Forest types of Ujung Kulon (West Java, Indonesia)

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ABSTRACT

Hommel, P.W.F.M. and H. van Reuler, 1990. Forest types of Ujung Kulon (West Java, Indonesia). Wageningen (The Netherlands), The Winand Staring Centre. Report 24.
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A vegetation survey was carried out in the Ujung Kulon nature reserve (West Java, Indonesia). Attention was paid to the altitudinal zoning of the vegetation, to succession and to the applicability of the phyto-sociological approach in forests of the humid tropics. The altitudinal zoning provides a clear example of the so-called telescope effect. The pattern of primary forests, secondary forests, and shrublands can be explained by the former shifting cultivation practice and the impact of the 1883 eruption of the nearby volcano Krakatau. The arguments against the phyto-sociological approach in the humid tropics are found to be invalid.

Keywords: minimal area, phyto-sociology, telescope effect, tropical forests.

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FOREST TYPES OF UJUNG KULON (WEST JAVA, INDONESIA)

Ujung Kulon is a peninsula, situated on the westernmost tip of the island of Java (Indonesia). The area covers some 30 000 ha. In 1883, the area suffered severely from the tsunamis and ash-rains, which accompanied the notorious eruption of the nearby volcano Krakatau. Consequently, famine, epidemics and plagues, which came as an aftermath of the disaster, caused the surviving inhabitants to leave the area. At present, Ujung Kulon is a nature reserve, renowned for its population of Javan rhinoceros (*Rhinoceros sondaicus*), which is probably the only one remaining in the world (1).

During the period 1981 - 1983, a survey was carried out in Ujung Kulon, initiated by the World Wildlife Fund. The main objective was to classify, describe and map the various vegetation types of the area. Moreover, attention was to be paid to current changes in the vegetation and to the food-availabity for the Javan rhino (2). As for methods, a broad landscape ecological approach was chosen (3). Photo-interpretation resulted in the delineation of preliminary landscape units and provided a strategy for stratified sampling. On 336 sampling sites vegetation, soil, landform and lithology were described. These four aspects were worked out into classification systems, which were eventually integrated into a landscape typology. Ecological interpretation of the landscape types is supported by additional information on history and climate, mainly gathered from literature.

As for the soils, first a local classification system was compiled, which was only afterwards translated into the FAO/UNESCO terminology (4). As for vegetation, both a physiognomic and a floristic (i.e. phyto-sociological) approach were tried out. Physiognomic typologies are available on a global scale, for the Malayan region as a whole, and even for Java (5). For an adequate description of all of Ujung Kulon's forest types, Eiten's global system of 'vegetation forms' appeared to be the most appropriate choice (6). As for the floristic approach, no suitable typology was available. In fact, in literature one meets a general scepticism concerning its practical applicability in the forests of the humid tropics. Still, an attempt was made to use the Braun-Blanquet approach, in which vegetation is described by its complete floristic composition and classification results from tabular comparison of the relevé data (7).

As a result of the survey, the arguments against the applicability of the approach in the humid tropics, as forwarded e.g. by Van Steenis (8), proved to be invalid. Especially, the issue of the minimal area (which is supposed to be exceedingly large) proved to cause no serious problems, if used in a practical sense and if all age classes and terrestrial growth forms are included. Figure 1 gives mimimal area curves for a stand of primary, semi-deciduous forest. For evergreen rain forest the curves are more or less

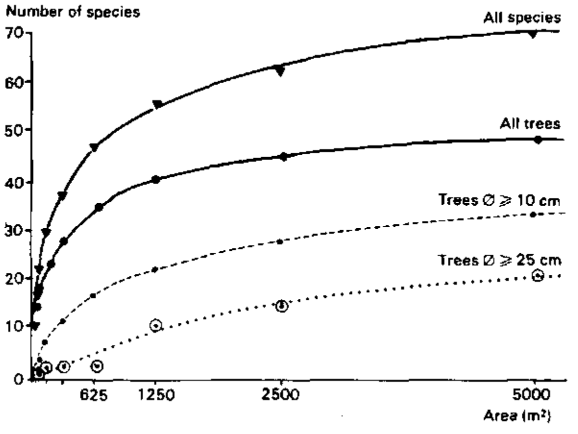

Figure 1. Minimal area curves for a stand of semi-deciduous, primary forest (Peucang Island, Ujung Kulon: comm. of Bischofia javanica and Ficus pubinervis)

similar, although species numbers are higher.

