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LAND CLASSIFICATION FOR LIVESTOCK FARMING SYSTEMS RESEARCH AND DEVELOPMENT IN JAVA

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Various approaches to classification of land for agricultural use in Java have been made by land-use planners (1), agricultural meteorologists (2, 3, 4) and geomorphologists (5). The emphasis in all cases, however, has been on classification for crop production. Little consideration has been given to utilization by livestock. The need for a land classification designed for national livestock research and development is obvious. Without such a classification it is difficult to gather objective information required for planning research and development, or to disseminate effectively the results of livestock research to farming areas.

In most land classifications, land is taken to comprise the physical environment including climate, relief, soils, hydrology and vegetation. It usually includes the results of past and present human activity but not current patterns of utilization (6). On the other hand, in classifying land for specific purposes, such as livestock development, present land-use cannot be ignored (7). Present land use is often a major factor influencing livestock production in Java (18).

Modern descriptions of farming systems research refer to the need for determination of "recommendation domains" (each domain being made up of farmers operating under similar circumstances and facing similar problems) (8), or stress the need for classification with the objective of "identifying parameters which allow the aggregation of farms into a relatively small number of farming systems, on which to focus research resources" (9).

In this paper the aim is to present means of classification of land which will provide a sound basis for:

(1) Sampling designs for livestock related surveys.
(2) Selection of research and development sites which are representative of important land units or systems.
(3) Dissemination of research results and development opportunities to areas in which similar results can be expected (10).
(4) Planning of regional livestock research and development priorities.

One important characteristic of the classification required is simplicity. The classes should be capable of recognition in the field by workers at all levels in livestock research and development, using maps or data which are easily available.

Climatic, topographic, soil and land-use data and maps are available from various sources in Indonesia. These, have been evaluated with a view to their possible utilization in this classification of land for livestock purposes.

Table 1. Altitude, rainfall and main land-use divisions used in land classification.

Altitude Classes	Low	Medium	High	Very high
Metres above sea Level	0-100	>100-500	>500-1000	>1000
Percent of Java	(44%)	(33%)	(15%)	(8%)

Length of Dry Season Classes	Long	Medium	Short
No dry months/yr*	>5	2-5	<2
Percent of Java	(35%)	(41%)	(23%)

Main Land-Use Types**					
Mixed Gardens (23%)	Mixed gardens /Ricefield (22%)	Irrigated Ricefield (18%)	Rainfed Ricefield (14%)	Forest (14%)	Estate Crops (3%)

* A dry month is taken as one having less than 100mm of rain (3).
** Definitions of Main land-use classes are given in Appendix 5.

General Description

A divisive, heirarchical classification is proposed, i.e. one in which the land area is divided by a stepwise process on the basis of criteria known to influence livestock distribution, farming systems or productivity. The three criteria - altitude, rainfall and land-use - were initially selected after literature review and analysis of national livestock and land-use data in Java (11), and were later tested in the field in West Java (12).

Four altitude classes, three of dry season classes, and six land-use classes were adopted and these are shown in Table 1, with the percentages of land falling into each unit in Java.

CHOICE OF CRITERIA FOR LAND CLASSIFICATION

"Land units for classification are units of convenience created by subjectively chosen breaks in the continuum of land change. Yet even if discrete land units are, in one sense, artificial they serve an important function as the means of communication and argument amongst scientists" (14).

It is often stated that for a land classification to have any stable value it should be based mainly on the permanent characteristics, that is, the "dominant natural factors" (15). However, a land classification based entirely on natural factors would not provide the whole story (16), especially with regard to livestock systems in Indonesia which are so dependent on other land-use. The main justifications for selection of criteria and the rejection of others for use in this land classification for livestock purposes are discussed below.

Altitude

Studies of provincial and national data (14, 18), indicate that total livestock densities and densities of individual species are often correlated with altitude. In West Java for instance, goat, duck and buffalo densities decrease with an increase in altitude, while sheep density increases. The mechanisms involved are not clear but appear to be largely related to land-use, and grazing, which in-turn may be affected by such altitude dependent variables as rainfall land slope, soil type, and air temperature (3, 6, 9, 34). Of significance to animals too is probably the influence of altitude on growth rate and nutritive value of fodders. The change in average temperature with altitude in Indonesia is illustrated in Appendix 7.

Because of its association with livestock density and systems of feeding, altitude has been selected as one parameter on which to base land classification of Java. Data on altitude are readily available, either from topographical maps or an altimeter. The three altitude levels of 100, 500 and 1000 metres above sea level are proposed. The use of these particular contours achieves a relatively practical and uniform division into four alti-

Table 2. The 18 main agroecological land units in Java/Madura.

