2	9	32	1301	TARINGI	3	31	15	1308
SIBOG	1	5	26	1328	TAUYA	5	45	28	1303
SIGU	2	13	12	1302	TAVULTAE	2	16	15	1301
SIHAN	2	12	22	1324	TEBINSARIK	2	12	24	1303
SIKENTIKA	6	21	28	1311	TEMNU	3	30	22	1307
SIKOR	3	26	24	1304	TEPMAWON	1	3	8	1329
SILALING	1	5	27	1328	TEPTEP	1	2	13	1327
SILAUL	2	11	18	1324	TERI	5	45	29	1303
SILEIBI	2	19	12	1303	TEVARI	3	35	16	1303
SILIBOB	2	9	33	1302	TIAP	3	30	23	1305
SILOPI	2	11	19	1303	TINAM	4	41	10	1316
SIMBAIWIWI	4	37	32	1303	TINAMI	2	17	6	1303
SIMBAR	3	34	13	1304	TINGI	4	39	13	1317
SIMBINI	3	26	25	1304	TINTIGINEI	3	34	15	1304
SIMBO	5	51	24	1313	TOBENAM	3	25	18	1305
SIMIDIDI	1	6	31	1328	TOKAIN	2	15	12	1301
SIMUKU	2	20	27	1324	TONGBUR	3	30	24	1305
SINANGE	1	6	32	1328	TOTO	3	26	29	1304
SINDAMA	1	5	28	1328	TOTOPA	5	48	11	1326
SINGEP	4	36	9	1303	TOVIAN	4	38	953	1308
SINGINAI	4	43	8	1315	TSANGAMP	4	43	9	1315
SINGOR	1	5	29	1320	TSEMBAGA	4	43	11	1315
SIRIAR	3	25	17	1305	TSEMBIUMP	4	43	10	1316
SIRIKIN 1&2	3	27	15	1304	TSUNGUP	4	42	11	1315
SIRIN	3	28	7	1304	TUGUMA	5	45	30	1321
SISAGEL	1	5	30	1320	TUGUTUGU	6	21	30	1311
SISILIKA	3	34	14	1303	TUMBU	2	8	27	1328
SISIMANGUN	3	30	21	1305	TUNG	3	30	25	1307
SISIMBA	5	51	25	1313	TUNGAGA	4	44	9	1315
SITABA	1	6	33	1328	TURAGERE	3	35	17	1308
SO	2	10	42	1301	TURUPARD	3	27	16	1304
SOBEROM	2	16	14	1303	TURUTAPA	3	27	17	1304
SOKUMU	3	32	12	1304					
SOLI	2	20	28	1324	UDISIS	2	14	17	1301
SOMEK	1	4	32	1328	UKURIGUMA	2	20	30	1303
SONGUM	2	7	12	1320	ULATABUN	3	26	30	1304
SOR	1	5	31	1328	ULIANGUPI	4	37	33	1303
SORANG	1	5	32	1328	ULUN 1&2	6	22	26	1311
SUAH	2	10	43	1302	UMBO	3	32	13	1308
SUANJAMBI	3	33	21	1304	UMBOLDI	1	4	36	1328
SUARU	3	25	23	1306	UMERUM	4	36	10	1303
SUBURA	1	4	33	1320	UMUIN	2	10	44	1301
SUIT	1	5	33	1320	UMUN	2	10	45	1325
SUMAU	5	48	9	1326	UNKENANG	3	31	16	1308
SUNUKAI	5	51	26	1313	URARA	6	21	31	1311
SURI	1	5	34	1328	URIA	5	48	12	1326
SUSURI	3	26	26	1304	URIA	5	49	18	1303
SUTUBU	4	38	40	1307	URIGINA 1	5	49	19	1303
SUVAT	3	27	23	1304	URIGINA 2	5	49	20	1303

6.2 RURAL VILLAGES WITH AGRICULTURAL SYSTEM NUMBERS IN ALPHABETICAL ORDER
Province: 13 Madang

Village	Dist	Div	Unit	System	Village	Dist	Div	Unit	System
URIRAI	5	47	20	1326	WATABU	4	38	44	1307
URUGEN	6	21	32	1311	WATANG	1	4	37	1320
URUGUN	2	10	46	1302	WAWAPI	4	37	34	1303
USERUK	4	36	11	1303	WEDARO	3	25	21	1304
USIMBUGOR	3	35	18	1304	WEHEGELo	2	12	29	1326
USINO	5	46	16	1303	WENGABU	4	38	45	1307
USU	2	12	25	1326	WENGE	2	8	28	1328
UTAR	3	33	25	1304	WIAI	5	49	21	1303
UTU	2	11	20	1324	WILWILAN	1	4	38	1320
UVORAI	3	33	26	1304	WINDILUK	1	4	39	1328
UWUNUPI	3	26	31	1304	WOBU	4	38	46	1308
VIMVITABU	4	38	42	1307	WOGUVUNT	3	35	19	1308
WAB	1	5	35	1320	WOKAM	3	32	14	1308
WABA	3	26	32	1304	WOMUK	4	40	10	1317
WABESI	4	38	43	1308	WOWO	4	40	11	1318
WABRIATAU	2	19	13	1303	WUIA	2	8	29	1320
WABU	4	36	12	1303	WULIM	4	39	14	1317
WABUSARIK	2	12	26	1303	YABIE	2	8	30	1303
WADAGINAM	3	27	18	1304	YABSAU	2	19	15	1303
WADAU	6	22	27	1311	YAGADUN	6	22	30	1311
WADO	1	6	34	1328	YAGI	2	12	31	1303
WAGADAP	3	27	19	1304	YAGOMI	1	4	40	1320
WAGIMUNDA	3	27	20	1304	YAHIL	2	10	49	1301
WAGUK	2	10	47	1325	Y AHL	4	39	15	1318
WAGUM	2	12	27	1324	YAIKORO	5	45	31	1322
WAGUMA	2	12	28	1324	YAKIBA	3	27	21	1304
WAIA	3	24	15	1309	YAKUMBU	5	49	22	1303
WAIBOL	1	5	36	1328	YAMAI	1	5	38	1320
WAIMERIBA	5	49	23	1303	YAMBAYAMBA	3	25	22	1305
WAITITANGU/					YAMBUNGLIN	4	41	11	1316
GIRIMBOK	3	33	28	1304	YANDERA	5	45	32	1322
WAIUTANG	3	33	27	1304	YANGULAM	2	7	13	1320
WAKEMA	3	30	26	1305	YARAWATA	2	20	32	1303
WAKON	6	22	28	1311	YAUANGOBA	1	3	9	1329
WALI	5	51	28	1313	YAULA	2	8	31	1328
WAMA	2	20	31	1324	YAUNIAI	1	5	39	1320
WAMUNTE	5	51	29	1313	YAURE	2	16	16	1303
WANAM	3	29	33	1305	YAVERA	3	27	22	1304
WANAMBRE	2	17	7	1303	YEIMAS	1	5	40	1320
WANARU	3	25	19	1304	YEIPAMIR	3	26	33	1304
WANDABONG	1	2	15	1328	YELSO	2	10	50	1325
WANGAR	2	9	35	1302	YENT	4	39	16	1318
WANGETO	1	6	35	1329	YERIA	2	19	16	1303
WANGOR	3	25	20	1305	YIGEBUGOR	3	33	29	1308
WANIF	2	11	21	1303	YOGAYOGA	1	5	41	1328
WANUMA	2	19	14	1303	YOIDIK	2	14	20	1302
WAPUT	5	48	15	1303	YOKOPI	2	8	32	1303
WARAI	1	5	37	1320	YOMNIGI	4	41	12	1316
WARAT	6	22	29	1311	YORI	1	5	42	1320
WAREKAM	3	29	34	1304	YORKI	1	5	43	1328
WAREMIS	3	29	35	1305	YORKIA	1	5	44	1328
WARINUNG	3	30	27	1307	YUMP	4	39	17	1318
WARIS	3	24	16	1309	YUNGENDAM	1	6	36	1328
WASAB	2	14	18	1302	ZUKIN	3	32	15	1307
WASABAMAL	2	14	19	1302	ZUMBA	4	38	41	1307
WASAMB	3	28	8	1304					
WASANGABANG	3	29	36	1305					
WASIKOKOP	1	2	16	1327					

