X. REVIEWS

Atlas Indonesia, by I Made SANDY, 2nd ed., 44 pl., format 30 by 30 cm. (1976). Published by Dwidjendra, Denpasar, Bali, Indonesia. Rp. 6000, equals ± US$ 15.00.

The whole country is covered by 24 maps, which give altitudes in zones 0-100-400-1000-1500-3000-4000 m. The maps give the provinces (e.g. in Sumatra: Aceh, S. Utara, S. Barat, Lampung, S. Selatan + Bengkulu, Jambi, in this not very obvious order, also note that Aceh lies N of N Sumatra, Lampung S of S Sumatra). The provinces are surrounded by white, most cumbersome when frontier areas like Kerinci are to be studied. Districts (kabupaten) are clearly indicated.

Kilometres are indicated, scales are not. Mostly, the scale is in the same order as in the Atlas van Tropisch Nederland, but not exactly so, and especially the Lesser Sunda Islands (Nusa Tenggara) are here larger and with more names. Eastern Timor (Timor Timur) has been added in the present edition: scale 30 cm to 240 km, vs. Seram 10 cm to 330 km. There are several detail maps of small islands like Ambon, Komodo, Ternate. Borneo (Kalimantan) and Celebes (Sulawesi) seem pretty well-covered, and one quickly learns to distinguish between Sulawesi Tengah (the neck and E-arm), and Sulawesi Tenggara (the SE-arm).

The Atlas seems intended for schools, and some simple additional maps are supplied, like geology of Java, Sumatra, Borneo, and Timor, but no climate, no volcanism, no population density, no vegetation (save Java and Lampung, in the latter much alang alang). A few photographs of animals occur, but the red star to indicate a nature reserve (cagar alam) is not even used to mark Cibodas. Roads are indicated in a probably optimistic profusion. No city maps to speak of. The language is entirely Indonesian. The execution is not bad at all.

There are far fewer names than in the Atlas van Tropisch Nederland, far more than in the Times Atlas and on maps of the National Geographic Society. The Index contains an estimated 8000 names, most unfortunately divided over 9 categories: places, mountains, capes, craters + lakes, rivers, tributaries (tambahan), bays, straits, and islands. Reference is made to (part of) island, but not to page, nor to grid.

Most disquieting to scientists is the fact (which also makes this Atlas, I am afraid, mandatory for institutes dealing with Indonesia) that some 40% of the names do not occur in the well-known Gazetteer published by the U.S. Board on Geographical Names (the new spelling accounted for, of course). Therefore, field workers and scientists, please use names that can be found in gazetteers of international scope, under indication of latitude and longitude! — M.J.

BRÜCHER,H., Tropische Nutzpflanzen / Ursprung, Evolution und Domestikation, ix + 529 p., many fig. (1977). Springer-Verlag Berlin, Heidelberg, New York. DM 248.

An introduction of some 30 pages is followed by 7 chapters concerning (1) starch plants, i.e. grasses and tubers, (2) protein plants, i.e. legumes, (3) technical plants supplying resins, fibres, etc., (4) fruits and vegetables, (5) spices and stimulants, (6) oil plants, (7) palms, obviously being too multi-purpose for the preceding classification. Missing are pharmaceutical plants (Cinchona, Rauwolfia, Vinca).

In general, for the more important and well-known species the treatment follows this pattern: botanical name, family, chromosome number(s), common names in German, English, French, Spanish, notes on origin, economic importance, botanical description including infraspecific classification, cultivars and notes on related species, cultivation, prospects of future domestication, important diseases.

It may also be useful to indicate what the book does not give. In the first place it was not the intention of the author to enumerate *all* useful tropical plants. He concentrates on the groups in which domestication (= purposeful adaptation by man accompanied by genetical changes through intentional selection) plays, has played or could play in the future a distinct rôle.

In the second place: this admirable book is very much a neotropical book. The most obvious cause is of course the fact that the author worked for more than 25 years in South America, and that his personal acquaintance with the Asiatic tropics seems to be restricted to one journey to India. This is, I think, responsible for the absence of Durio in the chapter on fruits (not even a line in the paragraph on "tropical fruits of secondary importance"!), for the half column devoted to sago, and for many one-sided or incomplete statements: Eugenia jambos fruits are valued in Trinidad, Tamarindus indica fruits are an emergency food in Africa and India and a beverage is made of them in the Caribbean, pisang ambon is considered an inferior kind of banana in Java.

But the cause of this neotropical unbalance may lay deeper too. It seems to me that much more work has been done on neotropical plants and crops than on palaeotropical ones, more is known of their history, there has been more breeding and selection. In the countries of Malesia there is plenty of room for more research in the field of "economic botany", not in the first place for the major crops but especially for the smaller crops and for the plants which are not even crops but could become so in future.

The book is expensive but worth its price. It is full of recent and relevant information, very well-readable, it is well-produced, contains many drawings and photographs and

up-to-date bibliographies. There are some (inevitable) inaccuracies in names, etc., and the index could have been prepared with more care: although the user often will try to find his entry via a common name, several of these I found missing in the index, though present in the text. — C.Kalkman.

CARLQUIST,S., Island Biology, 660 p., many fig. & photogr., 8° (1974). Columbia University Press.

This beautifully illustrated work tends to be a supplement to the former work of the author, 'Island Life' (1962) with "data relevant to concepts of evolution on islands", elaborated in the interval in five papers under the series title 'The biota of long-distance dispersal'.

The whole subject turns round two main aspects, both tuned on experience and ideas the author derived from his studies on Pacific island plants and tested on his later travels in other islands but also on continents, Australia, South Africa etc. These aspects are 'adaptive radiation' and 'long-distance dispersal'.

What the author understands under 'adaptive radiation' is not very clear, as it appears that everywhere he meets speciation in somewhat larger genera, for instance in Western Australia he finds that the species have adopted some way of growth mode and morphology: broom shrubs, cladode shrubs, thorn shrubs, twining plants, leaf-shape types, woolly vesture, spiralisation of leaves, flowers in heads, etc. We are also left in the dark how the ancestor of the radiations looked like. Was it not adapted? He omits to mention that all these selected types grow together and have the same ecology. By this the concept 'adaptive' becomes a vagary; his lists simply equal Vavilov's 'homologous series of variation'. There is also a chapter on Carlquist's hobby of 'insular woodiness'; he finds this now also on continents. As a matter of fact I have shown (Taiwania 18: 45-48. 1973) that this is not at all unique for islands and that almost all genera concerned have this also occasionally in continental floras.

The second main aspect is 'long-distance dispersal', "which obviously plays a supreme role for oceanic islands, and at least a significant role in the case of continental islands and continental masses. The vectors are omnipresent", to him mostly birds and water, wind to less degree. "Some, to be sure, operate not over indefinite distances", but from his examples thousands of kilometers do not mean much. He asks himself whether, "in assessing floristic and faunistic composition of islands and other areas, we should not begin by considering the positive hypothesis that dispersal over distances can occur, rather than beginning with a null hypothesis". This means a sort of shifting the burden of proof to

opponents and charging them to work also with a hypothesis; a most remarkable way of reasoning.

Carlquist started his ideas by study of insular Pacific floras, which he tries now to apply to the main trends he encountered in continental floras as well. Unfortunately these insular floras are frequently explained by the singular 'instant theory' of plant geography, whereas they are really extremely difficult to disentangle due to the almost absence of any geophysical records. Wrapped up in the instant one-sided island syndrome his reasoning became entrenched and divorced from orderly plant-geographical methodology. Thus an immense body of facts is presented in this book by an equally formidable number of hypothetical suggestions. — van Steenis.

CORNER,E.J.H., The freshwater swamp-forest of South Johore and Singapore, Gard. Bull. Suppl. 1: ix + 266 p., 18 fig. + 40 pl. (1978). Bound. Not for exchange. Sold by Botanic Gardens, Cluny Road, Singapore 10.

How well I remember my visit to the swamp forest in the Rejang delta, Sarawak! Since all humidity comes from below, moss growth increased towards the soil, the clammy atmosphere was deadly silent. Field workers easily contracted foot-rot. Still worse, however, was social life at Singapore in the 1930's – anyway to Mr. Corner, who regularly fled it, during weekends, from 1929 till 1941, to Mawai, some 70 km to the NE. From there, the larger Sedili River goes up for some 50 km, more or less parallel to the coast, at an average distance of 22 km. The smaller Sedili is about 12 km long (in a straight line), and runs about 2-4 km inland into the S. end of Jason Bay (on the 500,000 map of 1967 named Teluk Mahkota) opposite the mouth of the larger Sedili. The Bay itself, "once so secluded and beautiful with tracts of high forest terminating in the fringe of Casuarina overhanging the waves, has been transformed by logging and reckless deforestation into a hot, fractured, and unattractive landscape" (p. 6). Much of the swamp forests has suffered the same fate. When Professor Corner revisited the place in 1972 he nonetheless decided to publish his work, on these and other swamp forests W and NW of Singapore; a record of this inhospitable paradise lost.

We owe fine accounts of swamp forests in Sumatra and Kalimantan to Polak, in Sarawak and Brunei to Anderson, in Malaya further North to Wyatt-Smith, but only Corner's pen set forth their marvels. "Salt water from the estuary banks up the brackish water to a depth of several feet and the effect is carried upstream until there is a rise of merely an inch or so, but even this can affect the vegetation, especially to forest herbs which seem the least tolerant of flooding. The water would rise in the creeks and spill over into the swamp-

forest with a slight gurgling and hissing, as air was driven out, and a rush – here and there, where temporarily impeded by a fallen trunk; leaves and logs were floated; pneumatophores were covered, and a thin film of mud was deposited on them as the water retreated. Equally important is the recession of the tide, which increases at the spring tides as they approach the equinoxes when, as in other parts of Malaya at the change in tidal cycle, there may be only one extensive tide in twenty-four hours. On such an occasion at Kuala Pahang, I watched the river bed dry out into pools, exposing all the low mud-banks which were normally under water. These excessive tides, which I failed to study on the Sedili, must provide the rare opportunities for the establishment of seedlings of putat and rassau, after which they become bushy and spread with suckers from the base of the immersed stem" (p. 9). Corner goes on to tell about the floods from rain, to 15-20 feet, which enabled him to collect from the tree tops. "Wherever we touched leaf, twig, trunk, or floating log, showers of insects tumbled into the canoe. Everything that could had climbed above the water. Ants ran over everything. I bailed insects and spiders instead of water, even scorpions, centipedes, and frogs. ... I realised he importance of the hillocks in and around the swamp-forest to animal life, for anything that could escape the flood must have fled there. We met no corpses. Pig, deer, tapir, rat, porcupine, leopard, tiger, monitor lizard, and snakes must have congregated on those hillocks in disquieting proximity. I saw, later, the trampling of elephants round the foot of Bt. Kruing and Bk. Tinjau Laut. The commotion of flood and feet must have churned up the statistical regularity of sediment beloved by numerical ecologists" (p. 10).