Agroecological Land Unit			Percentage of land occupied in			
Altitude	Rainfall	Main land-use	West	Central	East	Java
Low	Low	Rainfed Sawah	7.5	2.0	14.0	8.2
Low	Low	Irrigated Sawah	3.0	7.5	9.0	6.4
Low	Low	Mixed Gardens	0.8	0.2	5.7	2.4
Low	Low	Sawah + Mixed Gardens	1.5	1.1	5.7	2.9
Low	Medium	Rainfed Sawah	2.5	5.0	3.0	2.5
Low	Medium	Irrigated Sawah	0.5	14.0	2.0	6.0
Low	Medium	Mixed Gardens	5.6	4.2	1.4	3.7
Low	Medium	Sawah + Mixed Gardens	2.6	4.2	1.4	3.6
Low	High	Mixed Gardens	6.5	0.6	—	2.4
Medium	Low	Sawah + Mixed Gardens	—	0.6	6.6	2.6
Medium	Low	Forest	—	0.2	6.6	2.5
Medium	Medium	Mixed Gardens	3.1	5.4	6.6	5.0
Medium	Medium	Sawah + Mixed Gardens	4.0	13.5	2.4	6.1
Medium	High	Mixed Gardens	6.7	1.5	—	2.9
Medium	High	Sawah + Mixed Gardens	4.0	2.0	—	2.0
High	Medium	Mixed Gardens	1.8	2.8	2.4	2.3
High	Medium	Sawah + Mixed Gardens	2.4	3.6	1.4	2.4
High	High	Mixed Gardens	4.2	1.4	—	2.0
		Total	57	70	68	66

'tude strata of each province and of Java as a whole (see Table 3). There is an added merit of consistency in that the 100 and 500 metre elevations have been adopted in other land classifications for Indonesia (1), and the 1000 metre contour is chosen because above this altitude temperature limits the growth of many lowland rice varieties, and horticultural crops predominate (3).

In an attempt to verify the choice of altitude levels used in the land classification, the four altitude strata were compared in two seasons in West Java in terms of the frequency of ruminant rearers using four broadly defined feeding practices viz. Fully grazed, Mainly grazed, Mainly hand-fed, Fully hand-fed (12).

The Low, Medium and High altitude strata were significantly different from each other in terms of ruminant feeding practices in both wet and dry seasons. Very high altitude was not significantly different to High in either season and was different from the Medium altitude stratum in the dry season only. The lack of statistical difference between the Very High and other altitude strata may be partly attributable to the small number of respondents (i.e. 15 farmers) in this stratum (21). Generally, there was a decrease in the amount of grazing and an increase in amount of hand feeding in the ruminant feeding systems as altitude increased. Although there appeared to be no significant difference between Very High and High altitude strata, the differentiation of land above 1000 metres was retained in the classification because of known differences in land, cropping and in temperature above this altitude (3).

Table 3. Percentage of land in each altitude stratum in West, Central, and East Java.

	ALTITUDE STRATUM			
	Low	Medium	High	Very High
West Java (35% of Java)	41	30	18	11
Central Java (28% of Java)	45	36	13	6
East Java (37% of Java)	46	35	12	7
Java	44	33	15	8

Rainfall (or Length of Dry Season)

The amount and pattern of annual rainfall may influence livestock production in numerous ways. Rain and cloud cover can reduce air temperature and hence affect livestock directly through comfort or indirectly e.g. through crop production and nutritive value of forages. Rainfall also influences humidity, which can be an important consideration in health (20), especially of animals kept in shady village conditions.

In Java annual rainfall varies from below 1000 mm in the northeast and north, to around 4000 mm in the central mountains and in parts of the southern coast (22). Except where irrigation is available, annual rainfall is a major determinant of types of crops grown and of farming systems (19). However, of more importance to livestock subsystems are the limitations imposed by length of the dry season.

For this classification the measure of rainfall proposed for use is the "length of dry season", adapted from Oldeman's agroclimatic classification of Indonesia (3), as shown in Appendix 8. A dry month is taken as one in which less than 100 mm of rain falls (80% probability), which is considered to correspond reasonably well with the level below which moisture stress is likely to affect yields of crops and grazing or forage plants. Dry season evapotranspiration ranges from three to ten millimetres per day in different regions of Java/Madura (3, 23).

The most significant feature of the data in Table 4 is the lengthening of dry season from West to East Java. The natural region maps confirm this trend. They also show that the North coast tends to be drier than the interior in all three provinces.

Since the northern coastal areas generally have fertile aluvial soils with gentle slopes, they are generally well suited to irrigation using water from the wet interior (3). The fully irrigated areas in the low rainfall

Table 4. Percentages of land in each rainfall stratum in West, Central, and East Java.

	RAINFALL STRATUM		
	Low	Medium	High
West Java (35% of Java)	17	35	48
Central Java (28% of Java)	16	17	17
East Java (37% of Java)	66	30	4
Java	36	41	23

areas of Java can be expected to support different farming systems to the non-irrigated areas.

In a study of 350 ruminant enterprises in West Java (12) it was shown that the three rainfall strata differed from each other in terms of frequency of feeding practices: Fully grazed, Mainly grazed, Mainly hand-fed and Fully hand-fed. Generally, the amount of grazing practiced was highest in the strata with the longest dry season (Low rainfall). The amount of hand feeding was highest in the shortest dry-season (High rainfall) strata.