Figure 2 shows the distribution of the most common forest types (described both as plant communities and as vegetation forms) of Ujung Kulon in relation to other aspects of the landscape, by means of a schematic cross section. From this figure, some interesting features of the landscape are apparent. One is the predominance of semi-deciduous vegetation in the lowlands. On the other hand, the higher mountain slopes are covered with evergreen rain forest. The vegetation of the summit area in some respects even mimics the physiognomy of the subalpine forests that occur on the mainland of Java at altitudes above 2400 m. Such a condensed vegetation zonation of mountainous islands or pen-insulas in the tropics is known as the 'telescope effect', in result (though not in cause) resembling the effect of mountain mass elevation (9). Note that the Ujung Kulon rain forests are mainly of primary nature and that variation in soil is hardly reflected in the pattern of vegetation types.

The semi-deciduous vegetation of the lowlands is predominantly of secondary nature. Here one finds, in general, strict relations between soils and vegetation types. However, where relatively young secondary vegetation is concerned, such relations may be less obvious. Especially, the rattan-dominated shrublands may occur on various types of soils. These shrublands cover the former fields that were abandoned in 1883. Unfavourable physical properties of the top layer of volcanic ashes had a strong impact on succession on these open sites.

As for a comparison of vegetation classification methods, one may conclude that both physiognomy and floristic composition clearly reflect the relation between climate and vegetation. However, plant communities provide a far better aid in analysing the relation between vegetation and edaphic factors, if such a relation is apparent at all. The palm forests may serve as an example. All such forests in Ujung Kulon are quite identical as for their physiognomy: there is a more or less closed layer a palms (mainly *Arenga obtusifolia*). Overhead, an upper tree layer of broad-leaved trees is present, in which huge strangling fig trees (*Ficus spec.*) predominate. The undergrowth is very sparse or even absent and so are lianas and epiphytes. On the other hand, differences in floristic composition result in the description of several plant communities showing a remarkably high correlation with other aspects of the landscape. Moreover, these plant communities can mostly be related to other, more complex (partly even primary) types, on account of similarities in floristic composition and site characteristics. This implies that hypotheses on current and future successional processes may be formulated.

Finally, the availability of rhino food-plants is best assessed by combining the results of both approaches. Physiognomy is broadly indicative for the availability of potential food-plants (defined in terms of density of suitable growth forms and size classes). Plant communities help to determine the available amount and distribution of preferential food-plants more accurately.