The floods show that this is not like the dome-shaped peat formations that are common in Sarawak, with 6 concentric vegetation zones, which are never flooded. Here, the zonation follows the river. Behind the mangrove and nipa, there are belts of 1) putat, Barringtonia conoidea, 2) rassau, Pandanus helicopus, with Gluta velutina, 3) mempisang, Polyalthia sclerophylla, with Elaeocarpus macroceras, 4) jejawi, Ficus microcarpa, 5) Tristania-banks, well above the tidal zone, 6) Saraca-streams, which come out of the dryland forest, and the only sort of vegetation that is not light-loving. Species-lists of all these zones are given. How the succession then may proceed, is discussed on p. 71 and 85. The 'riverside forest' of putat-rassau-mempisang is followed by 'inland forest' of, consecutively, Palaquium-Xylopia-Ganua-Melanorrhoea. From this, either lowland dipterocarp forest develops, or a raised bog which has its more abundant analogies in Sarawak.

To Sedili, most of the book is devoted: 45 pages of ecology, 72 pages to list all the vascular plants, 6 pages to ex-

plain the Malay names. The plant list gives 1710 species in all, of which 1082 in the swamp forest, 1/5 of them monocots; under each name the collection numbers are cited with reference to one of the 10 localities. It has the same scope as J.A.R. Anderson's list in Gard. Bull. 20 (1963) 147-228; Corner notes that notwithstanding ecological and plant-geographical differences, there is a 36% similarity in species. Less space occupy Jason Bay, the swamp forests that formerly occurred in Singapore Island, and those (much poorer) at Pontian in SW. Johore. A comparison is made with Kemaman River in Trengganu (p. 40-45), where Corner also made considerable collections.

All localities furnished data for the 59-page chapter of Special Notes on Plants, mostly based on the author's field observations added to his herbarium collections at Singapore. This is a connoisseur's chapter. Coverage is admittedly uneven; besides, other interesting observations occur elsewhere in the text. Some highlights are here mentioned, which will please monographers. Anacardiaceae: Gluta (page 165, but also 14); Annonaceae: Xylopia (165, 25); Bombacaceae: Kostermansia (171); Combretaceae: Terminalia (20); Clusiaceae: Calophyllum (173), Garcinia (174), Maesua (177); Dilleniaceae: Dillenia (179); Ebenaceae: Diospyros (182); Elaeocarpaceae: Elaeocarpus (184); Euphorbiaceae ("the family is bedevilled with microgenera and it seems the wood cannot yet be seen for the trees", p. 184): Macaranga (187), Trigonostemon (188); Flagellariaceae: Hanguana (191); Lecythidaceae: Barringtonia (195, 14); Moraceae: Ficus (199, 18); Myrtaceae: Eugenia (202, 42), Tristania (206); Pandanaceae: Pandanus (209, 7, 16); Rhizophoraceae: Carallia (212); Rubiaceae: Nauclea (214), Randia (214); Sapotaceae: Palaquium (216); Thymelaeaceae: Phaleria (221).

Under Phaleria capitata, its bearing on the Riouw-pocket is explained, although the species is not mentioned as such in that peculiar chapter (p. 87-90). The Riouw-pocket is a plant-geographical focus, in operation when the Sunda-Shelf was not covered by sea during the Ice-Age. "Great rivers traversed this plain in a north easterly direction from the mountains of the Malayan mainland, Sumatra, Java, the Riouw Archipelago, and west Borneo. The plain must have been filled in great part with swamps of mangrove, nipa, and fresh water swamp forest, possibly several hundred miles in extent and far greater than at present. This aggregate of swamp and river was, surely, a formidable barrier to the migration of plants and animals from the dry land on one side to the other. Thus these countries retain their floristic and faunistic peculiarities but enjoy a common heritage of such plants and animals that dwelt in the swamps or negotiated the peripheral uplands" (p. 88).

In the Riouw-pocket are southernmost Johore, East Sumatra S. of the equator, Bangka, Belitung, and Borneo W. of the Kuching meridian (which Ashton, Biol. J. Linn. Soc. 1: 184. 1969, found such an important Dipterocarp demarcation line). Corner had already briefly noted (Reinwardtia 4: 42. 1958) that some Ficus species do not cross the perimeter. Sedili is in the Riouw-pocket, the rest of Malaya is outside it; species telling the difference are listed. Plants must have migrated either within the Pocket, or around it, e.g. across the Anambas and Natuna Islands from N. Malaya to Sarawak NE. of Kuching. Corner sketchily enumerates 9 categories of distribution in connection with the Riouw-pocket, with under each a handful of species — a fascinating subject for further elaboration! And what consequences for conservation! It sets N. Sumatra apart from S. Sumatra, W. Borneo from S. Borneo and from NW. Borneo, Sedili apart from Endau-Rompin. Portions of swamp areas in each are to be conserved and analysed if we are to understand the plant-geography of the west-Malesian lowlands.

Returning to the story of the field, we note a monthly calendar of phenology (p. 28-31), partly compiled on a premaclurean ladder (59); how elephants enjoy the rotten heart of old trees (53); identification of stumps after felling (64) and many other observations on bark which reveal the identity of many a tree, especially useful in Eugenia (202); Aglaonema griffithii forming carpets under nipa (14); the sunken Pandanus helicopus (16); fungi behind the sandy beach (50); flowering may mean the end of monopodial tree growth (22).

Outstanding, however, seems the manifold contributions to a fresh field of knowledge: roots; see pages 20, 22-27, 46, 52. Many of the photographs show a bewildering variety. Species are enumerated for buttresses, stilt-roots, and pneumatophores (never in climbers, shrubs, or small trees!). Five forms of pneumatophores are described, labda-roots and loop-roots (figured on p. 23 and 25) perhaps new. Two forms in one tree is no exception, as the plates show. And this passage on the workings of roots is too delightful not to quote:

"When a tree was uprooted, much soil was heaved up; in time, trunk and roots decayed and a mound of soil up to 1½ m high was left beside a hollow or pool where the roots had been pulled out. This effect puzzled me for a long time until I saw many intermediate stages in the coastal forests where strong winds and sandy ground caused many trees to be uprooted. Salacca throve in the hollows and many seedlings sprouted on the mounds the top of which might exceed normal high tide levels. Some trees, when prostrated, threw up from the trunk along its whole length new shoots which rooted adventitiously and established a short row of new trees. I saw

such files of 3-8 trees of Elaeocarpus macrocerus which had grown to 20 m high with normal stilt-roots and formed colonies, or clones, in the swamp-forest. The old leaves of the massive palms such as Livistona, Oncosperma, and Pholidocarpus often created more or less barren patches by smothering or smashing the undergrowth. Along with rotans, their strong roots created special surroundings in the soil. Floods swept fallen trunks and limbs into heaps, padded with drifted humus, to create barriers, mounds, and pools where water was trapped, and this diversified the apparently uniform habitat. Pigs rooted up the soil in search of worms and edible rhizomes. Elephants, entering the swamp in the dryer periods, smashed pathways and pulled up seedlings, saplings, and many kind of monocotyledon. The result was the chaos of mounds, pools, muddy creeks, small clearings, and multifarious débris among dense stands of trees with stilt-roots and pneumatophores, often so closely as to obstruct passage" (p. 20).

How fortunate that Professor Corner published his work in this relatively unfinished stage! Now it urges biologists of every description to take over where he had to leave off. Thanks to Anderson's and his labours there is now a solid basis of identified material. But first we have the duty to save what is possible from devastation. No one can remain indifferent who has spent an evening with this book.

And an index of 29 pages! A word of compliment goes to Dr. Chang Kiaw Lan, the author's pupil and director of the Singapore Herbarium, for her fine editorial job. — M.J.

DESMOND,Ray, Dictionary of British and Irish botanists and horticulturists / including plant collectors and botanical artists, xxvi + 747 p. (1977). Taylor & Francis, 10-14 Macklin Street, London WC2B 5NF, England. £ 40, cloth.

It is always a pleasure to meet Mr. R.B.G. Desmond, who for some years was librarian of the Kew Herbarium, brimming with helpfulness and activity, gifted with a lightning intelligence and the bibliographer's steel in his mind. Besides history of botany, he has an interest in mazes. He wanted to bring out a new edition of Britten & Boulger's Biographical Index of British and Irish Botanists (1893, revised by Rendle in 1931) and has succeeded in a relatively short time: he himself speaks in the Preface of 8 years, which for a volume like this, is amazing.

The number of entries is between 8,000 and 10,000; there are no fewer than 6 James Andersons and even 7 Robert Browns. Living persons are not included; otherwise the selection is generous, besides the novel inclusion of nurserymen and botanical artists. Persons with a clear relation to British botany have been included, like the Bauers, F.M. Bailey, Brandis, Ehret, and even F. von Mueller; more remote ones like King's

collector Kunstler, and General Smuts, are not. Linnaeus, notwithstanding his heritage in London, did not make it, either.

All items (rarely exceeding one column of print) give the bare outlines of career, memberships, and achievements, then list biographical references, main locations of botanical activities, institutes where relics survive, sales held, and plant names given in honour of the person (by no means complete). The presentation is very compact, no savoury details are added, but there is Dr. W.T. Stearn's Historical Introduction to enjoy.

This is entirely a reference work, which gives the primary inroad. Most helpful is here the Subject Index (p. 685-747). Names of botanists are here listed under a variety of headings, for instance under E: Ebenaceae, Ecology, Ecuador, Egypt, England (see British Isles), Epilobium, Epipactis, Ericaceae, Ethiopia, Eucalyptus, Euphorbiaceae, Euphrasia. To those under Indonesia and Malaysia the island has been indicated.

Without prolonged use, errors are hard to detect in a reference work like this. Griffith should have been named, as an expert on palms beside Blatter; Papaver rhoeus p. 507. Sources relating to Malesia have been duly consulted, in addition to nearly 300 books and half that number of periodicals. Rare are the books with such a high specific weight. The typography is clear. Stearn rightly concludes: "It should accordingly be destined for as much or more wear and tear by grateful users as its predecessors of 1893 and 1931." — M.J.