Although the Low and Medium rainfall strata were not different in the wet season (i.e. when crops were in), they were significantly different in the dry season in terms of feeding practices used. In the dry season the proportion of grazing increased throughout West Java. This increased was greatest in the low rainfall stratum i.e. where few dry season crops can be grown.

Main Land-Use

When the boundaries of the "Natural Regions", which was based on altitude and rainfall classes, were plotted onto false-colour satellite imagery at a scale of 1 : 250,000, the visual homogeneity of land units within some Natural Regions was extremely low. It became apparent that the high variation in land-use within some Natural Regions was likely to result in high variation in livestock feed resources, present livestock distribution and potential development. This confirmed the need to include some other criteria in the classification, to achieve greater homogeneity in land units in the classification.

Several variables were considered and tested for inclusion in the classification, among them land form, average slope and soil type. These were however all rejected in favor of existing land-use as a third criterion.

Traditionally, livestock husbandry in Java takes a secondary place to cropping (24, 25), and with the high human pressure on the land this is unlikely to change considerably in the forseeable future. A basic thesis of this paper is that the type and potential of livestock subsystems in any area are closely linked to the prevailing land-use for other purposes. The high correlation in Java between maize production and total ruminant density is a good example of the way in which livestock rearing may be influenced by land-use (11).

Studies of land-use mapping (13), field exercises to check on changes since the maps were made, and studies of village animal husbandry (26), revealed that six main land-use types can be identified from the point of view of providing feed and other resources for livestock. These six broad types (listed in Table 5 and defined in Appendix 5) were adopted from land use classes already defined by other workers (31 and 32) in Java. Although marked variation exists within these simplified land use types, division of the natural regions on this basis is considered to account for a large part of the variation in factors affecting livestock production. The adoption in this land classification of more than six types would have resulted in too many small agro-climatic land units for practical purposes.

Other Variables Considered as Criteria in The Land Classification

Animal productivity in any agro-ecosystem is largely dependent on primary productivity, whether feedstuffs are derived mainly from crops, crop by products or pastures (27). As soil type is sometimes a major determinant of primary productivity within a particular climatic zone, this variable is often used as a criterion in land classification. However in Java two main problems preclude the use of soil type in a practical classification system:

1. Very high variation in many soil characteristics (e.g. texture, permeability, drainage, depth, fertility) occurs over relatively small areas, so that units are impractically small.
2. Existing soil mapping of Java is poor and is based mainly on taxonomic classes which are of little value in assessing potential productivity of soil (28, 29).

"Land form" criteria including average land slope, or broad descriptions of relief (e.g. flat, rolling, steep), are commonly used in land capability classifications (1). Such criteria are especially valuable in relation to "hazard of use" of the land from an erosion point of view. However land form is not included as a criterion in this classification because:

Table 4. The six main land-use types, and precentage of land area of each in West, Central, East Java and Java Provinces.

Main Land-Use	Percentage Of Land In Each Province			
	West	Central	East	Java
Mixed gardens	30	20	15	23
Mixed gardens/Sawah	20	30	20	22
Irrigated sawah (2-3 crops/yr)	10	30	15	18
Rainfed sawah	10	10	20	14
Forest (Primary, secondary, planted)	10	5	10	7
Estate crops (Rubber, tea etc)	4	1	1	3

4

1. An element of land slope is already included in the altitude stratification and in land-use type (29). The higher the altitude in Java, the higher the average land slope (1, 5).
2. Many livestock systems involve hand feeding (12), except in the lowest altitude zones where average slopes are gentle (1, 5) and erosion hazard minimal.
3. Estimation of average land slope is often difficult (without topographical maps), and average land slope means little in some land forms.
4. Similar feed resources are provided from the same land-use type, (e.g. irrigated ricefield) whether on flat or steep terrain.

A previously published land capability appraisal (1) classified all land in Indonesia as 'land development units', based on such features as land slope, soil pH, physiography, annual rainfall and relief. At first sight such a classification and mapping system appeared to provide an ideal basis for livestock research and development purposes. After detailed study, however, it was concluded that many of the land development units were defined in terms irrelevant to livestock production, and the maps were too inaccurate for use by livestock field workers.

Attempts to Classify Land by Multivariate Analysis.

Initially attempts were made to analyze data on 24 livestock and 15 physical variables from official district statistics, by means of Principal Component Analysis and Cannonical Correlation. The intention was to use ordination as an exploratory tool to obtain possible groupings of districts based on variables which were important to livestock distribution.

The large amount of data available and the apparently complex farming systems with so many interacting variables appeared to lend itself to this type of treatment. However, the district data were shown to be almost meaningless because of vast variation within districts e.g. altitude may range from 0 to over 2000 metres in some districts. Later, similar analysis was carried out on subdistrict data for five districts, although many of these are only slightly less variable than districts.