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM

Province: 13 Madang

Village	Dist	Div	Unit	RMU	Village	Dist	Div	Unit	RMU
SYSTEM 1301					HILU	2	10	23	2
ASIMBIN	2	16	2	16	HIPONDIK	2	9	16	242
BAGILDIK	2	13	4	1	IMBARB	2	15	5	242
BAHOR	2	10	6	49	KAMBA	2	9	18	5
BANAP	2	14	22	4	KAURIS	2	9	19	5
BARANIS	2	15	1	43	KOGUMAN	2	18	6	9
BILBIL	2	10	13	49	KOROG 1	2	10	26	5
BILIA	2	10	14	1	KOROG 2	2	10	27	5
BOMASA	2	13	7	1	KURUM	2	14	13	4
BUDAD	2	9	7	1	LAPTING	2	9	20	242
BUNABUN	2	16	5	35	MABENOB	2	9	21	3
DEDA	2	13	8	1	MEBAT	2	9	24	4
KARKUM	2	15	6	43	MIRKUK	2	10	31	5
KAWA	2	13	9	1	NOBANOB	2	9	28	5
KORAK	3	26	10	28	OHU	2	10	33	5
KRANKET	2	10	28	1	OPI	2	10	36	5
KUDAS	2	14	12	1	SARANG	2	15	11	43
LIKSAL	2	14	14	43	SARISAWU	2	16	13	242
MALAMAL	2	9	22	1	SAULIS	2	14	16	4
MALAS	2	15	7	39	SIGU	2	13	12	242
MATUKAR	2	14	15	1	SILIBOB	2	9	33	1
MEGIAR	2	15	8	43	SUAH	2	10	43	2
MEIWOK	3	26	15	28	URUGUN	2	10	46	5
MIRAP	2	15	9	43	WANGAR	2	9	35	242
MIS	2	9	25	1	WASAB	2	14	18	43
MURUKINAM	2	16	9	35	WASABAMAL	2	14	19	4
NOM	2	15	10	43	YOIDIK	2	14	20	4
ORD	2	10	37	49					
PANIM	2	10	38	5	SYSTEM 1303				
RIWO	2	9	29	1	ABAB	2	14	1	242
SEK	2	9	31	1	ABAIYA	2	20	1	9
SEMPI	2	13	11	1	ABASAKUR 1	2	18	1	9
SIAR	2	9	32	1	AI-ANDONK	3	35	1	234
SO	2	10	42	2	AIANGAT	4	37	1	151
TAVULTAE	2	16	15	32	AIGUT	5	47	1	51
TOKAIN	2	15	12	39	AKAVANGU	4	37	2	151
UDISIS	2	14	17	43	AKURUKAI	4	37	3	234
UMUIN	2	10	44	49	ANDUGUS	4	36	1	151
YAHIL	2	10	49	2	ANIMINIK	5	47	3	51
					ANIMINIKIN	4	36	2	151
SYSTEM 1302					ARAR	2	11	2	5
ABAR	2	9	1	242	ARIMATAU	2	19	1	7
ABASAKUR 2	2	18	2	9	ASAPI	4	37	8	151
ALUAK	2	9	2	242	ASAS	5	49	2	56
ANHABAK	2	13	1	7	ASIWO	2	13	2	7
AREGEREK	2	16	1	242	ASMISIN	4	36	3	151
ARONIS	2	14	2	4	ASTANGU	4	37	9	151
BAITETA	2	9	4	242	ATEMBLE	4	37	10	227
BALABAK	2	13	5	242	ATITAU	2	19	2	9
BALBE	2	13	6	270	ATSUVATAPI	4	37	12	151
BARAHEIM	2	10	9	5	AUPIO	5	47	4	51
BUDIP	2	9	6	242	AUTABAK	2	11	3	6
BURBURA	2	14	8	4	AVARTAMUR	2	18	3	11
DOLONU	2	10	17	5	AWAM	4	37	13	151
DUDULA	2	14	9	270	BADIMFOK	2	13	3	242
EVECHIL	2	18	4	10	BAIMAK	2	11	4	5
GARIGUT	2	9	9	242	BAIPA	2	8	5	62
GARUP	2	14	11	4	BAISRIK	2	12	3	50
HAIDUREM	2	9	12	5	BAMSOS	2	12	30	51
HAIMO	2	9	13	242	BANAM	5	46	2	54
HAVEN	2	9	15	3	BARATA	2	20	3	9