HALLé,F., R.A.A.OLDEMAN & P.B.TOMLINSON, Tropical trees and forests / An architectural analysis, c. 450 p., 120 fig. (1978). Springer Verlag, Heidelbergerplatz 3, D-1000 Berlin 33, Germany. Cloth DM 125, was estimated some time ago at US$ 57.50.

In 1970, Hallé & Oldeman published their well-known book in French; an English translation by B.C.Stone, An essay on the architecture and dynamics of growth of tropical trees, xxv + 156 p., was issued in 1975 by Penerbit University Malaya, Kuala Lumpur, Malaysia, and is still available at US$ 8.00 (paper). The present book, due for publication in April or so* is far broader in scope. It unites i) the above in extended and detailed form, ii) a chapter on the morphological background in which meristem developments are elaborated

* Dr. R.A.A. Oldeman, Hinkeloord, Foulkesweg 64, Wageningen, The Netherlands, Professor of Silviculture since mid-1977, kindly allowed me to read the book in proof. Page numbers here cited may therefore be approximate.

along the lines set forth in Tomlinson & Gill in Meggers (ed.), Tropical Rain Forest Ecosystems (1973), discussed on *p. 2371-2374* and *2724*, iii) chapters on the structure and behaviour of trees individual and in forests, elaborated from Oldeman's L'Architecture de la Forêt Guianaise, 204 p. (1974), iv) a large set of new illustrations, and many novelties in general.

Here are some extracts from the Preface to explain the authors' intention. They do not mean to give an exhaustive survey, but a point of view. Their ultimate concern is "with analysis of tropical ecosystems, mainly forests, in terms of their constituent units, the individual trees." Hitherto, trees have been treated as equivalent units. H O & T approach the trees in the forest as individuals, genetically diverse, developing, changing, responding to environment: each "an active, adaptable unit, and the forest is made up of a vast number of such units interacting with each other." First they look at trees in isolation, studying their form expressed in an 'ideal' environment, where its genetic potential is revealed clearly: "briefly, we find out what the tree can do." Then, what significance does architecture (which involves the idea of form, in its history) have for the success of a tree in the real, competitive environment of the forest? Since the humid lowland tropical forest contains the widest array of growth expressions, from which temperate forest can be understood while the reverse is not the case, the book concentrates on the tropics. Tree architecture is irrespective of size: the diminutive Phyllanthus niruri has the same model as 50 m tall Goupia glabra.

The Introduction makes it clear that the concept 'tree' is used in its widest sense: "it is unwise to offer rigid definitions where they are not wanted", and encompasses "the diversity of large plants in tropical ecosystems" (p. 2), including even bananas and gingers. Trees come into being through primary growth, i.e. from one apical meristem (e.g. solitary palms), mostly helped by secondary growth, through the cambium derived from the former. Another mode of growth is that from a system of rhizomes (e.g. in bamboos), and the fourth is that of a strangler. When the meristem has been properly divided in the various analyzed manners, branches can be formed by extension growth, which is continuous or rhythmic, while branching is sylleptic (without pause) or proleptic (with pause). Further differentiation is achieved by spiral, distichous, or decussate organization of the shoot, by orthotropy vs. plagiotropy (with their mixtures and reversals), and by long vs. short shoots, the latter frequently characterized by precise abscission and in a terminal or lateral position; the former position exclusively in tropical trees, like Terminalia.

Then come the models, in linear sequence of more or less increasing complexity, each named after a botanist, from Holttum to Troll, together 23, with McClure and Stone as newcomers on the roll of honour. These models are not mathematic at all, but "provide semantic pegs on which a great deal of information about tree growth can be hung" (p. 76). This section makes up 1/3 part of the book. Treatment is comparable to H & O 1970, but an identification key to the models is given and in the text there are more particulars and examples. Under each model a definition is given, and its one to several expressions, a photograph, diagrammatic drawings with legend, and a commenting paragraph. Occurrence among monocots and dicots is given, parts of the world where found with sometimes a record of altitude. Variations are discussed, strategy of the model, and a list of examples by family, with place and source, and noted if herb or liana. As for Malesia, some are from Malaya (here written Malaysia, beware!), some are from the Bogor Gardens, and some were studied in eastern New Guinea.

The little that is known about lianas, owing to Cremers' recent work, has been included; 9 tree models can be discerned among them, while for 3 models, unnamed so far, there is no arboreous counterpart. One of the latter accommodates Hugonia, one Ancistrocladus, and one Hedera. Architecture of herbs is still largely a blank (but see P.S.): reduction in size, neoteny (Diels's Jugendformen of 1906 unmentioned), derivation, and loss of original orientation, are briefly discussed. Fossils fare better: quite a list is given, and they are assigned to 9 models altogether.

In the model concept, emphasis lies on dynamics (p. 74-77) in contrast to the static character of tree growth habits and shape, which are to be regarded as stages in an inherited growth program; this determines a series of consecutive phases. For this reason, the study of architecture must cover the whole life cycle of trees. The time required can be reduced by growing them in a humid slat house in a cubic meter of good soil; many species will flower early. The genotypic pattern – which obeys Corner's rule that a stout axis bears big structures and conversely – is affected by environmental factors. In this interaction pattern, the tree works with its architectural potential in an opportunistic manner.

A main instrument to that end is the so-called reiteration unless the trees strictly adhere to their inborn model, as many gymnosperms do (see P.S.). The predictability of their appearance demonstrates in a way the amount of freedom and flexibility in the reiterating trees. Reiteration, a key concept in Hallé-Oldeman thinking, can easily be observed in many a tilting branch, for instance on river banks, over the water. Rows of sucker shoots may develop, each growing into a

small-sized yet complete structure which repeats the branching pattern: a local reversion to the juvenile condition. It also occurs higher up in crowns, where shoots die to be replaced by others which develop vigorously. Eventually, a whole crown, during the process of final expansion, has thus been fragmented into 'discrete subcrowns'; see Whitmore's fine photographs in his Tropical Rain Forests of the Far East, fig. 2.6. This process of renewal (through activation of resting meristem) enables trees to fill space where they find it suitable, and in fact to build a forest canopy. In doing so, they can utilize light and other forms of energy in the most advantageous manner to build up their body. The stages of adjustment of the proportion between their metabolically functional and non-functional (= dead, heartwood) biomass, can be expressed in a 'vigor curve' (p. 313), through the tree's life periods. These are: tree of the future, going up (or suppressed); tree of the present, at maximum size; tree of the past, decaying. The coexisting trees of one period are together regarded as an 'ensemble', each with its own bioproduction pattern. The trees of the present largely determine the forest structure.

Strategies consist of two components: a K-component which concentrates on vegetative production, a long and quiet life, as the emergents aspire to, and an r-component which aims at profligacy, spending itself in reproduction during a short life, as is the style of the pioneers, the biological nomads.

When a 'chablis' occurs in the canopy, all these processes come into operation. Chablis is a French term denoting "the fall of a tree, in itself as well as the resulting situation in the forest, a light-admitting gap in the canopy, the piled-up debris on the soil, and the surviving, more or less damaged trees of all sides" (p. 282). Destruction is followed by regrowth, in fierce competition among the pioneers; then a 'homeostasis', a period of balance, occurs, again followed by fierce competition when the pioneers die; some 60-70 years after the damage, when the canopy is definitely closed, balance returns. In terms of meristemology, our starting point, homeostasis means that meristem tissue is distributed in rather even layers at various height, which Oldeman has related to vertical light and humidity gradients. Thus he brings within reach the solution of the long-standing problem: how did it come about that angiosperm forests in different parts of the world, composed of different floras, yet have the same structure?

Such is the main line of the book. Compared to its lucidity and vision, shortcomings are slight. Galium (p. 6), although herbaceous, does have decussate leaves and interpetiolar stipules like other Rubiaceae, according to E.Reinders, Leerboek der Algemeene Plantkunde 2nd ed. 1: 489. The strang-

ler in fig. 1D seems to start its life as a snake. Urticaceae, with their abundance of woody plants in the tropics, can hardly be termed 'temperate, mainly herbaceous' (table 3). Eleven synonyms for the good old English word Schopfbaum are given on p. 100 save that word itself. When the authors have explained that architectural considerations cast light on a set of new characters on the one hand, and unify a number of characters which help determine the role of the plant in the vegetation (p. 330-331) on the other, we wonder about the consequences for phytogeography and taxonomy (touched on by C.E. Ridsdale in FMBulletin 28). Family names are sometimes indicated, sometimes not.

The execution, in two-column print, is fine. A glossary explains c. 165 terms. The drawings (by Hallé, who is said to have spent every free hour on them for 2½ years, and deeply immersed himself in the study of graphical representation) are strikingly good, laborious yet spare, recalling those of Corner but more symmetrically conceived and done with more professional tightness, with a steely elegance, and expertly assembled.

A second edition would benefit from a fifth element: an elaboration of the taxonomic-plant geographic pattern that this philosophy may have to reveal. At Montpellier Hallé is building up a file of taxa with their architectural data, but not yet enough to embark on a satisfactory analysis of geographic and ecologic distribution. Their publication could well be accompanied by a really thorough treatment of all matter now put under 'The botanical world of the tropics', and with the genus as a unit, which reflects diversity so much better than can be done at the species level.

But as it lies before us now, the book has already all the promise of a classic, thus after Schimper, Richards, and Corner ranking fourth on the shortest list of decisive contributions to man's view on the tropical forest, with countless implications. — M.J.

P.S.: Professor Oldeman kindly supplied the titles of three unpublished theses related to the subject:

EDELIN,C., Images de l'architecture des conifères, 255 p. (Thèse Specialité, Montpellier 1977).

JEANNODA-ROBINSON,V., Contribution à l'étude de l'architecture des herbes, 76 p. + bibliogr. + index (Thèse Specialité, Montpellier 1977).

KAHN,S., Remarques sur l'architecture végétative dans ses rapports avec la systématique et la biogéographie, 33 p. + bibliogr. + annexes (Rapport D.E.A. Université Montpellier 1975).

HENNIPMAN,E., A monograph of the fern genus Bolbitis (Lomariopsidaceae), 331 p., 87 fig. (1977). Nijhoff, Box 442, The Hague, Netherlands. Paper, Dfl. 96.00.

This is by far the most thorough study yet made of a very interesting group of ferns which displays an intricate pattern of inter-relationships between species. This situation is made more complex by the development of hybrids, a process facilitated by the growth of prothalli in large numbers on wet rocks in stream-beds in the shade of forest, the normal habitat of most species of Bolbitis. The artificial classifications of the 19th century separated these species in various ways; Dr. Hennipman's index shows that one or more of them have been referred to 22 other genera. They were not recognized as one group until the 1930s and as late as 1928 they were wrongly united with some species of a different alliance.