Although some groupings of subdistricts were suggested by the ordinations, these appeared to be associated mainly with altitude and rainfall, and many anomalies resulted which seem likely to have originated from serious errors in the data. When data for some of the variables were checked in the field and found to contain serious errors, that approach to classification of land was abandoned in favour of a simpler one, based on concepts which could be more easily understood and accepted by the people who would have to use the classification.

PRACTICAL APPLICATION OF LAND CLASSIFICATION

The main fields of application for land classification in livestock research and development are associated with:

1. Sampling and design in survey research.
2. Siting of research or development projects.
3. Dissemination of research results or development opportunities.
4. Planning of regional livestock priorities.

Various heirarchical classifications of land in Java may be derived using the three groups of criteria described above i.e. altitude class, rainfall class and main land-use type. The particular classification adopted should depend upon the aims and upon the area in which the study or project is being conducted.

Where human influence or land utilization is considered to be of overriding importance, the primary division in the heirarchy should be based on main land-use. When the main interest (or the main source of variation) is in environmental factors, then altitude or rainfall is used in the primary division of the heirarchy. The order of division in this paper, i.e. using Altitude, Rainfall then Main land-use, may be useful for many land classification applications, but other heirarchical classifications using the same criteria may be more appropriate for other applications.

Sampling Applications

Any study on livestock-related topics in Java entails difficult problems in design and sampling, because of the vast population size and range of conditions under which people farm animals. The information provided in this classification of land is intended to assist researchers in tackling their sampling problems in a broad but systematic way. The data provided have already proved useful in the planning and execution of surveys (35, 36), usually in combination with data from other sources.

In most surveys it is essential to limit the number of land or other units studied in some objective way. The selection of large land units is an obvious approach taken by many surveyors. Other surveys have concentrated on areas of high stock density, or areas with particular climatic conditions. The list of "major agro-ecological land units" in Table 2 has been combined with data on livestock numbers of each main species and sub-district land-use data to design extensive surveys on livestock and forage topics in Java (26).

Good spacial distribution of sampling sites is usually important in survey design. This can be achieved

initially from the Natural Region mapping (Appendix 1-3), followed by study of Land-use maps (13) and then field visits to selected sub-district offices, to select actual villages and plan access, prior to sampling itself. The use of aerial photography in conjunction with Natural Region mapping for final selection of farms is becoming practical and very valuable in many areas of Java.

Certain surveys are self-limiting in their aims e.g. a study on the forage potential of national estates. Design in this case would be relatively simple from the maps and data provided in this study, although much more detailed background information would be available from appropriate sources prior to field work.

Siting of Research or Development Projects

Often the scientist finds himself under pressure from a number of sources to do work which he feels should have lower priority than other work. If he is to argue successfully for correct allocation of resources in his work it is essential that good background data be available to support his argument. A sound land classification should assist scientists and development planners to site projects for maximum benefit to farmers.

Certain livestock-related studies or projects may be concerned only with particular land types (e.g. those under ricefields), while others may be aimed at livestock improvement in particular climatic conditions (e.g. Low altitude, Low rainfall land). The tables presented above are intended to provide a guide to the proportions of land in Java in various broadly defined categories, while the maps (Appendix 1-3) give an indication of the location of major areas of each Natural Region.

Dissemination of Research Results and Development Opportunities.

Research and extension workers need a clear understanding of the relationship and similarities of the area in which they work with other areas of Java (and South East Asia). Land classification should help agriculturalists in this respect i.e. to select from other areas, research results or development opportunities (10) which are likely to be locally applicable.

The choice of climatic criteria in this classification was made with a view to compatibility with criteria used in other agroclimatic classifications in Indonesian (3) and South East Asia (36). It is feasible therefore to refer to published agro-climatic mapping of Thailand or the Philippines and to relate land conditions and farming technology there to conditions and possibility for change in Java.

Planning of Regional Research and Development Priorities

If information on land, livestock and farming problems can be made available to policy-makers in a clear and logical form, then the likelihood of understanding and of sound decisions on research and development being made are enhanced. A broad land classification could be very valuable in this respect i.e. communication between scientists and policy-makers.

References to Table 2 and Appendix 6 show the largest single agro-ecological land unit in this classification of Java to be "Low altitude, Low rainfall, Rainfed sawah" (8.2% of total land area). The largest Main land-use type defined is Sawah/ Mixed gardens (22%). However the proportions of each land-use type and agro-ecological unit vary markedly between provinces, so that certain units assume much higher than average importance in individual provinces e.g. Low altitude, Medium rainfall, Irrigated sawah (14% of land) is the largest unit in Central Java. These and other data should provide broad general guidelines for planners in making decisions on priorities for research and development.