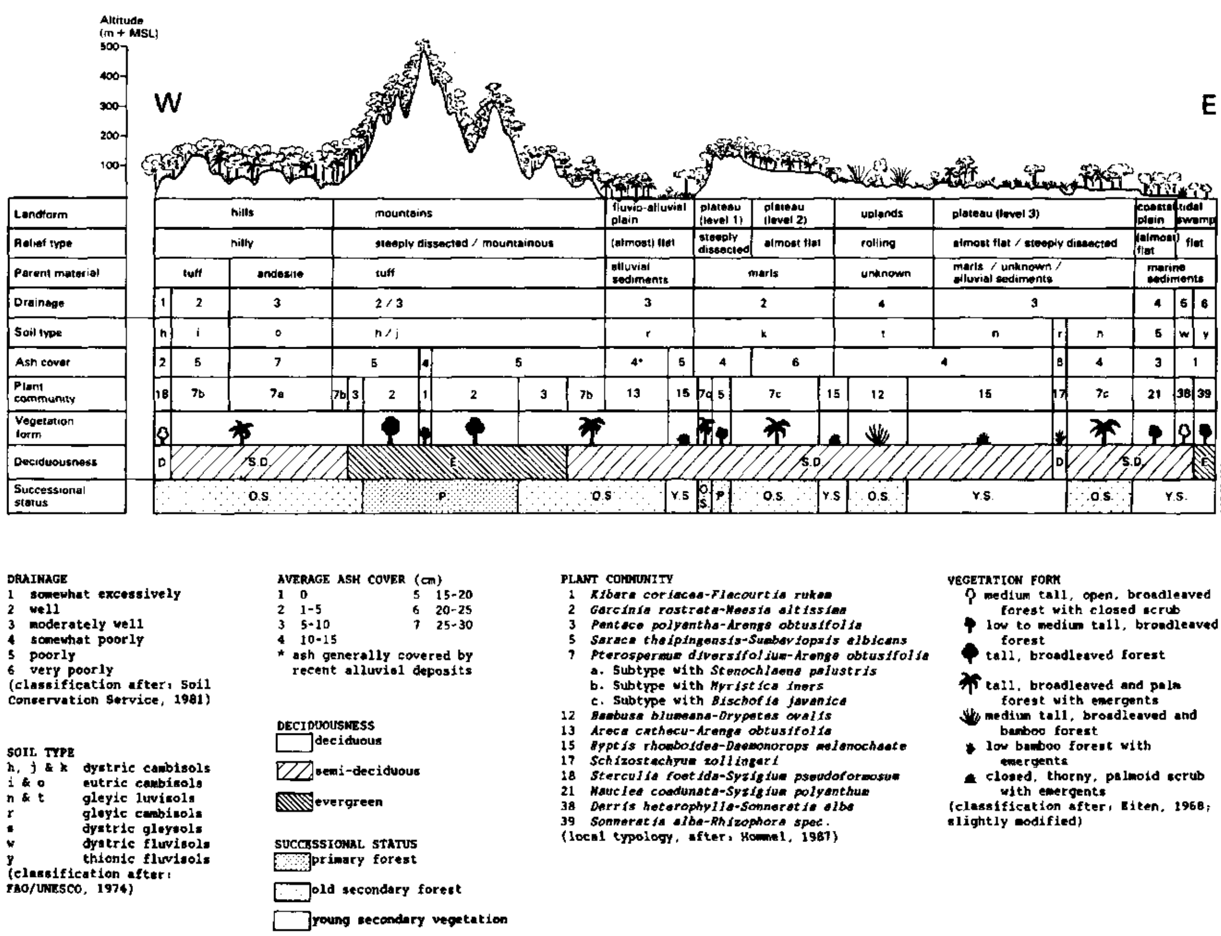

Figure 2. Schematic cross section of Ujung Kulon (orientation: west - east; length: 27 km)

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Appendix:
Summarized version of the vegetation constancy table (slightly modified after Hommel, 1987).

The species are grouped into sociological groups. . = this group should not occur; 1 = at least one species of this group may occur; 2 = at least one species of this group should occur; 3 = like 2, but at least one species is dominant in 25-75% of the plots; 4 = like 2, but at least one species is dominant in 75-100% of the plots. Dominant species have a cover of more than 45%; the species at issue are underlined. * = insufficiently known community.