Dr. Hennipman recognizes 44 species which are distributed throughout the wetter parts of the tropics. He divides 34 of them into ten series, mainly on the basis of venation and spores. A very full and beautifully reproduced series of drawings shows the details of venation in all species, and there are excellent SEM photographs of spores, with an original discussion on the development of their perispores. At the end, an Index of Collections is given. Distribution maps show that one series is pantropic; the others belong to either SE. Asia and Malesia, America or Africa, two series being distributed in both Africa and America. One species, sole member of its series, is confined to the Seychelles Islands, and shows relationships both to Asia and America.

The ten species not allocated to series are separately described, and possible indications of their relationships are discussed. It is suggested that they are all of hybrid origin, though only one (B. novoguineensis) has mainly abnormal spores (it occurs on three islands; how did it travel from one to another?). In addition, twelve hybrids, all with aborted spores, are separately described, the parentage of six being considered definite. All the hybrids are considered to be between species belonging to different series within Bolbitis. A thirteenth hybrid, originally described as a species, from a cultivated plant at Bogor, with the name Leptochilus trifidus v.A.v.R., is more problematic. Dr. Hennipman identifies with it specimens from three localities in Sumatra, and suggests that their structure indicates a probably origin from hybridization between Bolbitis sinuata and Leptochilus decurrens. But the latter species is generally recognized as belonging to the family Polypodiaceae which is not considered to be at all closely related to Bolbitis. I think that more evidence is needed before this parentage can be accepted and suggest that the possibility that the other parent was a Tectaria should be considered.

Dr. Hennipman lists chromosome counts made from 49 plants of Bolbitis, many of them his own, from plants in cultivation. He shows that there exist series of hybrids, some being probably autotriploids and autotetraploids; some are hybrids with irregular meiosis or complete failure of pairing. In Malaya and the Philippines different series of hybrids have developed within the species B. heteroclita and have multiplied extremely on stream-banks, spreading by creeping rhizomes and propagated by bulbils. A full understanding of the genetic complexity shown by these plants can only come by an elaborate series of experimental crossings, in the way that Dryopteris, Asplenium, Polystichum and other genera have been studied in Europe and North America. Meanwhile Edanyoa difformis Copel. is placed as a synonym of B. heteroclita; it is a very distinctive and elegant little plant, easy to cultivate, and surely needs a distinctive name as a cultivar.

Young plants of different species of Bolbitis pass through different juvenile developmental stages; these are elaborately illustrated in a way never before attempted, and their significance is discussed in relation to the possible origins and relationships of the genus. Some plants develop fertile fronds at a juvenile stage.

My chief criticism of this excellent work is that Dr. Hennipman does not give an adequate explanation of the basis of his subdivision of the genus into series; his discussion on the subject is brief and his diagram is not fully explanatory. I do not doubt that his arrangement is a natural one, but a reader unfamiliar with the genus would need to make a very thorough study to arrive at a good understanding of the scheme.

On minor points, I do not see why he fails to accord specific rank to B. appendiculata subsp. vivipara; and I cannot accept his judgement that B. malaccensis C.Chr. and B. nitens Holttum are mere "habitat forms" of B. sinuata, not worthy even of varietal rank. The former has the same habitat as normal B. sinuata but is constantly distinct in two widely-separated localities; the latter has a quite distinct habitat on dry rocks where I cannot believe that B. sinuata would exist. I judge that both are genetically distinct and should have names. B. nitens has a very restricted distribution near Kuala Lumpur. — R.E.Holttum.

JANZEN,D.H., Ecology of plants in the tropics, vi + 66 p., 4 pl. (1975). Edward Arnold, 25 Hill Street, London W1X 8LL. Board £ 2.80, also in paper cover.

This small book covers much ground, stimulating rather than instructing. It lacks an interest in the descriptive side, witness the opening sentence: "It is my opinion that the study of plant biology in general, and the biology of

tropical plants in particular, has suffered greatly from overemphasis on descriptive morphology, phytosociology, and systematics." Such an attitude breeds disappointment. The vast numbers of species in the tropics compel biologists to preserve plants, to know about plant structure, and to identify materials properly, lest their results are worthless. Before pupils, in the belief that "of all areas of the world, tropical biology does not need new cakes baked with old recipes, but rather some new recipes" (p. 57), embark on gathering data "so as to test at least certain simple hypotheses, and yet simultaneously be adventurous in approach" (p. 57), they do well to scan a journal like the Annales du Jardin Botanique de Buitenzorg, which reports on a wealth of thorough investigations on common tropical plants, not in the first place to test hypotheses, but to collect plain facts. As it now seems, with Janzen around for a few more years, our store of ideas will be much fuller than our store of facts.

While beginners eventually may feel deceived, more orthodox botanists like me can find delight, for the same reason. To the one who has acquired an idea of a rain forest, its structure and life forms, and who knows "Bombacopsis, Ceiba, Cassia, Pterocarpus, Cochlospermum, Gliricidia, Spondias, Tabebuia" (p. 26) personally or where to look them up, Janzen brings in relation and dynamism. He sketches fascinating plant-animal relations, and conjures up a whole array of biological significances, in leaf shedding or leaf persistence, in sucker shoots or in producing plentiful seed crops.

Hardly a fact goes without a train of thoughts: "Somewhat enigmatically, Bromeliaceae are absent from the Old World tropics; while various Old World ferns appear to be morphological analogues to bromeliads, there appears to be a very large amount of empty branch habitat. One hesitates, however, to suggest the obvious experiment of introducing bromeliads to the Old World because of the strong possibility of economic repercussion" (p. 14). How magnificent — until we find Pitcairnia feliciana in the Flora of West Tropical Africa, 2nd ed. 3 (1968) 67!

This passage does not stand critical reading: "Cordia alliodora, a canopy-member tree, may be seen standing leafless for weeks in the middle of the rainy season in a Costa Rican rainforest that receives over 4 metres of rain evenly distributed over the year" (p. 5) — how can an even distribution leave room for a rainy season? And this passage intrigues me (unfortunately undocumented as most statements are): "A population of vines generally contains both right- and left-handed individuals with respect to the way they twine around the substrate; in the northern hemisphere left-handed individuals have significantly larger seed crops than right-handed ones, and the effect is reversed in the southern

hemisphere" (p. 10). I pensively look at Burkill's text on Dioscoreaceae: "The annual stems do not twine from their base, but commence to twine at a little distance above the soil, and do so consistently either to the right (fig. 4c) or to the left (fig. 4a). Departure from this rule has been observed in none but a single African species; and there are dwarf species among which is Trichopus zeylanicus (see p. 297) which do not attain sufficient height for twining. The direction of twining is an important taxonomic character" (Fl. Males. i 4: 293. 1951).

Janzen's work is brimming with suggestions which bring the forest to life before the reader. Vines have less chance than trees to recover by their roots the nutrients from their own discarded leaves (p. 11). From a plant's viewpoint, pollination is an exercise in optimizing the flow of genes to other flowers and back (p. 16). Time and percentage of fruit ripening may be an answer to selection pressure (p. 26). Large neotropical birds regurgitate seeds after the fleshy part has come off in their stomach (p. 32). Herbivores may contribute to diversity by keeping down population size of plant species; an increase of distance between individuals may thus be an advantage to plant species (p. 46/47). And so on, aplenty.

The chapters deal with Vegetative biology; Pollination biology; Fruit and seed biology; Chemical defences; Community structure; Tropical agriculture; and conclude with 10 topics of Suggested Field studies. Much of Janzen's thinking proceeds in the wake of Corner's, whose works he curiously fails to mention. Fascinating connections are drawn between plants and environment, plants and animals, in terms of investment and return, symbiosis and antibiosis, all in plain concise language; lights go up by the dozen, arresting conclusions make me nod — but Pitcairnia and the Dioscoreaceae continue to bother me. — M.J.

LACKEY,J.A., A synopsis of Phaseoleae (Leguminosae-Faboideae), with emphasis on Glycine (soy bean) and relatives. Mimeographed thesis (1977). Iowa State University, Ames, Iowa, U.S.A.
The essentials are published under the title: A revised classification of the tribe Phaseoleae, in Bot. J. Linn. Soc. 74 (1977) 163-178.

A monograph on generic level. All genera of this very difficult and complex tribe have been investigated from herbarium material, from the viewpoints of cytology, leaf-anatomy and chemotaxonomy. The revised classification comes close to Taubert's classification in the first edition of Engler & Prantl's Die Natürlichen Pflanzenfamilien 3, 3.

The main differences are that Taubert's subtribe Galactiinae have dissolved into the Diocleinae, the genera Mastersia

and Nogra are transferred to the Glycininae and Spatholobus is removed the Phaseolae to the Tephrosieae, where I cordially welcome it, as I had already noticed that Spatholobus is difficult to distinguish from certain Derris and Kunstleria in flowering stage. Some genera, in Taubert's system in the Glycininae, are put in the subtribe Kennediinae, but these were already kept separate from the Glycininae in Bentham's system.

A new subtribe is the Ophrestiinae, consisting of the African and Indian genera Ophrestia (incl. Paraglycine and Pseudoglycine), Pseudoeriosema and Cruddasia. The latter genus was up to now always uncertainly placed. In Taubert's system (added by Harms) into the Diocleinae with a questionmark, in Hutchinson's system in the Galactiinae. Other genera, occurring in SE. Asia, and which have changed from subtribe are Endomallus (now in Cajaninae); Pachyrrhizus (now in Diocleinae); Vandasia (now in Kennediinae); Centrosema and Clitoria (both with a questionmark in the Phaseolinae); Pueraria, Diphyllarium and Mastersia (now in Glycininae, the latter two with a questionmark). Keys to the subtribes and to the genera are given, here and there tentative keys to species are added (e.g. Pueraria). Some distribution maps are included, but from these it appears clearly that the author unfortunately did not consult the rich collections in the Rijksherbarium at Leiden.

There are no descriptions of the genera, but the critical characters are discussed under the genera and under their close relatives. From the 88 accepted genera 50 occur in SE. Asia. The author does not pretend to have solved all generic problems, and a compliment must be made for his very careful approach in those cases, where only scanty material was available, and where a solution must wait for more or better collected material, and no hasty conclusion was forced. A very thorough work which will prove to be very useful for flora-makers and a rich source for all sort of information on this very complex group of Leguminosae. — R.Geesink.