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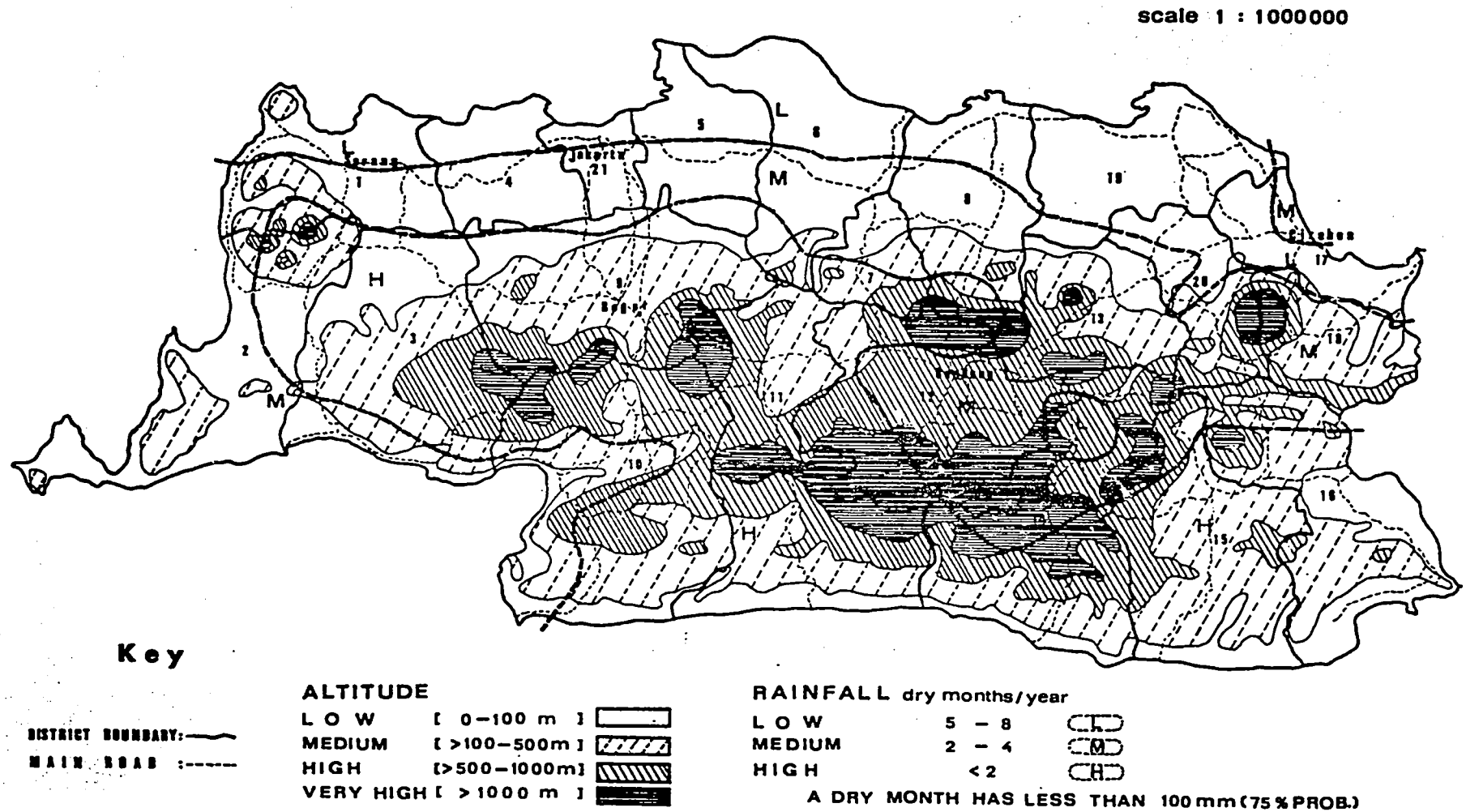