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM
Province: 13 Madang

Village	Dist	Div	Unit	RMU	Village	Dist	Div	Unit	RMU
BARIK	2	11	5	5	KANGARANGATE	3	34	8	15
BASKEN	2	15	2	242	KATEKOT	2	17	3	10
BAUK	2	10	11	11	KAWOT	2	19	4	9
BEMDIK	2	14	3	242	KESA	5	49	5	64
BEPOUR	2	16	3	34	KETUBA	5	49	7	56
BIDIMAI	2	9	5	5	KIKIREI	5	46	12	151
BIGEI	5	46	4	54	KOMIARUM	2	20	15	9
BIL	5	46	5	54	KORIGEI	5	49	8	56
BILAKURA	2	14	4	242	KORIGINA	5	49	9	228
BIRIBIRIE	5	48	1	51	KORONA	5	49	10	56
BOBORANA	2	20	4	7	KOROPA	5	49	11	61
BRAHMAN	5	45	5	56	KOSILANTA	2	20	16	9
BUBNO	2	14	5	242	KRAMASARIK	2	12	16	50
BUDUM	2	14	6	242	KUKURMASAK	2	18	7	12
BUTELGUT	2	9	8	5	KUMBUMBA	2	18	8	18
DANARU	5	46	6	56	KUMBUNA	2	19	5	46
DIMIR	2	15	3	242	KUNDUK	5	47	15	51
DUNUBA	5	46	7	54	KWANJE	2	7	8	62
EBENAN	2	20	6	12	KWARINGIRI	4	36	6	151
ELEBE	2	14	10	242	LAE	4	36	7	54
EMBOR	2	16	7	16	LAGAHA	2	11	11	5
FAITA	5	45	10	210	LONGAR	4	37	26	151
FULUMU	2	10	20	5	MABET	2	17	4	9
GAL 1	2	11	6	5	MAGILA	2	20	17	7
GAL 2	2	11	7	5	MAGILAN	2	20	18	9
GALISAKAN	4	36	4	151	MAIK	2	13	10	9
GAMENKIN	2	15	4	242	MAKINTON	2	16	8	9
GARALIGUT	5	46	8	54	MANEP	2	9	23	7
GASUA	5	47	11	51	MANGE	4	36	8	151
GASUAL	5	47	12	51	MATA LOI	5	49	12	228
GAUM	4	36	5	45	MATEPI	2	11	14	5
GGERI	2	9	10	5	MAUMIKU	3	35	13	18
GOMURU	2	12	12	51	MEGINAM	2	11	16	5
GUHUP	2	9	11	5	MEGIRANU 1	2	19	6	7
GULKUBRANA	2	20	7	9	MEGIRANU 2	2	19	7	7
GUTEB	2	11	10	6	MESEKOR	2	17	5	10
HAPURPI	2	9	14	8	MOSIMO	2	14	21	17
HENENGABE	2	17	2	10	MUKURU	2	9	26	5
HINIHON	2	17	1	10	MUNIMATAMAN	2	19	8	9
IAMAMUK	3	34	4	12	MUSAK	5	46	14	222
IBUBUE	3	34	5	15	MUSITA	2	19	9	18
IDIMAKUMA	2	20	8	9	MUTUVAL/KAUNGAVA	2	18	9	12
IGOI	5	46	9	54	NAKE	2	9	27	5
IGURUE	5	48	4	51	NAMBINJ	4	37	28	151
IKARINAGRA	2	20	9	7	NARU	5	48	14	51
ILEBEGUMA	2	20	10	9	NEGIRI	5	47	16	51
ILIMA	2	20	11	7	NUGU	5	48	6	51
ILLEMAMKUTU	2	20	12	12	ONGORU	5	49	13	228
INASI	3	34	6	18	PARAPASAM	4	37	29	151
INSINSIBI	3	34	7	9	PARAWEN	2	20	24	50
IPOKONDOR	4	37	15	234	PASINKAP	4	37	30	151
IRARAPI	4	37	18	151	PERENE	2	16	10	9
IRIV AIS	4	37	19	151	PERI	5	49	14	228
ISOWAK	4	37	20	151	POROSAE	2	18	10	18
ITAPI	2	9	17	5	PUKSAK	5	48	8	51
ITARANGU	4	37	21	151	PUNGAMBU	4	37	31	150
IVAGRIPI	4	37	22	151	RAIBANA	5	49	15	64
IWAM	4	37	23	151	REINDUK	2	16	11	18
KAIBUGU	3	35	8	148	SAIPA	2	8	26	62
KALAFULUM	5	46	10	227	SANA	5	49	16	228
KAMAMBU	2	19	3	50	SANEPI	2	11	17	5