METZNER,J.K., Man and environment in eastern Timor, xxix + 380 p., 41 tab., 38 fig., 49 phot. Typescript, offset (1977). Development Studies, ANU, Box 4, Canberra ACT 2600, Australia. A$ 6 + postage $ 2.15.

The thesis of a geographer*, who carried out field work between August 1969 and December 1970, and studied many sources and air photographs. The result is a 'geo-ecological ana-

* Staff member of the Südasieninstitut, Box 103066, Heidelberg, Germany, as are Hausherr and Von Lengerke; see Bibliography.

lysis' of a segment straight through the island, from North (Baucau) to South (Viqueque), 30 by 60 km, at lat. 126°30' E.

Timor is non-volcanic, rich in 'fatu' or big limestone hills; highest elevations in the area are 2373 and 1769 m. The area is very backward. People avoid the malaria-infested lowlands; many live in isolated hamlets (map on p. 18), connected by trails, through highly erodible and very degraded terrain. Fences, to protect a shaky agriculture from wandering livestock (which is kept mainly for social status), require much labour and large quantities of wood.

The author has been careful in preparing many diagrammatic maps: altitude (p. 2), reliefzones, 8 categories (p. 23), geology (p. 30), average slope gradients, to over 40% (p. 37), monthly rainfall (p. 40), soils, 12 types (p. 66, legend on p. 41), vegetation, 16 types (p. 94), land use patterns, 10 types (p. 152), environmental zones, 25 in number (p. 296), and several more maps of socio-geographic interest; also a number of profiles (line on p. 2) are given: of soil types (p. 43), of climate (p. 90), of vegetation (p. 99), of land use (p. 154), of environmental zones (p. 29).

Together, they reveal a mosaic of considerable complexity, determined by a strong seasonality of the climate with yet an erratic intensity of rainfall. Temperature ranges are considerable, but air humidity is high in all seasons: 72-79%. No stored water being available for irrigation, water in the soil is the paramount controlling factor, expressed by mean weekly run-off (p. 79).

While most of the book is devoted to a systematic description of lands and land use, the vegetation is dealt with in two rather elaborate sections, p. 91-115, and p. 295-315. Metzner, who collected 270 numbers (now at Leiden), received assitance of Rijksherbarium botanists, and also found much of value in M e ij e r D r e e s (Bloembergen's account of a tour to Timor and Wetar is not mentioned). R. C i n a t t i, who did some botanical work in E. Timor, and made a first vegetation map (of limited use, see p. 96), is listed in the bibliography as G o m e s. H. O. F o r b e s is mentioned as an important contributor to Timor botany, in his Wanderings in the Eastern Archipelago of 1885.

Author estimates that about 90% of the vegetation area has been affected by man; exceptions are the lulik or sacred forests, mostly at higher altitude. The ensuing problem of land classification (take actual or climax vegetation as standard?) he approached cautiously (p. 97). Mapping actual vegetation with the climax concept in mind, he distinguished categories as follows: 1) Tropical montane cloud forest, above 1500 m, with Podocarpus imbricatus and P. amarus 30-40 m tall, Artocarpus 'poniformis' (= A. gomezianus); 2) Moist evergreen forest at 1000-1500 m, encroached by types 5, 6 and

9 which may be seres; 3) Semi-deciduous forest, not sharply distinct from type 2, where rainfall exceeds 1000 mm and the dry season is less than 4-5 months, trees to 20-30 m, leaf-shedding for one-third; fire exserts here heavy pressure; 4) Largely deciduous forest, local, trees to 15-20 m; 5) Forest/savanna mosaic, at 300-1500 m, with Casuarina; 6) Eucalyptus urophylla woodland, locally in pure stands at 1000-1200 m; Savanna, with a) Eucalyptus alba, rather pure, of lower altitude but locally up to 1250 m, hybridizing with the former, b) Acacia leucophloea, more mixed, c) Casuarina junghuhniana, the largest in the area, from sea level up to 1200 m, among grass, and indicator of degraded clay soils, d) palms: Borassus with an understorey of Jatropha gossypifolia and no grass on periodically inundated plains, Corypha in more ever-moist conditions; 8) Scrub with Tecoma, local; 9) Grasslands, burned, grased, eroded; 10) Beach; 11) Mangrove, with Melaleuca behind; 12) Swamp forest, trees 30-40 m tall, suggestive of rain forest and here described far too briefly; 13) Riparian forest, a) up to 300 m, b) 300-1000 m, c) higher. Some species are named. Photographs illustrate each vegetation type. Author writes that he prepared a vegetation map 1:50,000, and it is most unfortunate that it is here so small and poorly reproduced.

In the second section dealing with vegetation, the 25 Environmental Zones are treated in about one page each, with description; distribution; flora (main trees and shrubs, and grasses); climate; soils; land use; photograph.

During the regime of the Portuguese, who removed indigenous checks on population growth, there was an increase from 150,000 in 1862 to 610,000 in 1970. Sound, simple measures towards better self-sufficiency are proposed; any development plan for a region should be based on a study like this one. There are c. 265 references. Summaries in Portuguese (p.351), Indonesian (p. 354), German (p. 357), and a very small one in English (p. viii). A 4-page Glossary is given, and a list of geographical names. Botanists would have been grateful for a list of plants, and the fine, informative photographs had deserved a better reproduction. An unfortunate manner of binding prevents the book from being fully opened, and the cover should have been firmer. — M.J.

OCHSE,J.J. (in collaboration with R.C.BAKHUIZEN VAN DEN BRINK), Vegetables of the Dutch East Indies (edible tubers, bulbs, rhizomes and spices included) / Survey of the indigenous and foreign plants serving as pot-herbs and side-dishes, xxxvi + 1006 p., 463 fig. (Bogor, 1931). Facsimile reprint A. Asher, Keizersgracht 526, Amsterdam. Cloth Dfl. 190, equals ± US$ 80. For India, contact Jagmander, 24-B/5 Original Road, Karol Bagh, New Delhi 110005.

This high-quality reprint carries biographical notes about the authors, and at the end a list of nomenclatural corrections, by Bakhuizen the younger, who thus brought the nomenclature in line with Backer & Bakhuizen's Flora of Java. The corrections amount to c. 108, apart from some orthographic and author corrections – quite a number in proportion to the c. 389 species in 241 genera in 81 families with which the book deals. Of these, the cryptogams number 22 species in 13 genera and 7 families. Crop plants are included as well as wild species that are utilized as they grow; the latter form the great majority. The book concentrates on Java, but also covers the other islands of Indonesia, and in view of the wide distribution of many of its species, no doubt will find its users far beyond, the more so as it is rich in details and seems a thorough piece of work pleasant to consult and well-indexed. The selection of species is a generous one. One species covers, on average, two quarto pages. Treatment includes vernacular names in half a dozen languages, an extensive botanical description, remarks on habitat, occurrence, distribution and propagation, how (parts of) the plants are used, and literature: mainly Heyne, Filet, de Clercq, Koorders, Backer. Each species is figured with a clear line-drawing.

The rich contents have been carefully indexed: there is a list of vernacular names outside Java, of languages and geographical names, a list of books (152 titles, a mixed lot, containing interesting items) and of periodicals (30 titles), and an index of names, used in Java and scientific.

Most interesting, however, is the 'List of various vernacular names of objects, properties or actions' (p. 943-970). It explains what all the dishes and substances are. Thus oonek is "the claw-like prickles on the flagellum which terminates the leaves of many kinds of rattan"; kateemoos is a "delicacy made of grated cassava mixed with goola djawa and roasted grated coco-nut, wrapped in a banana-leaf and steamed". People who wish to acquaint themselves with Indonesian cookery and language will be delighted in this index; updated, expanded and illustrated it could become a best-seller.

Of course, the pre-war spelling of Indonesian words has been retained; in the translation, it was Anglicized by replacing the Dutch oe (Indonesian u) by oo, and a long i by ee; see the rules for pronunciation on p. viii-ix. C.A.Backer be here remembered for making the English translation, through which this book was opened to the wide circle of users it deserves. For Indonesia, it is a mine of directly applicable information.

Then why is the price prohibitive to the country which would be so well served by the 'Vegetables'? I asked the publisher; he told me that he had made a variety of efforts to

arouse interest in Indonesia. Authorities in that country could apply for a number of copies under a literature aid program, to acquire the book for university and public libraries. The edition was held up for some time to wait for a response, but the response was minimal. So the edition had to be small and the price accordingly high. Two reasons may exist for a lack of Indonesian response: 1) the old editions (the first, Dutch one of 1925 and the English one of 1931) were widely distributed in Indonesia, 2) the language problem: a translation into Indonesian may be needed to bring the text within common reach, as the situation now is. Making such an edition possible might be a worthy subject of development aid, the more so since the 'Vegetables' seems perfectly to suit the modern critera: contribute to self-reliance, and favour the poor people. In the hands of local agriculturists, Ochse's work may contribute much to that goal. — M.J.

P.S.: We also received Vegetables for the hot, humid tropics/ A newsletter and annual communication among research workers. Edited by F. W. M a r t i n & R. M. R u b e r t e; published by the Institute of Tropical Agriculture, Box 70, Mayaguez, Puerto Rico 00708, U.S.A., distribution is free of charge.

It gives review papers; short research reports; brief commentaries; notes on programs; descriptions of species or varieties; news, announcements, conference notes, reviews, requests for exchange. Deadline for contributions is 1 June of every year.

Number 2 (1977) has 79 pages, stencilled, efficiently produced. It is sensibly conceived, well-edited, so that it may exist for a long series of years, which we hope. — M.J.

POORE, Duncan, Ecological guidelines for development in tropical rain forests, viii + 39 p., 6 illus. (1976). IUCN, 1110 Morges, Switzerland. Paper, $ 4.50.

The great body of knowledge among ecologists about a wise use of natural resources was condensed and written up for a wider public by R.F. Dasmann and others in a paperback 'Ecological Principles for Economic Development' (1973; see *p. 2380-2382*). This book has since found a wide circulation. Its publication was soon followed by two conferences, the first in Caracas (February 1974), the second in Bandung (June 1974; proceedings reviewed on *p. 2646-2648*). At these conferences, the 'Principles' were elaborated into a set of practical 'Ecological Guidelines', which is a kind of checklist of ecological criteria for development projects in humid tropical countries. The proceedings of the two conferences were published by IUCN as a kind of technical papers, and while all

experts are now familiar with them, they have not yet reached the audience of planners, authorities, politicians, educators etc. in the region for whom they are intended. So it was a logical step, to take the Guidelines out of the technical papers, and to publish them, with a brief introduction and explanation, as a separate booklet, and a very handsome one, just the right size (21 by 14½ cm, 10,000 words) to be digestible by those whom it concerns.