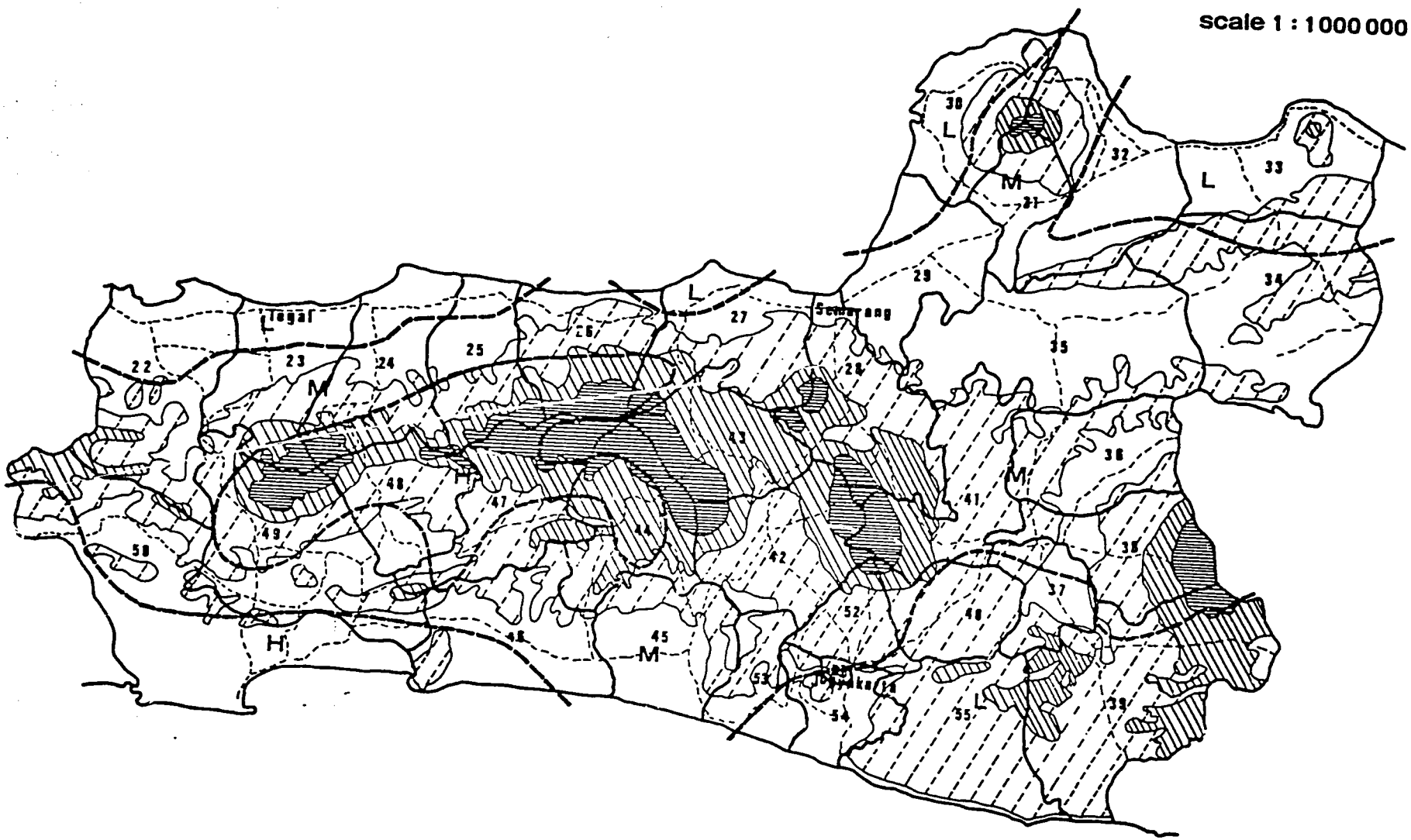
Appendix 1. West Java natural regions (altitude + rainfall).