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM
Province: 13 Madang

Village	Dist	Div	Unit	RMU	Village	Dist	Div	Unit	RMU
SAUSI	5	49	17	56	ARIMBUGOR/MOIE	3	34	1	18
SELAUSI	2	19	10	11	AVUNAMAKAI	3	33	3	146
SENGRUSENGRU	2	19	11	12	BANGASAV	3	34	2	18
SEPU	5	46	15	227	BARIT	3	32	3	143
SEREMBEN	2	16	12	16	BEIAMP	3	28	3	136
SEVOI	2	20	26	5	BUBUM	3	25	7	25
SILEIBI	2	19	12	50	BWANAVAB	3	25	8	127
SILOPI	2	11	19	6	DALUA	3	25	10	21
SIMBAIWIWI	4	37	32	151	DONGWANAM	3	27	1	18
SINGEP	4	36	9	151	DUAPMANG	3	28	4	136
SISILIKA	3	34	14	15	DUGUMOR	3	25	11	21
SOBEROM	2	16	14	18	DUMADUM	3	27	2	18
TARINA	2	20	29	12	EREIBADAS	3	26	7	16
TAUYA	5	45	28	56	EREIVANUM	3	26	8	30
TEBINSARIK	2	12	24	50	EVUAR	3	33	5	18
TERI	5	45	29	56	EVWARAME	3	27	3	127
TEVARI	3	35	16	234	GAIRA	3	34	17	13
TINAMI	2	17	6	9	GIAR	3	28	5	136
UKURIGUMA	2	20	30	7	GUGUBAR	3	26	9	18
ULIANGUPI	4	37	33	151	GUM	3	27	4	18
UMERUM	4	36	10	151	GURUBE	3	27	5	18
URIA	5	49	18	56	GUTEPUK	3	33	6	127
URIGINA 1	5	49	19	56	IABARANGA	3	34	3	12
URIGINA 2	5	49	20	56	IGAMUK	3	29	17	127
USERUK	4	36	11	151	IKUNDUN	3	33	8	18
USINO	5	46	16	56	ISENGEN	3	29	21	127
WABRIATAU	2	19	13	9	ISUNG	3	29	22	127
WABU	4	36	12	151	ITUTANG	3	33	11	127
WABUSARIK	2	12	26	50	KATIATI	3	35	9	148
WAIMERIBA	5	49	23	56	KIMBUGOR	3	35	10	148
WANAMBRE	2	17	7	9	KISILA	3	34	9	148
WANIF	2	11	21	5	KOKOPOGASA	3	34	10	18
WANUMA	2	19	14	11	KUNDEGENDE	3	35	11	146
WAPUT	5	48	15	56	MAKAPAI	3	33	12	18
WAWAPI	4	37	34	151	MANDUGAR/SUMUN	3	33	13	18
WIAI	5	49	21	51	MANGIGIM	3	28	6	136
YABIE	2	8	30	64	MANUNGWAR	3	26	12	18
YABSAU	2	19	15	9	MARI	3	29	25	136
YAGI	2	12	31	51	MAVUNDI	3	35	14	148
YAKUMBU	5	49	22	56	MAWAK	3	26	13	30
YARAWATA	2	20	32	7	MILALIMUDA	3	25	14	21
YAURE	2	16	16	16	MINDIVI	3	33	15	18
YERIA	2	19	16	10	MISIBURA	3	26	17	18
YOKOPI	2	8	32	51	MORESAPA	3	27	8	136
SYSTEM 1304					MOSIAMANOT	3	27	7	18
ABABIGAB	3	26	1	20	MUAKA	3	26	19	25
ABER	3	29	2	127	MUGUMAT 1	3	27	9	20
ADUI	3	29	3	127	MUGUMAT 2	3	27	10	18
AIDIBAL	3	25	1	21	NIKSAPAI	3	35	15	148
AKETA	3	26	2	18	PAPUR	3	26	20	29
ALISUAP	3	26	3	18	PARIAKANAM	3	27	12	18
AMBOK	3	33	1	127	PONDOMA	3	33	19	146
AMJAIBIBU	3	35	3	148	PORPOR	3	33	20	145
AMUK	3	28	1	136	PUK	3	29	30	127
ANDARUM	3	32	1	127	ROUMIRAP	3	27	13	18
ANDEAMARUP	3	28	2	136	SABERO	3	25	16	21
ANGABA	3	35	4	148	SAMBANGASAV	3	34	11	18
ARAMANT	3	33	2	18	SANARVAT	3	27	14	13
AREP	3	29	6	127	SARAMUN	3	26	23	25
ARIANGON	3	29	7	136	SIKOR	3	26	24	27
					SIMBAR	3	34	13	147

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM
Province: 13 Madang

Village	Dist	Div	Unit	RMU	Village	Dist	Div	Unit	RMU
SIMBINI	3	26	25	23	LILAU	3	25	13	128
SIRIKIN 1&2	3	27	15	136	MAKARUP	3	29	24	127
SIRIN	3	28	7	136	MAKERE	3	30	12	127
SOKUMU	3	32	12	127	MALALA	3	26	11	23
SUANJAMBI	3	33	21	146	MASAWARA	3	29	26	133
SUSURI	3	26	26	25	MEDIBUR	3	26	14	26
SUVAT	3	27	23	19	MERIMAN	3	26	16	26
TAMAGOT	3	26	27	23	MOAB	3	25	15	128
TAMANDAPUR	3	33	23	18	MORO	3	26	18	26
TANGUAT	3	33	22	127	NAUPI 1	3	29	27	127
TARIGAPA	3	26	28	29	NAUPI 2	3	29	28	127
TINTIGINEI	3	34	15	18	NIAPAK	3	29	29	127
TOTO	3	26	29	26	NUBIA	3	30	14	129
TURUPARD	3	27	16	19	RARIN	3	26	21	25
TURUTAPA	3	27	17	18	RUGUSAK	3	30	17	133
ULATABUN	3	26	30	29	RUGUSAK 2	3	29	31	136
USIMBUGOR	3	35	18	146	RURUNAT	3	26	22	26
UTAR	3	33	25	18	SANGAN	3	30	18	127
UVORAI	3	33	26	146	SEPA	3	29	32	127
UWUNIPI	3	26	31	44	SIRIAR	3	25	17	21
WABA	3	26	32	20	SISIMANGUN	3	30	21	129
WADAGINAM	3	27	18	136	TIAP	3	30	23	127
WAGADAP	3	27	19	20	TOBENAM	3	25	18	22
WAGIMUNDA	3	27	20	18	TONGBUR	3	30	24	127
WAITITANGU/GIRIMBOK	3	33	28	18	WAKEMA	3	30	26	127
WAIUTANG	3	33	27	18	WANAM	3	29	33	128
WANARU	3	25	19	127	WANGOR	3	25	20	21
WAREKAM	3	29	34	136	WAREMIS	3	29	35	127
WASAMB	3	28	8	127	WASANGABANG	3	29	36	127
WEDARO	3	25	21	127	YAMBAYAMBA	3	25	22	128
YAKIBA	3	27	21	13					
YAVERA	3	27	22	18					
YEIPAMIR	3	26	33	18					
SYSTEM 1305					SYSTEM 1306				
ABEGANI	3	29	1	127	BIMAT	3	25	4	21
AKUKUM	3	30	1	127	BUIAIKULU	3	29	11	128
AMBANA	3	25	2	128	KAMASINA	3	29	23	127
AMINTEN	3	26	4	24	SUARU	3	25	23	127
APINGAN 1	3	29	4	127					
APINGAN 2	3	29	5	127	SYSTEM 1307				
ARIAP	3	29	8	127	ASKUNKA	4	38	2	234
ARINGEN	3	29	9	127	ATIAPE	4	37	11	233
BABANGAUA	3	25	3	128	BAK	3	31	1	133
BANANG	3	30	3	127	BANGAPELA	3	32	4	131
BEIDUP	3	26	5	22	BIRAK	3	32	17	127
BEKUN	3	29	10	127	BIRAP	3	30	4	132
BONAPUTA	3	25	6	21	BULIVA	3	31	4	236
BUSIP	3	26	6	22	CHUNGREBU	4	38	8	234
DAGOI	3	25	9	128	DAKIT	3	32	5	131
DIMUK	3	29	12	136	DAMANGGIP	3	30	5	131
DINAM	3	29	13	127	DIBU	4	38	9	234
GORAK	3	29	14	127	DJAM	4	38	10	151
GUN 1	3	29	15	127	GIRI 1	3	30	6	127
GUN 2	3	29	16	127	GIRI 2	3	30	7	127
IGOS	3	29	18	127	GOINBANG	3	31	11	236
IKEMIN	3	29	19	127	GRENGABU	4	38	13	234
IKU	3	30	9	129	GUASINGI	4	38	14	225
IRUARI	3	29	20	127	GWAIA	3	30	8	131
KAUKOMBA	3	25	12	22	IGANA	4	38	15	235
KONGNAN	3	27	6	127	JITIBU	4	38	17	151
					KABUK	3	31	12	236
					KOMINIMUNG	4	38	20	141
					KOMINUNG	3	30	10	127