Wise allocation of various resources, High standards in changing from one use to another, High standards of management are the ideals. The Guidelines, in firm italics, precede the actual recommendations, often with an explanation in between. For example: Guideline: "Where it has been decided that an area should be allocated for a protective use, this should in all cases take priority over other uses" (p. 12). Explanation: "Other uses – for example extraction of timber or excessive use by the public – can easily damage irreversibly the protective value of the forest." Recommendation 14: "For each area a primary objective of management should be stated and any other uses which are inconsistent with the primary use should not be allowed." As we already see from these quotations, the booklet is very qualitative and almost serene. The reasoning is sound and, well, reasonable. No nation in the area can afford to ignore it. The language is so diplomatic that no one can take offense.

It covers Land use policy, Preservation of natural ecosystems, Protection forests, Timber production, Shifting agriculture, Water resources, Field and plantation crops, Fisheries, Pest control, Settlements, engineering works and industry; nothing on tourism. While hardly any country is called by name, the serene photographs are all from the Malesian region, and it is clearly applicable to Indonesia. It is a document on its own; no reference is made to further reading.

The scientist who feels irritated by the absence of facts, names, and figures, should realize that ideas come first and implementation comes later. This booklet surely calls for a crew of keen interpreters and watchdogs. But if authorities have come to adopt it, realizing that conservation is not a purpose in itself, but serves the long-term benefit of the local people who are dependent on their forests, a great step forward would have been taken. Translation into Indonesian would be highly desirable, but especially if amplified with plain, common, shocking examples, so that no reader will let the forest die in peace. — M.J.

PRANCE,G.T. & T.S.ELIAS (ed.), Extinction is forever / Threatened and endangered species of plants in the Americas and their significance in ecosystems today and in the future, vi + 437 p. (1977). New York Botanical Garden, Bronx, N.Y. 10458, U.S.A. Paper cover, $ 20.

Problem: i) climax forest and grassland floras have been greatly reduced and locally extirpated throughout the Americas, ii) island floras, with their high endemism and relatively low numbers of individuals per plant species, are severely threatened by soaring human impacts, iii) weedy, ruderal, and marginal-land floras which have spawned so many of our food crops, are constantly pressured by land clearance, mechanized agriculture, and chemical herbicides, iv) wetland floras, especially in the temperate areas, are being decimated by drainage, landfill, and intensive land use, v) hydrophytic vegetation of fresh waters is increasingly subject to the ravages of eutrophication, vi) coastal and estuarine floras are being degraded and reduced by amenity development and pollution, vii) fragile desert floras are being severely damaged and diminished by land settlement, alteration in hydrology, and off-road vehicles, viii) rare and endangered species are subject to depredation by commercial collectors and individual devotees (p. 1). Causes: population growth, advancing industrial technology, and social affluence.

Hence this Symposium was held at New York, to commemorate the Bicentennial of U.S.A. independence, with 159 participants, who contributed 37 papers, on 1) Threatened and endangered species problems in North America, 9 papers, not further discussed here because they have little bearing on the tropics, 2) Mexico, Central America, and the Caribbean, 3 papers, 3) South America, 11 papers, 4) Plant groups especially endangered, 6 papers, on bulb plants, cacti, palms, carnivorous plants, orchids, and pteridophytes, 5) Special topics, 6 papers. There are two keynote addresses, by G.M. Woodwell on The Challenge of Endangered Species (p. 5-10), and by G. Budowski on A Strategy for Saving Wild Plants (p. 368-373). Useful Appendixes are a 182-item bibliography on the subject (worldwide, but somewhat unbalanced, e.g. Corner, Richards, Van Steenis missing), and the text of the Washington Convention law on trade in endangered species (which is making an impact on the exchange of herbarium specimens as well).

Much of the book is filled with lists and considerations regarding (categories of) endangered species. Since in the tropics these are too many and too poorly known, this seems to be essentially a sterile approach. The genus as a unit, the familiar concept in Malesian and Pacific botany, seems not yet to have entered New World botanical thinking (see also p. 206). The gene-pool concept, so essential in conser-

vation, just at generic level, has scarcely been explored, and not a list of commercially directly important genera has been given for which habitat conservation is considered necessary, although distribution of the 10 Hevea species has been mapped on p. 176. On threatened ecosystems, admittedly important, not much information has been amassed, and enumerations are lacking.

Some original matter in the book claims the attention of botanists. First, Prance's paper on plant-geographic subdivisions or Amazonia (p. 195-213). Based on distribution patterns of species in Chrysobalanaceae, Caryocaraceae, Dichapetalaceae, Connaraceae, and Lecythidaceae, he distinguishes 7 regions: map on p. 209. Second, Pires & Prance's paper (p. 158-194), accounts for horizontal distribution patterns of 8 tree species, mapped in detail, in ecologically different plots in Belém, and height/girth diagrams of 8 species revealing shade tolerance (such species occur in many small trees, light demanders occur in few large ones), and growth rates. Less fortunate seems a many new combinations-paper in this non-taxonomic book, by Ravenna on corm and bulb species (p. 257-266).

One looks for a vision, and finds two. First, Goodland & Irwin (p. 214-230). They are the authors of the book Amazon Jungle: Green Hell to Red Desert? (155 p., 1975, Elsevier Scientific, Box 211, Amsterdam). Second, De Alvim (p. 347-352). The former emphasize the ecology side, the latter the development size of the great issue. Goodland & Irwin observe the destruction of the tropical environment in the name of 'development'; de Alvim's concern is with the people: "Only a mentally unbalanced person would say that plants and animals are more important, more useful, and in more need of care and love than the millions of people throughout the world — particularly those in the so-called 'third world' — who are dying before their time because of poverty, disease and hunger" (p. 347). (This seems to me a false manner of posing the problem, since human needs and qualities are introduced on the animals' side of the equation.) De Alvim goes on to briefly discuss the promise of cocoa, rice, oil palm, brazil nut (Bertholletia, Lecythidaceae), rubber, and finally pastures, in everwet Amazonia, where he sees a future for these crops, but he does not solve the ambiguity: "I hope that I have proven my basic thesis that commercial agriculture in the wet tropics is not as discouraging or frustrating as some people think it is. An important point to keep in mind in this connection is that in the tropics barriers still exist which are not yet understood, particularly by those with little training in tropical agriculture. Some of these barriers are ecological, while others are cultural. Good scientific knowledge about the plant and its environment,

particularly with reference to plant-soil relationship, is an essential ingredient for planning successful agricultural programs. If natural vegetation grows luxuriantly in the wet tropics in spite of poor soils, why should we not be able to devise man-made plant communities which will imitate the natural ecosystems and grow equally as well as the rain forest, while simultaneously producing something valuable to man? I am convinced that the solution of this problem is not as difficult as, for instance, the astonishing scientific achievement of sending a man to the moon" (p. 352). Thus Mr. De Alvim acts out his illusion — for 5 lines later, his paper ends without so much as a hint at the solution he needs.

Now Goodland & Irwin. "Diverging from the almost total taxonomic stance of the book, this chapter presents the ecological viewpoint that protection of individual rare species in Amazonia is either impossible, ineffective, or inappropriate" (p. 214). They take it that "Tropical moist forests are being destroyed ... primarily in the name of 'development'. All exploitation of tropical forests, therefore, must be considered together with the development that spurs it. In this paper, an extreme viewpoint is presented that no practice yet devised for the use of tropical wet forests is ecologically sustainable and economically justifiable in the long term. We question whether development is best served through prevailing tropical forest activities and we maintain that the present course is self-defeating, that clear-cutting tropical wet forest is so perilous that it should be supplanted by more rational alternatives until sustained yield can be achieved. Objectives and goals for development include desires to improve the lot of the poorer segment of society, to eliminate slums, to increase food production, to utilize a natural resource (forest), to augment exports, and to earn foreign exchange. We propose that clear-cutting tropical wet forest may assuage such desires for a brief period, but that ultimately it culminates in a worse situation than obtained before development" (p. 214).

A most important general remark is made by Goodland in the discussion: "We have removed the very key factors upon which population stability depends. When a country produces a product for a distant market and when that producer has no control over prices, when the product is not storable and when it takes some years to get into production, then normal feedback loops of population stability are broken. There is no means by which the populace can know that its own numerical limit is being exceeded or when it is growing too rapidly. But where people have a feel of how much land is available, then they know that a stable community improves qualitatively while a growing population reduces the quality for all. In other words, I submit that when people have some sort of in-

ternal feedback, they will want to reduce or maintain their own population, which is a more favourable situation than imposition of controls from outside" (p. 230). For Java, this may hold good as well, if we consider the flow of imports, which obscures judgement on the situation.

The paper also throws a light on the changing economic situation to the disadvantage of tropical forests: "A significant characteristic of world agricultural commodity trade is the poverty of tropical exporting nations, particularly those in the banana trade. ... Though the importers are the world's richest nations, consumers in those nations are paying less for bananas. Their price has fallen 30% in the last 20 years, while the price of the products bought by banana producers soars annually, e.g. fertilizer, pesticide, machinery. The banana trade is lucrative – for the transporters, marketers and distributors who reap 80% of the price, while the producer receives 10% or so. When bananas leave the country of origin (and often before), prices are out of their hands, just as with most other tropical crops – sugar, cocoa, coffee, tea, cotton, vegetable oils, and rubber, for example. Conversion of tropical wet forest into an export crop can become a debasement: a tractor 'costing' three tons of bananas in 1960, 'cost' eleven tons in 1970. In 1960, Malaysia earned enough money by exporting 25 tons of natural rubber to buy six tractors. Today, the same 25 tons of rubber buy only two tractors. To the extent that rubber and bananas represent cut and transmuted forest, such export is a powerful and, of necessity, increasing force accelerating the removal of forest" (p. 221).