Plant-communities → / Sociological groups with their main species: ↓	1 Kibara-Flacourtia	2 Garcinia-Meesia	3 Pentace-Arenga	4 Rubus-Gleichenia*	5 Saraca-Sumbaviopsis	6 Uncaria-Sumbaviopsis*	7a Pterosp.-Arenga-Steno.	7b Pterosp.-Arenga-Myris.	7c Pterosp.-Arenga-Bisch.	8 Parinari-Gnetum	9 Pterygota-Rinorea*	10 Bischofia-Ficus	11 Cerbera-Buchanania	12 Bambusa-Drypetes	13 Areca-Arenga	14 Oncosperma-Salacca	15a Hyptis-Daemon.-Dill.	15b Hyptis-Daemon.-Lant.	16 Canthium-Albizia*	17 Schizostachyum	18 Sterculia-Syzygium	19 Dendrocnide-Syzygium	20 Dendrocnide-Arenga*	21 Nauclea-Syzygium	22 Corypha-Ardisia	23 Ximenia-Ardisia	24 Calotropis-Dodonaea*	25 Dactyloct.-Digitaria*	26 Fimbrist.-Chrysopogon	27 Fimbrist.-Oplismenus	28 Barringtonia-Syzygium	29 Sophora-Calophyllum	30 Pemphis-Lumnitzera	31 Mikania-Pandanus	32 Ipomoea-Ischaemum	33 Ischaemum-Scaevola*	34 Nymphaea-Najas*	35 Phyla-Eleocharis	36 Pandanus-Scirpodendr.	37 Lumnitzera-Ardisia*	38 Derris-Sonneratia	39 Sonneratia-Rhizophora
1 Kibara cor., Aeschynanthus rad., Microtropis ellipt.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2 Phyllanthus hassk., Eurya acum., Cyathea? junghuhn.	2	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3 Asplenium nidus	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
4 Lasianthus retic., Pandanus nit., Alocasia longiloba	2	2	1	1	1	1	1	.	.	.	.	.	.	1	.	.	1	.	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5 Garcinia rost., Parartocarpus ven., Cryptocarya den.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6 Calamus orn., 'Paku leata' Polyp., Cyrtandra ?picta	2	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7 Meesia altis., Lasianthus hirs., Xanthophytum frut.	.	3	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8 Gleichenia truncata, Amomum spec., Ficus racemosa	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9 Calamus jav., Diospyros frut., Aglaia ?odoratissima	2	2	2	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10 Myristica iners, Payena acuminata, Neonauclea calyc.	.	2	2	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11 Amorphophallus variab., Ardisia lur., Lerchea long.	.	1	2	1	2	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12 Sumbaviopsis alb., Elaeocarpus glab., Ardisia cymul.	.	.	.	.	2	4	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13 Stenochlaena palustris	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.
14 Mallotus blumeanus, ?Wendlandia glab., Capparis pyr.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15 Baccaurea javanica, Dillenia excelsa, Artocarpus el.	1	2	2	2	1	1	2	2	2	.	1	.	.	.	1	2	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16 Diospyros macrophylla, Garcinia parv., Galearia fil.	.	1	2	1	1	1	2	2	2	1	1	1	.	1	1	1	1	1	1	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17 Stelechocarpus bur., Planchonia val., Dracontom. pub.	.	1	1	1	1	1	.	2	1	1	1	1	.	.	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18 Ficus spec. ('strangler', not F.microc., stup.&tinc.)	.	.	1	1	1	1	1	1	1	1	1	1	1	.	1	1	1	.	.	.	.	.	1	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
19 Diospyros cauliflora, Sterculia macr., Bombax valet.	.	.	.	.	2	1	1	1	1	2	2	.	.	.	1	1	1	1	1	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20 Rinorea cymulosa, Mallotus moritzianus, Kopsia arb.	.	.	.	.	1	1	.	.	.	2	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
21 Pterygota horsfieldii, Ficus magnoliaefolia	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22 Aglaia/Dysoxylum spec., Syzygium zol., ?Anacolosa f.	1	2	2	1	2	1	1	1	1	2	2	2	2	1	1	1	1	1	1	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23 Pterospermum javanicum	.	.	.	1	2	1	1	1	1	1	1	2	2	.	.	1	1	1	1	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24 Aglaia argentea, Cryptocarya fer., Scolopia spinosa	.	.	.	.	2	2	.	1	1	2	2	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25 Suregada glomerulata, Rauvolfia reflexa	1	.	.	.	.	.	.	.	1	2	2	2	2	.	.	.	1	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26 Ficus pubinervis, Myristica gust., Zanthoxylum nit.	.	.	.	.	.	.	.	.	.	.	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