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM
Province: 13 Madang

Village	Dist	Div	Unit	RMU	Village	Dist	Div	Unit	RMU
KRAGABU	4	38	21	233	LITIBU	4	38	24	162
KWANGA	4	38	22	234	MARANGET	3	35	12	149
LIMBUBU	4	38	23	234	MARINGIS	3	31	14	129
MANGAI	3	31	13	130	MELETO	4	38	25	158
MINU	3	30	13	127	MISIVINDI	3	33	14	145
MISINKI	4	38	26	131	MOTOKON	4	37	27	227
MOIBU	4	38	27	233	MUI	4	38	951	157
NAMBABU	4	38	30	150	MUTUNGU	3	33	16	144
NARESA	4	38	32	225	NABRINGI	4	38	28	225
NODABU	4	38	33	241	NAGRUBU	4	38	29	154
PAKINGABU	4	38	35	241	NANIKESO	4	38	31	154
PIR 1	3	30	15	127	OIUMKUIN/AYAT	3	33	17	145
PIR 2	3	30	16	127	ONGEI	3	33	24	145
REBU	4	38	36	241	OSUM	3	33	18	144
ROMKUN	3	32	11	131	PAUVRIT	3	32	8	143
ROMKUN	4	38	37	131	PELLA	4	38	952	248
SABU	4	38	39	233	RENG	3	32	10	127
SUTUBU	4	38	40	234	SEPEN 1	3	30	19	132
TEMNU	3	30	22	127	SEPEN 2	3	30	20	133
TUNG	3	30	25	127	TARINGI	3	31	15	135
VIMVITABU	4	38	42	241	TOVIAN	4	38	953	157
WARINUNG	3	30	27	127	TURAGERE	3	35	17	149
WATABU	4	38	44	234	UMBO	3	32	13	127
WENGABU	4	38	45	234	UNKENANG	3	31	16	130
ZUKIN	3	32	15	131	WABESI	4	38	43	225
ZUMBA	4	38	41	131	WOBU	4	38	46	233
SYSTEM 1308					WOGUVUNT	3	35	19	149
ARAGINAM	3	35	2	144	WOKAM	3	32	14	131
AVUNKUN	3	32	2	127	YIGEBUGOR	3	33	29	144
AWAR	3	30	2	129	SYSTEM 1309				
BAMFU	4	38	3	225	ABARIA	3	24	1	124
BOGEN	3	33	4	235	BALIAU	3	24	2	124
BOTBOT	3	31	3	129	BOKURE	3	24	3	124
BROKOTO	4	38	5	158	BORDA	3	24	5	124
BUMBERA	4	38	6	154	BUDUA	3	24	6	124
BUNUNGOM	4	38	7	225	DANGALE	3	24	7	124
DAIDEM	3	31	5	236	DUGULABA 1&2	3	24	8	124
DAMUR	3	31	6	132	IASSA	3	24	10	124
DOBARAT	4	37	14	227	JOGARI	3	24	11	124
DONGON	3	31	7	236	KOLANG	3	24	12	124
FOREGA	4	44	3	162	KULUGUMA	3	24	13	124
GABUN	3	31	8	129	MADAURI	3	24	14	124
GALEK	3	31	9	132	WAIA	3	24	15	124
GAMEI	3	31	10	132	WARIS	3	24	16	124
GOKTO	4	38	11	161	SYSTEM 1310				
GONMO	4	38	12	225	BOISA ISLAND	3	24	4	124
LANGARET	3	33	7	140	SYSTEM 1311				
INDAVAI	3	35	6	144	APARE	6	21	1	121
INGAVAIA	3	33	9	235	BADILU	6	23	1	120
IPORAITZ	4	37	16	227	BAFOR	6	22	1	121
IRAGARAT	4	37	17	162	BANGME	6	21	2	121
ISARIKAN	3	33	10	235	BIU	6	22	2	121
IVARAI	3	35	7	149	BOROMAN	6	22	3	121
JABIS	4	38	16	152	BUSON	6	21	3	121
JOGOI	4	38	18	225	DAILDIGU	6	21	4	121
JONGITA	4	38	19	161	DANGSAI	6	22	4	121
KAIAN	3	31	17	129	DAUP	6	22	5	121
KUPI	4	44	7	227	DID	6	22	6	121
KURAKEM	4	37	25	227					
LAPTU	3	32	7	127					