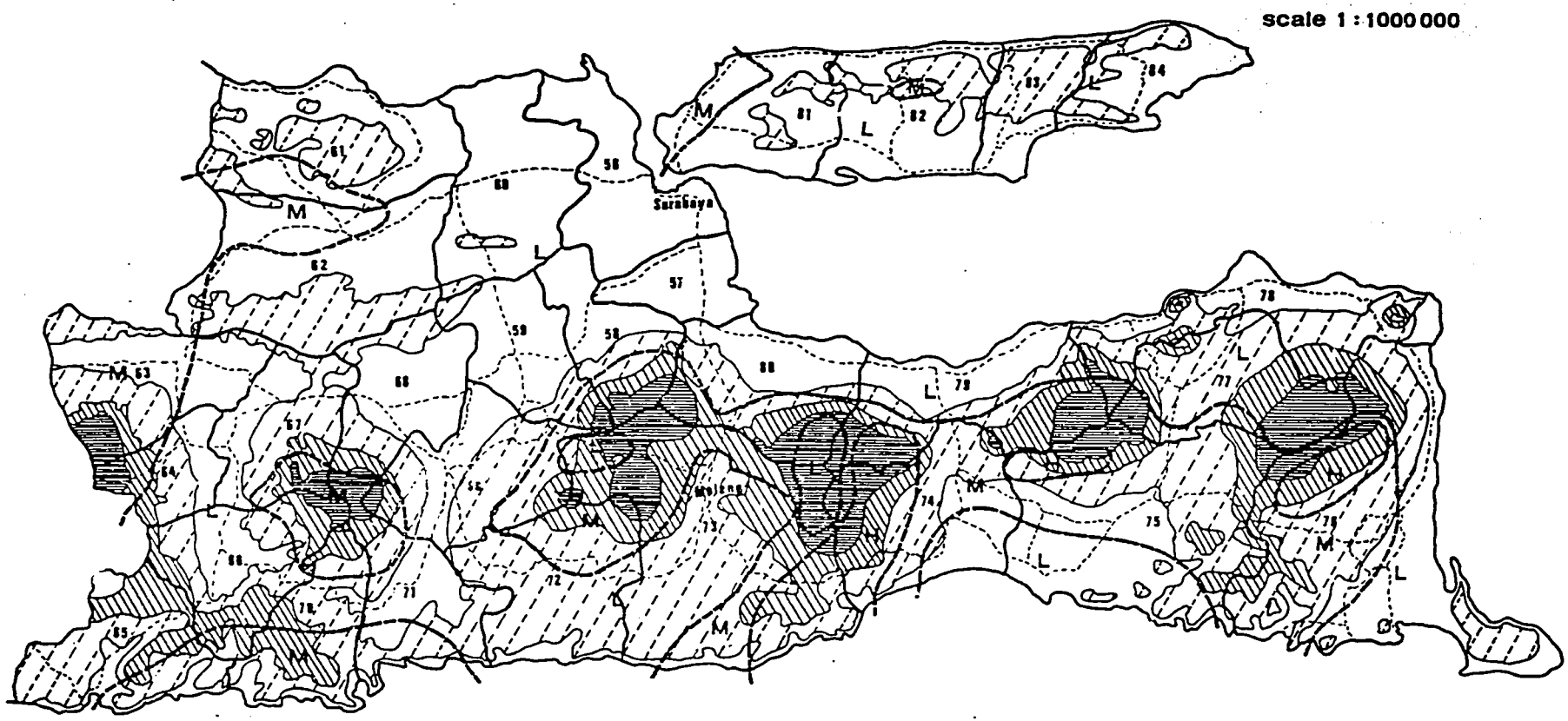


Appendix 2. Central Java natural regions (altitude + rainfall).



For key to ALTITUDE and RAINFALL classes see Appendix 1

Appendix 3. East Java natural regions (altitude + rainfall).



For key to ALTITUDE and RAINFALL classes see Appendix 1

Appendix 4. Key to names and numbers of Districts (Kabupaten) of Java in Appendix 1 - 3.

West Java Appendix 1	Central Java Appendix 2	East Java Appendix 3
No. District	No. District	No. District
1. Serang	22. Brebes	56. Surabaya
2. Pandeglang	23. Tegal	57. Sidoarjo
3. Lebak	24. Pemalang	58. Mojokerto
4. Tangerang	25. Pekalongan	59. Jombang
5. Bekasi	26. Batang	60. Lamongan
6. Krawang	27. Kendal	61. Tuban
7. Purwakarta	28. Semarang	62. Bojonegoro
8. Subang	29. Demak	63. Ngawi
9. Bogor	30. Jepara	64. Magetan
10. Sukabumi	31. Kudus	65. Pacitan
11. Cianjur	32. Pati	66. Ponorogo
12. Bandung	33. Rembang	67. Madiun
13. Sumedang	34. Blora	68. Nganjuk
14. Garut	35. Grobogan	69. Kediri
15. Tasikmalaya	36. Sragen	70. Trenggalek
16. Ciamis	37. Sukoharjo	71. Tulungagung
17. Cirebon	38. Karanganyar	72. Blitar
18. Kuningan	39. Wonogiri	73. Malang
19. Indramayu	40. Klaten	74. Lumajang
20. Majalengka	41. Boyolali	75. Jember
21. Jakarta	42. Magelang	76. Banyuwangi
	43. Temanggung	77. Bondowoso
	44. Wonosobo	78. Situbondo
	45. Purworejo	79. Probolinggo
	46. Kebumen	80. Pasuruan
	47. Banjarnegara	81. Bangkalan
	48. Purbolinggo	82. Sampang
	49. Banyumas	83. Pamekasan
	50. Cilacap	84. Sumenep
	YOGYAKARTA	
	51. Yogyakarta	
	52. Sleman	
	53. Kulonprogo	
	54. Bantul	
	55. Gunung Kidul	

Appendix 5.

DEFINITION OF MAIN LAND USE TYPES
(See References 31 and 32)

"Sawah" is a level block of land used for flooding of wet rice or sometimes for sugar cane by irrigation or rainfall. Sawah is often planted to other crops such as maize, soybeans, groundnuts, vegetables, after the main rainfall or irrigation season is finished. Because they must hold water for wet rice production, the boundaries of sawah blocks consist of raised banks (galengan). On steep land these banks may constitute a high proportion of the total area, and may provide an important source of cut forage for ruminants.

Rainfed sawah (contains > 70% of this unit/km² cropped area)

This land-use type depends for its water supply mainly on rainfall (tadah hujan). In this classification dryland sawah may be temporarily irrigated for part of the year but can only grow *one crop* of wet rice per year. Secondary crops may be grown following rice harvest. The fallow period during which no crops are grown may be from 4 to 8 months.

Irrigated sawah (contains > 70% of this unit/km² cropped area)

Water supplied by irrigation allows at least two crops of rice per year (or sugar cane production all year). The fallow period (if any) between crops during the year is relatively short (4 months or less). Delineation or mapping of Fully irrigated land in Java is very difficult, as the extent of irrigation varies from year to year i.e. with rainfall but often markedly with changes in condition of irrigation works. In High rainfall areas land may be termed Irrigated sawah where no proper irrigation works exist, but water is available from rainfall or streams throughout the year (e.g. on mountain slopes).