27 Pterospermum div., Diospyros malab., Schefflera ell.	.	.	.	.	2	2	1	1	1	2	1	1	1	1	.	.	1	.	.	.	1	.	1	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
28 Dillenia obovata, Microcos tomentosa, Lepisanthes sy.	.	.	.	.	.	.	3	1	.	.	.	.	.	1	1	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29 Drypetes ovalis, Streblus spec., Diospyros polyalth.	.	.	.	.	.	.	.	1	2	1	1	.	.	3	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30 Hypobathrum racemosum, Dalbergia pinn., Uvaria spec.	.	.	1	1	1	1	.	1	1	2	2	2	1	2	.	.	1	1	1	1	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31 Bambusa blumeana, Panicum not., Mischocarpus sund.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	1	1	1	1	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32 Aporosa aurita, Vitex glabrata	.	.	1	1	1	1	1	1	1	1	1	1	.	2	1	.	1	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33 Bischofia javanica	.	.	.	.	.	.	.	.	1	1	1	2	1	.	2	.	.	.	2	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34 Lindernia ruell., Ophiorrhiza trich., Nervilia spec.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	2	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35 Areca cathecu, Catimbium malaccensis, Alocasia macr.	.	.	.	.	.	1	.	1	1	.	.	.	.	.	2	1	1	1	1	.	1	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
36 Oncosperma tig., Pyrenaria ser., 'Paku anjing' (Pol.)	.	1	1	1	.	.	1	1	1	.	.	.	.	.	2	2	1	1	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
37 Salacca edulis	.	1	1	1	.	.	.	.	1	.	.	.	.	.	1	3	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
38 Dioscorea nummularia, Smilax leuc., Dinochloa scand.	2	1	1	2	.	1	1	1	.	.	.	.	.	.	.	.	1	2	1	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39 Merremia pelt., Hyptis rh., Lepistemon bi./Merr.vit.	.	.	.	.	.	2	.	.	1	.	.	.	.	1	1	1	2	2	2	1	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
40 Albizia procera, Hedyotis coerulea, Canthium horrid.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41 Schizostachyum zollingeri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42 Sterculia foetida, Macaranga tanar., Tectaria spec.	.	.	.	1	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43 Syzygium pseudof., Planchonella ob., Claoxylon pol.	1	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	2	.	.	.	.	.	.	.	2	.	.	1	.	.	.	.	.	.	.	.
44 Aglaia latif., Dendrocnide st., Pseuderanthemum div.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45 Polyalthia lateriflora, Ardisia lanc., Drypetes lon.	.	1	1	1	2	1	2	2	1	2	1	1	.	.	.	.	.	.	.	.	2	1	2	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
46 Arenga obtusifolia	.	2	3	1	2	2	4	3	4	2	1	.	.	1	4	1	1	1	1	1	1	1	4	1	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
47 Piper spec., Syzygium spec. (rest), Symplocos spec.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	.	1	1	.	2	.	1	.	.	.	.	1	1	.	.	.	.	.	.	.	.	1	.
48 Amomum megalocheilos, Pinanga coronata, Apama tom.	2	2	2	2	2	1	1	1	1	.	.	.	.	1	1	1	2	2	2	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49 Homalomena cordata, 'Kilalayu' (Sapind.), Donax cann.	2	2	2	2	2	2	2	2	2	.	.	.	.	2	2	2	2	2	2	1	2	2	2	2	.	1	.	1	.	.	1	.	.	.	.	.	.	.	1	.	.	.
50 Daemonorops melanoch., Lygodium ciricin., Ficus mont.	.	1	1	2	1	2	2	2	2	.	.	.	.	2	2	2	3	3	2	2	2	2	2	3	1	1	.	.	.	1	1	.	.	1	.	.	.	.	2	1	1	.
51 Leea sambucina, Tetracera scandens, Tetrastigma lan.	.	1	1	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	1	2	.	.	.	.	.	1	.	.	.	.	.	.	2	.	1	.
52 Amomum compactum, Arenga pinnata, Cissus discolor	.	.	.	.	2	1	.	.	1	.	.	.	.	2	.	1	1	1	1	1	.	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
53 Spondias pinnata, Embelia spec., Cananga odorata	.	.	1	1	.	.	1	1	1	1	1	1	.	1	.	.	1	1	1	1	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
54 Licuala spinosa	.	.	.	.	.	.	1	1	1	.	.	.	.	2	2	1	1	1	1	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
55 Syzygium polyanthum	.	.	.	.	.	.	.	1	1	.	1	.	.	.	2	1	1	1	1	.	.	.	.	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