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM
Province: 13 Madang

Village	Dist	Div	Unit	RMU	Village	Dist	Div	Unit	RMU
DIMER	6	21	5	121	SYSTEM 1313				
DOROKATAM	6	21	6	121	BAKOKONA	5	51	1	62
DUMAD	6	22	7	121	BARIM	5	51	2	64
GAMOG	6	22	8	121	BERINGE/NANGOIYA	5	51	3	65
GIAL	6	21	7	121	BORO	5	51	4	62
KATOM	6	22	9	121	BUTEMU	5	51	5	62
KAUL 1	6	21	8	121	DAMANTE	5	51	6	62
KAUL 2	6	21	9	121	GOILO	5	51	7	62
KAUL 3	6	21	10	121	GOMUMU	5	51	8	62
KAUL 4&5	6	21	11	121	GONGEIA	5	51	9	62
KAVAILO	6	22	10	121	GUMBARAMI	5	51	10	66
KAVIAK	6	21	12	121	GURIA	5	51	11	62
KENG	6	21	13	121	GURUMBO	5	51	12	62
KEVASOP	6	22	11	121	KIKIPEI	5	51	13	62
KILDEN	6	22	12	121	MORO	5	51	14	66
KINIM	6	21	14	121	MORORO	5	51	15	66
KOROPAK	6	21	15	121	MUNGO NAHO	5	51	16	65
KUBAM	6	22	13	121	MUNGO RAWA	5	51	17	65
KUBURNE	6	21	16	121	NININGO	5	51	18	62
KUDUK	6	22	14	121	SAGASAGA	5	51	19	65
KULKUL	6	21	17	121	SARANGA	5	51	20	66
KUMORIA 1 AND 2	6	22	15	121	SENEI	5	51	21	66
KURUM	6	22	16	121	SERENGO	5	51	22	62
KURUMLANG	6	21	18	121	SEWE	5	51	23	66
KURUMTAUR	6	21	19	121	SIMBO	5	51	24	65
LANGLANG	6	21	20	121	SISIMBA	5	51	25	62
LILLOI	6	22	17	121	SUNUKAI	5	51	26	62
MANGAR 1	6	22	18	121	WALI	5	51	28	62
MANGAR 2	6	22	19	121	WAMUNTE	5	51	29	62
MAPOR	6	21	21	121					
MARANGIS	6	21	22	121	SYSTEM 1314				
MARUP 1	6	22	20	121	FORAN & SISSIAK	2	10	19	1
MARUP 2	6	22	21	121	KESUP	2	10	25	1
MATER	6	21	23	121					
MATIU 1	6	23	2	120	SYSTEM 1315				
MATIU 2	6	23	3	120	AIGRAM	4	41	1	186
MOBAN	6	22	22	121	AINGDAI	4	44	1	184
MOM 1, 2 AND 3	6	21	24		AMBISIBA	4	44	2	255
MULUK	6	22	23	121	ANGAMARVIN	4	37	4	227
NARER	6	21	25	121	ANIMUNK	4	37	6	162
NGOR	6	21	26	121	ANYAGOIM	4	37	5	182
PAIN	6	22	24	121	APANAM	4	37	7	162
PATILO	6	22	25	121	BANK	4	43	1	186
SANGANA	6	21	27	121	DUNDULOMP	4	39	4	184
SIKENTIKA	6	21	28	121	FAINJUR	4	39	5	178
TARAK	6	21	29	121	FOGAIKUMPF	4	43	2	186
TUGUTUGU	6	21	30	121	GAI	4	43	3	186
ULUN 1&2	6	22	26	121	GALAI	4	41	3	255
URARA	6	21	31	121	GUNTS	4	43	4	186
URUGEN	6	21	32	121	KANAINJ	4	44	4	255
WADAU	6	22	27	121	KARAP	4	41	6	255
WAKON	6	22	28	121	KEIBAM	4	39	11	166
WARAT	6	22	29	121	KINIMBONG	4	43	5	266
YAGADUN	6	22	30	121	KOMARAGA	4	44	5	255
					KONDOR	4	37	24	162
SYSTEM 1312					KUAK	4	44	6	255
BOK	1	1	1	118	MANYINBAI	4	44	8	255
KAUT	1	1	2	115	MONDO	4	43	6	186
MALALA	1	1	3	115	NIMBRA	4	43	7	186
MATAFUNA	1	1	4	115	SINGINAI	4	43	8	186
					TSANGAMP	4	43	9	186

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM
Province: 13 Madang

Village	Dist	Div	Unit	RMU	Village	Dist	Div	Unit	RMU
TSEMBAGA	4	43	11	186	BARU	1	4	3	113
TSUNGUP	4	42	11	253	BASOR	1	6	2	94
TUNGAGA	4	44	9	255	BIBI	2	7	4	90
SYSTEM 1316					BIDUA	1	6	4	94
ARAPAN	4	40	2	267	BOM	2	8	9	88
ARUNK	4	41	2	253	BONGA	1	4	4	112
BABAIMP	4	42	1	253	BONGU	2	8	10	85
FUNDUM	4	40	5	252	DAMOIN	1	5	8	95
FUNGOI	4	40	6	252	DEIN	1	6	7	90
GABUN	4	42	2	252	FAIGURUP	1	4	9	96
GIRINGIRI	4	41	4	254	FANGGER	1	4	10	113
GONGRAU	4	42	3	253	GALEK	1	5	10	93
KAIRONK	4	40	7	251	GALI	1	4	12	104
KAKOPI	4	42	4	265	GANGLAU	1	6	13	90
KAMPANYING	4	42	5	253	GOGOUI	1	6	14	230
KANDUM	4	41	5	253	JAMJAM	2	8	16	88
KEREIVEN	4	41	7	253	KAKIMA	1	4	15	96
KOKI	4	42	6	266	KALALIN	1	4	16	114
KUIB	4	42	7	253	KALIKU	2	8	18	85
KUMBRUF	4	42	8	266	KASU	1	4	18	113
KURUMDEK	4	41	8	253	KUBUK	1	6	19	87
MIAMI	4	42	9	253	KUL	2	7	6	90
MURIKI	4	41	9	253	KULILAU	1	6	20	90
NUGUNT	4	42	10	265	KUMISANGER	2	7	7	90
TINAM	4	41	10	251	KUPDUI	1	4	20	98
TSEMBIUMP	4	43	10	195	LALOK	2	8	21	88
YAMBUNGLIN	4	41	11	254	LAMTUB	1	6	23	91
YOMNIGI	4	41	12	253	MAIBANG	1	5	17	65
SYSTEM 1317					MALALAMAI	1	4	21	112
AINONK	4	40	1	251	MALE	2	8	23	88
ARADIMP	4	39	2	168	MAMGAK	1	4	22	96
BILUM	4	40	4	179	MARAKUM	2	7	9	89
GEBRAU	4	39	8	256	MINDIRI	1	6	25	90
GOMP	4	39	9	183	MUR	1	4	26	113
GUBAINE	4	39	10	256	NAMPA-SUANG	1	4	27	97
SALEMP	4	40	8	251	PESANGANA	1	4	28	108
SANGAPI	4	39	12	250	RERAU	2	8	25	85
SANGUVAK	4	40	9	251	RIMBA	2	7	10	89
TINGI	4	39	13	183	SAWOI	1	4	29	113
WOMUK	4	40	10	179	SEKWANAM	2	7	11	86
WULIM	4	39	14	168	SEL	1	4	30	113
SYSTEM 1318					SERIANG	1	5	25	94
ANGA BERE	4	39	1	169	SEURE	1	4	31	113
ARENAMP	4	40	3	179	SINGOR	1	5	29	91
DANGU	4	39	3	185	SISAGEL	1	5	30	95
FANKFANK	4	39	6	173	SONGUM	2	7	12	89
FITAKO	4	39	7	173	SUBURA	1	4	33	96
WOWO	4	40	11	168	SUIT	1	5	33	93
YAHL	4	39	15	169	TALMIRO	1	4	34	104
YENT	4	39	16	169	WAB	1	5	35	106
YUMP	4	39	17	169	WARAI	1	5	37	91
SYSTEM 1320					WATANG	1	4	37	104
AMUN	1	5	2	79	WILWILAN	1	4	38	114
ARAWUM	2	7	1	89	WUIA	2	8	29	51
BAGEN	1	4	1	96	YAGOMI	1	4	40	113
BALAIA	2	8	6	51	YAMAI	1	5	38	92
BANDIT	1	4	2	96	YANGULAM	2	7	13	89
					YAUNIAI	1	5	39	95
					YEIMAS	1	5	40	93
					YORI	1	5	42	95