"Conversion of tropical wet forest into an agricultural commodity maximizes short-term returns while at the same time it irrevocably precludes even the possibility of future sustained yield, since much of the resultant deterioration is irreversible. The decision to extirpate the forest, therefore, tacitly assumes that the harvests of short-lived monocultural substitutes are worth more than the forest itself. Not only are the monoculture harvests limited in duration, but their benefits accrue largely away from the people directly involved in the development programs. Part of the solution lies in appreciating the value of the forest" (p. 218). Or, to put it even clearer: "Conversion of tropical forest does not yield sustained increases in food. Rubber and palm oil are used to earn foreign exchange, which then must largely be spent on necessary imports of pesticides, fertilizers, and foreign machinery for more forest clearance. In other words, forest is exported in the form of a cheap product such as cocoa or lumber, in exchange for expensive tachnological products needed to perpetuate the process itself and the economic society dependent upon it. Though some employment is

provided, the prime beneficiary in this vicious circle is the manufacturer" (p. 217). It seems that this point is well borne out by the facts about the Forestry Situation in Indonesia, on *p. 3020-3024* in this issue.

What about the value of the forests? A few significant passages are to be quoted. "The tropical wet forest ecosystem is not readily appreciated by owner-governments, largely because its value is esoteric, long-term, and not readily converted into profit. Further, the value is not restricted solely to the owner, and the benefits may be conferred on all humanity. Much of the value is like an insurance policy that may pay off handsomely in the future. Meanwhile, the premiums — in this case, the pressures to cut — are onerous. Some of the value is assumed rather than readily proven. Part of the value is subjective while part will only become valuable if sociological trends continue as projected. Finally, part of the value reposes in the minds of people in other countries, and is not appreciated by the owners themselves. Although the capital value of the ecosystem is immense, the sustainable withdrawable interest is minimal. ... Possibly the greatest value of the forest is the hidden service of environmental protection: enrichment and protection of soil, attenuation of climatic extremes, moderation of water flows, buffering of the atmosphere, purification of air and water, and suppression of large fluctuations of plant and animal populations. Although provided and maintained free to society, disruption of this service can be unimaginably expensive and damaging. Substitution of tiny components of this environmental protection service — such as flood and erosion control, agricultural fertilizers and pesticides, water supply, fuel, and subsidies for afflicted communities — consumes inordinate quantities of resources and human energy better applied elsewhere. This waste is entirely and cheaply avoided by leaving protective forest intact. Cures of environmental ills, at best, are ineffective, expensive, or nonexistent. Thus prevention of environmental abuse, in the long run, is not only essential for future generations, but the most economical and wisest course to pursue" (p. 215).

Authors quote a prediction of mid-1976 that within 27 years there will exist no more trees in Amazonia, should clearing continue (p. 216). This comes closely to those for Indonesia, which foresee the end of the rain forests there by about 2005. What they advocate is, to leave the Amazonia forests in peace, and instead to concentrate development in alternatives. On p. 222, they name the varzea (riverine lands subject to seasonal enrichment flooding), water bodies (for aquaculture), fertile soil pockets (for agriculture, perennials), non-forested tracts (savanna, campo, grassland), second-growth areas (for intensive tree plantations) and,

especially, the cerrado (for appropriate technology). The cerrado is the savanna-like vegetation which covers 1.6 million sq.km of southern central Brazil. It is largely uninhabited, and its environment is "relatively robust and resilient whereas damage to fragile Amazonian environments can be irreparable. The cerrado biota is depauperate when compared with that of Amazonia. Rare and endangered species certainly occur in the cerrado ... but the pockets of endemism are relatively well-known" (p. 224). A multitude of other arguments are advanced, and a plea made for long-term development based on five ecological tenets; carrying capacity, closed ecosystem, sustained yield, diversity, and small-scale, with reference to D.H. Janzen, Science 182 (1973) 1212-1219, and his Ecology of Plants in the Tropics (1975). Soils (as appeared in the discussion) in the cerrado are poor, but not quite as poor as those of Amazonia. The idea is, to buy time. Only when enough is known to ensure sustained yield from a wet tropical forest, can there be a reason to return there. "It must be taken as a cardinal responsibility that we do not destroy what we cannot recreate and do not yet comprehend" (p. 215).

These lavish quotations hope, of course, to show a way out of a dilemma that also threatens the plant world of Malesia. There, too, are huge tracts of 'marginal land' available for utilization, difficult and expensive though this is, but the only way to avert disaster. The other purpose is, to bring out what I found most valuable in a book which otherwise is rather uneven, and confusing to the non-botanist. It is a great pity that in the panel-discussion the question "How can people or institutions in industrialized countries assist in building awareness and offering means toward adequate management, particularly in avoiding the loss of a unique heritage for science, education, and inspiration?" (p. 361) was left unanswered*, however interesting is the ensuing Eucalyptus debate. Also, the question how large an area of tropical forest must be to function as a reserve went without a clear answer, although Professor P.W. Richards's estimate of 'at least tens of square kilometers' (p. 365) seems to have been borne out since, by the calculations in T.C. Whitmore's Aga- this book (1977, here reviewed on *p. 3084-3087*).

It seems therefore desirable, if the efforts spent on this symposium are to influence authorities and policy-makers,

* Here is a three-fold suggestion. Make available an expert selection of existent knowledge in readily understandable form. Promote conservation education in tropical countries at all levels. And have ecological criteria implanted in the policy-making of overseas development agencies, as the World Bank has already done.

that the net results are laid down into a paper for wide publication, perhaps to extend and strengthen the IUCN Ecological Guidelines for Tropical America of 1975. Otherwise this book will, I fear, remain a closed book. Not even summaries are provided. It is well-produced, however, with many instructive sketch maps, diagrams, and good photographs. — M.J.

PERDUE,Robert E. Jr & J.L.HARTWELL (ed.), Proceedings of the 16th Annual Meeting of the Society for Economic Botany, 'Plants and Cancer'. Cancer Treatment Reports 66 (August 1976) 973-1215. Published by Cancer Institute, 8300 Colesville Road, Blair Bldg, Rm 3A05, Silver Spring, MD 20910, U.S.A.

Fifteen papers of a symposium. About 25,000 species of higher plants have been screened so far on anti-cancer activity; more than 2000 showed promise. Funds have risen steadily. As for the tropics, some work has been done, especially on Africa. A general report on Distribution of anticancer activity in higher plants, by A.S.Barclay & R.E.Perdue Jr is on p. 1081-1113. It presents a breakdown based on mass testing, and not very revealing except that gymnosperms are twice as rich as angiosperms. More interesting is the text in which promising taxa are very briefly specified. We pick out those groups which occur in Malesia and perhaps deserve examination from there as well.

Alangiaceae: Alangium
Amaryllidaceae: Crinum
Apocynaceae: Alstonia, Ervatamia, Tabernaemontana
Aristolochiaceae: Aristolochia
Asclepiadaceae: Tylophora
Bignoniaceae: Stereospermum
Boraginaceae: Heliotropium
Burseraceae: many
Celastraceae: many
Convolvulaceae: Argyreia
Elaeocarpaceae: Sloanea
Euphorbiaceae: Mallotus, Phyllanthus, Sapium
Flacourtiaceae: Xylosma
Hernandiaceae: Hernandia
Icacinaceae: many
Lauraceae: Cryptocarya
Loranthaceae: Phoradendron
Olacaceae: Schrebera
Oleaceae: Schoepfia
Papilionaceae: Sesbania (and many others)
Rhamnaceae: Colubrina
Rosaceae-Chrysobalanoideae: Parinari
Rubiaceae: Cephaelis, Psychotria
Rutaceae: many

Sabiaceae: Meliosma
Sapotaceae: Manilkara
Saxifragaceae: Dichroa
Simaroubaceae: Brucea, Picrasma
Styracaceae: Styrax
Thymelaeaceae: Wikstroemia

Oncogenic and tumor-promoting plant substances deserve attention, too; a many-author paper on p. 1171-1214 deals with them, on the strength of 599 references. The most important to Malesian botany seem to be of the ferns: Pteridium; Apocynaceae: Rauvolfia; Cycadaceae: Cycas circinalis; Euphorbiaceae: Croton tiglium; Lauraceae: Cinnamomum; Palmae: Areca catechu; Papilionaceae: Crotalaria, Derris, Milletia, Tephrosia; Rubiaceae: Cinchona.

Much of the volume is devoted to chemistry and methods, but the latter do include indications for collecting, by Dr. Robert E. P e r d u e Jr, MPRL, ARS, USDA, Beltsville, MD 20705, U.S.A. It is accompanied by a project description, and a map of present and prospective sources of supply (p. 987-998). Other papers tell about plant folklore (p. 979-985) and the preparation of extracts (p. 999-1005). The program is apparently in full swing, and interest is turning to Malesia, too. Contact Dr. Perdue! — M.J.

RIJKSEN,H.D., A field study on Sumatran orang utans (Pongo pygmaeus abelii Lesson 1827) / Ecology, behaviour and conservation, 421 p., 161 fig. Meded. Landbouwhogesch. Wageningen 78-2 (Wageningen, The Netherlands, 1978). Distributed by Natuurbeheer, Marijkeweg 15, Wageningen.

The botanical interest of this work amply justifies this review. No doubt a variety of primatological journals will discuss the 89 elements of ape behaviour listed on p. 238; we concentrate on its contribution to an understanding of the west Malesian rain forest ecosystem. From 1971 to 1974 Rijksen carried out field work in the Gunung Leuser Reserves in N. Sumatra, mostly at Ketambe, an area of 150 hectares at 350-450 m in the Alas Valley, half of its perimeter occupied by river. In other parts of the reserves and in Borneo he collected observations for comparison.

The orang utan has its range for 85% on Indonesian territory, notable in N. Sumatra and most of Borneo (fig. 14). About 1/3 of its present distribution area as mapped is suitable habitat for the apes. In Borneo, the population (ssp. pygmaeus) is about 6 times that of the Sumatran subspecies (which has two races), but protection in Borneo is inadequate even on paper. In Sumatra, better protection provisions exist, at least on paper, but 2/3 of the forest which makes up the actual habitat is threatened by logging. The altitudinal limit to orang distribution, which may occur at 1400-1500 m, may

be set by the absence of certain food plants rather than by cold (p. 38). Most important among the food plants are strangling figs. An orang weighs 30-70 kg, has a range of 200-1000 ha. About 5 orangs per sq.km live at Ketambe, predominantly in trees, at 10-30 m height (vertical distribution of the six primate species on p. 127); 32% of their food plant items occur at 25-45 m height in the canopy, 51% at 10-25 m, and 17% below 10 m (p. 52-54).