56 Lagerstroemia flos-reg., Vitex pub., Micromelum min.	.	.	.	.	.	.	1	1	1	1	1	1	.	1	1	1	1	1	1	.	.	1	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.
57 Nauclea coadunata, Corypha utan, Cayratia trifolia	.	.	.	.	.	.	.	1	1	.	.	.	.	1	.	1	1	1	1	1	.	1	.	2	2	.	.	.	.	.	1	.	.	.	.	.	.	1	3	2	1	.
58 Eupatorium odoratum, Mikania cordata, Gmelina ell.	.	.	.	1	.	2	.	.	.	.	.	.	.	.	.	.	2	2	2	1	1	3	1	1	1	2	1	1	1	1	1	.	1	.	1	.	.	1	1	1	1	.
59 Lantana camara	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	2	.	.	1	.	1	.	1	2	1	1	.	.	1	.	.	.	.	.	.	.	1	.	.
60 Glochidion zeylanicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.
61 Mallotus philipp., Curculigo orch., Diospyros ferrea	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
62 Ximenia americana, Pteris vitt., Stachytarpheta jam.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	2	2	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.
63 Dodonaea viscosa, Calotropis gigantea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
64 Digitaria heter., Dactyloctenium aeg., Eclipta pros.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
65 Desmodium triflorum, Phyllanthus ur., Imperata spec.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.
66 Fimbristylis dich., Chrysopogon acic., Borreria art.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
67 Murdannia nudiflora, Alysicarpus vagin., Sida rhomb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.
68 Axonopus comp., 'Jampang piit' (Poac.), Cyperus spec.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	1	2	2	.	1	2	1	1	1	1	1	2	2	2	.	1	.	.	.	.	.	.	1	.	1	.
69 Fimbristylis miliacea, Hygrophila er., Hedyotis dif.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
70 Barringtonia as., Messerschmidia arg., Pandanus bid.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	.	.
71 Ardisia humilis, Ficus septica, Buchanania arboresc.	.	.	.	.	.	1	1	1	1	2	2	2	3	1	1	1	1	1	1	1	1	2	1	2	4	3	2	1	1	.	2	2	1	.	.	1	.	1	2	3	1	.
72 Calophyllum inoph., Guettarda speciosa, Ixora palud.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	1	.	3	1	.	.	.	1	2	.	.	.	.	.	.	.	1	1	.
73 Sophora tomentosa, Scaevola taccada, Cassytha filif.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	1	1	2	.	.	.	.	.	.
74 Hernandia peltata, Terminalia catappa, Cerbera mang.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2	1	2	.	.	.	.	.	.	.	1	.
75 Desmodium umbellatum, Mallotus tiliaef., Pemphis ac.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	2	3	.	.	.	.	.	.	.	1	.
76 Cycas rumphii, Pongamia pinnata, Crinum asiaticum	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	1	.	.	.	.	1	.	.	.	1	2	.	.	.	.	.	.	.	.	.
77 Pandanus tectorius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	3	2	.	4	.	.	.	.	.	.	.	.
78 Ischaemum muticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	1	1	1	3	.	1	1	.	.	3	.	.	.	.	1	1	.
79 Fimbristylis cym., Euphorbia atoto, Thuarea involuta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1	1	.	1	2	1	.	.	.	.	.	.
80 Ischaemum fieldingianum, Cymbopogon rectus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
81 Najas indica, Utricularia ?gibba, Nymphaea nouchali	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
82 Phyla nodiflora, Eleocharis dulcis, Typha angustif.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	3	.	1	.	.
83 Pandanus furcatus, Scleria spec.	2	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
84 Scirpodendron ghaeri, Livistona hasseltii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	4	.	.	.
85 Premna corymbosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	1	1	.	.	.	.	.	2	.	.	.
86 Breynia spec.	2	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	1	.	2	.	.
87 Lumnitzera spec., Casuarina equisetifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	4	1	1
88 Acrostichum aureum, Derris heteroph, Nypa fruticans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	1	1	1	3	.
89 Sonneratia alba, Aegiceras cornic., Ceriops decandra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2	2
90 Rhizophora apiculata, Rhizophora spec., Ceriops tag.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	3