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM
Province: 13 Madang

Village	Dist	Div	Unit	RMU	Village	Dist	Div	Unit	RMU
SYSTEM 1321					MARITAMBU	2	20	19	50
ALEVETI	5	49	1	56	MAWAN	2	11	15	11
BOGAI	5	45	3	258	MUGUNURAMBU	2	20	20	48
EMEGARI	5	45	9	269	MURUPI	2	20	21	48
ISABI	5	45	14	217	MUSIVANGA	2	20	22	48
MENDI	5	45	26	269	ORONGA	2	20	23	48
OMKWISI	5	45	22	264	OUPAN	2	12	20	50
PISINGAMI	5	45	23	264	SAMOSI	2	20	25	48
PROMISI	5	45	24	213	SIHAN	2	12	22	49
TUGUMA	5	45	30	217	SILAU	2	11	18	11
					SIMUKU	2	20	27	48
SYSTEM 1322					SOLI	2	20	28	48
ARANAM	5	45	1	269	TADUP	2	12	23	221
BAUI	5	45	2	258	UTU	2	11	20	11
BONONI	5	45	4	203	WAGUM	2	12	27	50
BUNDIKARA	5	45	6	269	WAGUMA	2	12	28	50
DAGAMBARU	5	45	7	258	WAMA	2	20	31	50
DIDINONGOI	5	45	8	203					
GOGUBAGU	5	45	12	203	SYSTEM 1325				
GUIEBI	5	45	13	258	AGURU	2	10	1	2
KARAMUKE	5	45	15	269	AIHA	2	10	2	2
KARISOKARA	5	45	16	203	AIYAP	2	10	3	2
KINDARUPA	5	45	17	177	AMELE	2	10	4	5
KURINOGOBU	5	45	18	203	BAFULU	2	10	5	11
MARUM	5	45	19	177	BANUP	2	10	8	2
MOKINANGI	5	45	20	203	BAU	2	10	10	11
PUPUNERI	5	45	25	258	BEMAHAL	2	10	12	5
YAIKORO	5	45	31	269	DALAM	2	10	15	49
YANDERA	5	45	32	203	EFU	2	10	18	5
					GUMAN	2	10	21	5
SYSTEM 1323					HAIYA	2	10	22	2
ABIKAL	5	50	1	67	HUDINI	2	10	24	2
BEMBE	5	50	2	67	MIRHANAK	2	10	30	2
DUMPU	5	50	5	67	MOILSEHU	2	10	32	49
KESAWAI	5	49	6	61	OHURU	2	10	34	2
					OMURU	2	10	35	2
SYSTEM 1324					SAH	2	10	39	2
AMAIMON	2	12	1	50	SALUGU	2	10	40	2
ASIKAN	2	11	1	11	SEIN	2	10	41	2
ATO	2	8	4	49	UMUN	2	10	45	49
BAI	2	20	2	48	WAGUK	2	10	47	49
BALIMA	2	10	7	49	YELSO	2	10	50	2
BARUM	2	12	4	49					
BEMARI	2	12	6	50	SYSTEM 1326				
BERIN	2	12	7	50	AMASUA	5	47	2	51
BUROA	2	12	8	51	ARIMORI	5	46	1	54
BURU	2	12	9	221	ATU	2	12	2	221
DAWA	2	20	5	7	BAISOP	5	47	6	51
DERIN	2	12	10	49	BEGESIN	5	47	5	51
DOGIA	2	10	16	49	BEIRE	5	46	3	51
DUDUELA	2	8	14	51	BEMAL	2	12	5	51
ERIMA	2	8	15	49	BOKWA	5	47	8	51
GILOLO	2	11	8	11	EIONIMEK	5	47	9	51
GONUA	2	12	13	49	ENSARUP	5	47	10	51
GUMALU	2	11	9	5	EWEIWA	5	48	2	51
IVAP	2	20	13	48	GARINAM	2	12	11	51
KAGI	2	20	14	48	IBINORO	5	48	3	51
KUYONBON	2	12	17	221	INAM	5	48	5	51
LOWO	2	11	12	11	INOMTOP	5	47	13	51
MALOLO	2	11	13	11	JAL	2	12	14	51
MARAGA	2	10	29	49	JOBTO	2	12	15	49