Mixed gardens (contains > 70% of this unit/km² cropped area)

Land is not levelled as for sawah, although it may be terraced. In this classification for Java, Mixed gardens includes several land-use types such as those often termed kebun, tegalan, ladang. Both permanent crops (e.g. coconuts, fruit trees, bananas), and annuals such as cassava, maize, and beans are grown every year. In some poor soil areas the land is not all used every year and this is more strictly termed tegalan. In Java most tegalan is becoming used more intensively each year. Most land marked on the 1971 Land-use Maps (13) as tegalan can now be called Mixed gardens as can the fringes of many areas shown as forest.

Vegetable production is an example of a specialized type of Mixed gardens, usually on mountain slopes (beans, cabbages, onions, carrots). However, vegetables are also produced on sawah in certain areas. Where vegetables follow wet rice crops, the land-use type is sawah.

A large variation in soil type exists in Mixed gardens land over Java. Considerable differences in fertility can result in large productivity differences. However, as the crops and the type of by-products from Mixed gardens are common over a wide range of soils, this broad land-use term is considered appropriate for general use in the classification. Specialised farming systems such as vegetable production within Mixed gardens may however need special consideration in planning livestock related studies.

Sawah and Mixed gardens (contains > 30% sawah and > 30% Mixed gardens/km² of cropped area)

The sawah in the mixture may be either dryland or irrigated. In addition to the usual by-products of Mixed gardens, considerable quantities of rice straw are available for forage.

Estate crops (contains > 70% of the unit/km² of cropped area)

Plantations of permanent crops such as rubber, tea, coconuts, oil palm. Although this land-use type only occupies about 2% of Java, certain estates (e.g. young rubber and coconut plantations) can have high potential for providing forage and for ruminants.

Forest (contains > 70% of this unit/km² of land)

Refers to all planted and native forest, including secondary forest, mountain tops, steep areas and nature reserves.

Note: In allocating land to main land-use categories, areas of house-yard (or Pekarangan) are ignored. For example, an area containing 40% of Sawah and 20% Mixed gardens and 40% of house-yard would be classified as Sawah/Mixed gardens, because over 30% of *cropped* land is in Mixed gardens.

Appendix 6. Agroecological land units in Java and its provinces (percentages of total land area in Java).

Natural Altitude class	Regions Rainfall class	Percentages of land in each Natural Region in provinces and in Java %	Main Land-Use Types (%) Rainfed	Sawah	Irrigated	Sawah	Mixed Gardens	Sawah/	Mix Gdns	Forest	Estate	Crops	Swamp/	Mangrove	Eroded	Land
Low		West	15	7.5	3.0		0.8	1.5								
		Central	11	2.0	7.5		0.2	1.1								
		East	38	14	9.0		5.7	5.7		1.1						
		All Java	23	8.2	6.4		2.4	2.9		0.9			2.0			
Low	Medium	West	16	2.5	0.5		5.6	2.6		0.8	0.3					
		Central	28	5.0	14		4.2	4.2		2.8					0.3	
		East	7	3.0	2.0		1.4	1.4		0.3						
		All Java	16	2.5	6.0		3.7	3.6		1.2	0.1		1.0		0.1	
Low	High	West	10		0.5		6.5	0.5		0.5	1.5					
		Central	6		3.6		0.6	1.2		0.3						
		East	1													
		All Java	5		1.2		2.4	0.5		0.3	0.5		1.0			
Medium	Low	West	1													
		Central	4	0.2	0.6		2.2	0.6		0.2	0.1					
		East	22	1.6	0.5		0.5	6.6		6.6					1.1	
		All Java	16	0.7	0.3		0.8	2.6		2.5	0.1				0.4	
Medium	Medium	West	9	0.2	0.1		3.1	4.0		0.9	0.4					
		Central	27	1.5	2.5		5.4	13		2.7	0.5					
		East	12	0.8	0.3		6.6	2.4		0.6	0.6				0.3	
		All Java	14	0.7	1.0		5.0	6.1		1.3	0.5				0.1	
Medium	High	West	20		3.0		6.7	4.0		4.0	1.0					
		Central	5		1.0		1.5	2.0		0.3						
		East	1													
		All Java	9		1.3		2.9	2.0		1.5	0.4					
High	Low	< 3% of Java														
High	Medium	West	6	0.5	1.0		1.8	2.4		0.1						
		Central	8	0.2	1.0		2.8	3.6		0.2						
		East	7				2.4	1.4		2.4	0.3					
		All Java	7	0.3	0.7		2.3	2.4		1.0	0.1					
High	High	West	12		0.6		4.2	3.6		2.4	0.6					
		Central	4		0.4		1.4	1.6		0.4						
		East	1													
		All Java	6		0.3		2.0	1.7		1.0	0.2					
V. High	Low	< 2% of Java														
V. High	Medium	< 4% of Java					2			2	1					
V. High	High	< 4% of Java														
Total all Java			13	18	22		23	11			3	4		1		

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