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM
Province: 13 Madang

Village	Dist	Div	Unit	RMU	Village	Dist	Div	Unit	RMU
KEPSAU	5	46	11	51	KEPOIAK	1	4	19	110
KOMAS	5	46	13	51	KIAMBAUI	1	5	12	79
KONENGUL	5	47	14	51	KOIAKU	1	5	13	79
MAIR	2	12	18	49	KOKING	1	5	14	79
MOPO	5	48	13	51	KULEL	2	8	19	51
OUBA	2	12	19	221	KUMBURUNKU	1	5	15	78
OWORU	5	47	17	52	KUREI	1	6	21	79
POINE	5	48	7	52	KWATO	2	8	20	51
SAI	5	47	18	51	KWONGO	1	6	22	79
SAKWARI	2	12	21	51	LUSUANG	1	5	16	79
SANAWAI	5	47	19	52	MABELUKU	2	8	22	51
SUMAU	5	48	9	52	MAMBIT	1	3	4	79
TABABU	5	48	10	51	MASI	1	5	18	79
TOTOPA	5	48	11	51	MATOKO	1	5	19	79
URIA	5	48	12	52	MAUWERERE	1	5	20	79
URIRAI	5	47	20	51	MEBU	1	3	5	78
USU	2	12	25	51	MEIBU	1	6	24	83
WEHEGLO	2	12	29	49	MONARA	1	4	24	108
SYSTEM 1327					MULUMIANG	1	4	25	99
TEPTEP	1	2	13	102	MUNIANA	1	5	21	79
WASIKOKOP	1	2	16	102	ONGO	1	6	26	79
SYSTEM 1328					ORINMA	1	6	27	83
AIYAU	2	8	1	51	PULABU	2	8	24	64
AIYAWANG	1	5	1	79	RAMBA	1	5	22	79
ALIBU	2	8	2	85	REITE	1	5	23	94
ASANG	1	5	3	79	SAKORILA	1	6	28	78
ASUI	2	8	3	51	SARAKIRI	1	6	29	79
BANG	2	7	2	84	SARI	1	5	24	78
BANGRI	2	7	3	271	SEGI	1	6	30	83
BAUAK	2	8	7	51	SIBOG	1	5	26	79
BAUBO	1	6	3	94	SILALING	1	5	27	79
BILIAU	1	5	5	91	SIMIDIDI	1	6	31	79
BILONG	1	5	6	78	SINANGE	1	6	32	79
BOIMBI	2	8	8	84	SINDAMA	1	5	28	79
BOTOTO	1	6	5	78	SITABA	1	6	33	77
BUAI	2	8	11	51	SOMEK	1	4	32	96
BUDAMU	1	6	6	78	SOR	1	5	31	95
BULGEBI	1	4	5	98	SORANG	1	5	32	79
BURAM	2	8	12	85	SURI	1	5	34	79
BUSAKA	1	5	7	95	TAPEN	1	4	35	113
BWANA	1	4	6	106	TARIKNAM	1	3	7	79
DABAN	1	4	7	97	TUMBU	2	8	27	51
DAUMONIA	2	8	13	51	UMBOLDI	1	4	36	96
DELBANGAT	1	4	8	98	WADO	1	6	34	79
DIMAN	1	6	8	78	WAIBOL	1	5	36	96
DOGINGO	1	6	9	82	WANDABONG	1	2	15	107
DUMUN	1	6	10	80	WENGE	2	8	28	84
FORGUAN	1	6	11	94	WINDILUK	1	4	39	107
FUNYUNDE	1	6	12	78	YAULA	2	8	31	64
GABUMI	1	5	9	79	YOGAYOGA	1	5	41	98
GUHU	1	6	15	83	YORKI	1	5	43	78
GUHUNGOR	1	5	11	79	YORKIA	1	5	44	78
GUIARAK	1	4	13	96	YUNGENDAM	1	6	36	83
GUR	2	7	5	82	SYSTEM 1329				
GUTI	1	6	16	79	BAGALAWA	1	5	4	78
JILIM	2	8	17	84	BAGONDA	1	6	1	77
KABUNDANGIN	1	4	14	99	BAMBU	1	3	1	267
KAPUNGAPANG	1	4	17	98	GABUTAMON	1	4	11	106
KARAKARA	1	6	17	78	GUMBAION	1	3	2	267
					GWARAWON	1	3	3	78

6.3 RURAL VILLAGES LISTED BY AGRICULTURAL SYSTEM

Province: 13 Madang

Village	Dist	Div	Unit	RMU	Village	Dist	Div	Unit	RMU
KUBIGAM	1	6	18	78	SYSTEM 1331				
KWEMBUM	1	2	10	105	BOPIRUMPUN	5	50	3	67
MIOK	1	3	6	243	BUMBU	5	50	4	67
MOAM	1	4	23	106	MUSUAM	5	50	6	67
TEPMAWON	1	3	8	78	SANKIAN	5	50	7	67
WANGETO	1	6	35	78					
YAUANGOBA	1	3	9	267					

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, MADANG PROVINCE¹

Code	Division	Code	Division
01	RAI COAST	04	RAMU
01	Long Island	36	Angamu-Kumaran
02	Yupna	37	Aiome-Angau-Anor
03	Nankina	38	Rao Breri
04	Warup	39	Western Schraders
05	Mot	40	Kairronk
06	Yaganon	41	Asai
		42	Simbai
02	MADANG	43	Mareng
07	Kabenau	44	Gainj
08	Bogadjim		
09	North Ambenob	05	UPPER RAMU
10	South Ambenob	45	Bundi
11	Gak Utu	46	Igoi-sop
12	Transgogol	47	Bagasin
13	Sek-Rempi	48	Sumau-Garia
14	Saker-Garus	49	Urigina-Kesawai
15	Megiar	50	Dumpu-Kaigulan
16	Bunabun	51	Naho Rawa
17	Inland Bunabun		
18	Avisan	06	KARKAR
19	Wanuma	21	Waskia
20	Kosilanta	22	Takia
		23	Bagabag
03	BOGIA		
24	Manam Coastal		
25	Bogia Coastal		
26	Ulingan		
27	Mugumat-Yakiba		
28	Tangu		
29	Makarup		
30	Hansa Bay		
31	Lower Ramu		
32	Andarum		
33	Josephstaal		
34	Siluwa		
35	Urawin		

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.

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. Kandangan (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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