Data on the food plants are interesting enough. Orangs at Ketambe fed on 92 different kinds of fruit, 13 of leaves (mostly Alangium scandens and Acacia pennata, but remarkably, only at certain hours, p. 76), 22 of other vegetative parts like top-sprouts, orchid bulbs, or bark, 2 of aerial aroid roots, 2 or more of epiphytic fungi, and 17 of animal elements. Rijksen collected 114 species of plants used as food (listed on p. 405-409), in 85 genera, in 46 families; among them rank Moraceae with 21 species, Euphorbiaceae with 10 sp. (Bischofia under Staphylaeaceae to be included), Annonaceae with 6 sp., Meliaceae with 5, Asclepiadaceae, Leguminosae and Sapindaceae with 4. While assistance was received from the Rijksherbarium (where a set of the specimens is preserved) with regard to identification, the field data are the author's own.

Trees and shrubs comprise 53% of the plant species, lianas 28% (Rijksen repeatedly asserts their great importance, not only as food providers but also as pathways in the forest canopy), epiphytes 8%, strangling figs 7%, herbs 4%. Some 90% of these food plant species are confined to the primary forest. Of the trees used, 68% are rated 'important' as a source (i.e. 22% 'esteemed' + 46% 'preferred'); of the lianas 63% are important (4% + 59%), of the epiphytes 22%; the others are merely rated 'others'. Eight species of strangling fig, Ficus annulata, benjamina, drupacea, elastica, glaberrima, stupenda, sundaica, and virens, together yield the staple food more or less the year round (availability tables on p.67 and 71). Apparent differences in taste between the figs of conspecific trees may be due to differences in gender (p. 73).

Besides the figs, the 'esteemed' species are Antiaris toxicaria, Durio oxleyanus, Garcinia bancana, Heritiera elata, and Nephelium lappaceum. Durio oxleyanus is praised for its nice taste when still unripe; Rijksen notes the absence of the obnoxious zibethinus-smell at maturity (I noted, however, in the same species in Sabah, that it does have the smell, but weaker — a regional difference?). Orangs must be clever to negotiate the forbidding durian armour; three striking photographs on p. 85 show an orang opening it with a stick, then pulling out the spines with his teeth. The hard shell of Heritiera fruits they crack open (no other animal being able to do this); sometimes they carry off loaded

branches (p. 84) – which may hint to cauliflory as a point of survival value. Poisonous Antiaris and Strychnos ignatii apparently cause them no harm, nor do the stinging leaves of Dendrocnide. Some quite large seeds, swallowed whole, leave undamaged, but Durio seeds probably do not survive (p. 97).

It is worthy of note that 12 of the 52 'important' tree species, i.e. 23% are huge individuals when adult, and have fruit crops enough for several apes to feast on during 1-3 weeks (p. 68). The table on p. 69 concludes that together 42% of the tree species yield a large amount of fruit in limited space, vs. 58% a small and/or scattered amount. Such facts cast a light on evolution: the apes had to chose for a non-gregarious life up in the trees probably because of long time persecution by humans, and have implications for conservation: orang utans need the big trees; the one Heritiera tided the population over the month October (p. 71).

Forest composition was studied along Rijksen's meshwork of trails, 5 m on both sides. Of trees 15 cm or thicker, 2137 were recorded (p. 49), an average of 475 on one hectare. Results of the analysis by genera: Aglaia (Meliaceae) 11.4%, Mastixia (Cornaceae) 8.5%, Xerospermum (Sapindaceae) 4.8%, Walsura (Meliaceae) 4.2%, Litsea (Lauraceae) 4.1%, other Lauraceae 4.0%, Eugenia (Myrtaceae) 3.8%, Dipterocarpaceae a mere 3.6%, Castanopsis (Fagaceae) 3.1%, Drypetes (Euphorbiaceae) 2.5%, Macaranga (Euphorbiaceae) 2.1%, Garcinia (Guttiferae) 1.9% (p. 410). Tree densities per hectare differ accordingly, from 52 trees in one ha for Aglaia to 1 in 150 ha for Heritiera. Four giant strangling figs occurred in half a hectare. Out of the 52 important food plants only 4 species = 8% are common; 36% are less common, and 56% are represented by few or even single trees (p. 65; fig. 26 gives a location map of 15 important food plants).

This habitat, with its paradox of an astounding diversity on the one hand, of which the elements are sparse and far apart on the other, has to a great extent allowed the rather solitary way of life for orangs heavy weight animals as they are (p. 305). Author testifies to the keen knowledge of the area the apes possess (p. 81), and besides the data here gathered together gives a host of interesting facts and views which will appeal to a wide array of biologists. Who can read without excitement about orangs watching the flight of hornbills, in order to locate distant fruit-bearing trees?

To give an idea: his Introductory part covers 27 pages, Ecology 121, Behaviour 166, Conservation 53. The last chapter reflects Rijksen's intense involvement for seven years. After setting forth the legislative aspects in a fine informative account (p. 332-334), he deals with threats by hunting, shifting cultivation, human population growth, logging and its impact on the ecosystem; then comes an evaluation of re-

habilitation (valuable, but only in rain forests still empty of orangs); discussion and conclusion. In hunting, cannibalistic desires are perhaps here and there involved to this day. Rehabilitation, in the 'orang creches' which generated much publicity and which provided a home for confiscated animals, has been very successful in reducing this threat. Deforestation has now become the major danger. Shifting cultivation, already increased through population growth in addition to migration pressure along the Alas river upstream, has been aggravated by a neglect of restrictions imposed by the adat = traditional law, on the practice and the manner of execution. As a result, the local people are ruining their land in the senseless way shown along the Kabanjahe-Leo Balang road in the once beautiful Karo Highlands. Rijksen notes the disastrous belief in western ideologies about 'development aspirations' which in the western countries themselves are now criticized as untenable and immoral.

On the subject of logging (p. 349-365) Rijksen gives many inside data and impressions; they concern the illegal felling inside the reserve, with its impact on the ecosystem, the sly demise of the Sikundur part of the Leuser reserves, and the deceitful pretext of 'selective cutting'. Felling a big tree will create a gap of about 50 by 30 m in the canopy; in general, a cut of 10% of the trees results in an actual destruction of 55% of the other trees, leaving a mere 35% of the canopy intact. Short term effects entail a flight of animals whose social structure is disrupted; long term effects include a disappearance of c. 48% of the mammal fauna, a failure of the birds to establish themselves in adjacent areas, unavailability of the larger trees as potential hosts for the strangling figs which orangs need – and these very species of figs are confined to the rain forest! – and disruption of the liana network vital for food as well as for locomotion. Since some more passages will be quoted in this issue under 'Conservation', this may suffice to indicate that the orang utan is absolutely dependent on the intact rain forests, and cannot make do with a degraded habitat.

References amount to c. 380; we might add A. & C.M. Hladik, Rapports trophiques entre végétation et primates dans la forêt de Barro Colorado (Panama), La Terre et la Vie 1 (1969) 25-117. A list of the vertebrates observed in the area is given: Amphibians 4 species, Reptiles 33, Birds 127, Mammals 54. There is a number of illustrative maps (particularly the one showing extent of forest in N. Sumatra, p. 151). Slips of the pen or the printer are never so serious as to render a plant name beyond recognition. The lack of an index I tried to make good by citing so many page numbers; a homage to the author, who after becoming a veterinarian doctor, now shows a grasp of both botany and zoology, literature past and present

(botanists are pleased to see, for instance, the work of O. Beccari given its due), pure and applied science. It leads the reader to explore many questions, and never disappoints in answer. A masterly work, a true source-book. — M.J.

Wealth of India / Raw Materials. Vol. 10: Sp–W, xlix + 591 + xxv p., 175 fig. (1976). £ 23.00, $ 65.00. Vol. 11: X-Z and Indexes, xxvii + 385 p., 29 fig. (1976). £ 20.00, $ 42.00. Order from Sales and Distribution, Publications Directorate, Hillside Road, New Delhi 110012, India.

The other series is Industrial Products, in 9 volumes. Both are now complete, although repeated efforts to obtain vol. 1 and 2 were never rewarded. An informative folder announces Supplement volumes to 4 on Fisheries and to 6 on Livestock. Otherwise the contents are mostly botanical: vol. 10 gives 648 entries of which 625 on plants, 10 on animals, 13 on minerals. As important items in 10 and 11 are listed Sterculia, Strychnos, Swertia, Swietenia, Syzygium, Tamarindus, Tectona, Terminalia, Theobroma, Thevetia, Trichosanthes, Vigna, Vitex, Zingiber, Zizyphus.

The words of praise already spent on this work (*p. 2232*) could easily be repeated here. Clear and balanced in presentation, with an abundance of detail, plenty of references, accurate in spelling, and illustrated with well-reproduced photographs and line-drawings, it is a true mine of information.

The editors facilitated the reviewer's task by giving some statistics in vol. 11: 5000 plant species dealt with, in 1730 genera (1334 dicots, 322 monocots), in 233 families, broken down with Gramineae 134 genera, Leguminosae 122, Compositae 87, Euphorbiaceae 57, Labiatae 50, Rubiaceae 42, Palmae 36, Acanthaceae 32, Apocynaceae 30, Asclepiadaceae 29, Liliaceae 28, Araceae 27, Umbelliferae 26, Rosaceae 26. The total number of pages, two-column print, is 5000.

The last volume gives 260 pages of cumulative Indexes, in three-column print: to Botanical Names (synonyms in italics), Zoological Names, Active Principles and other important compounds, Names in Indian Languages, and trade names. Some corrections to all volumes at the end.

Mr. Y.R. Chandha and his team, as well as the users, are to be congratulated upon the completion of this 20 year's achievement. It has set a new standard in this field. — M.J.

WHITMORE,T.C., A first look at Agathis, ix + 54 p. + 12 plates with phot. (1977). Forestry, South Parks Road, Oxford, England. Tropical Forestry Papers no 11. Price unknown.

Agathis (Araucariaceae) with 'some 13 species' occurs in Malesia (except in S. Sumatra, Java, the Lesser Sunda Islands, southernmost New Guinea, and most of the Solomons) with 1

species; in Santa Cruz there is 1 sp., in the New Hebrides 1 sp., in E. Australia 1 sp., in New Caledonia 5 sp., in Fiji 1 sp., in N. New Zealand 1 sp.; fossil occurrences are in SE. Australia and S. New Zealand.

The Malesian population is terribly polymorphic and ecologically versatile; it goes here under the name A. dammara and is tentatively subdivided into 3 subspecies, one in Sumatra, Malaya, Borneo, one in the Philippines, Celebes, Moluccas, one in New Guinea. Whitmore has managed to steer clear of every taxonomic decision, and where indispensable, uses 'provenance' nomenclature. This is wise, since none of the taxonomic work done in the genus is satisfactory. Although Whitmore's look at Agathis can hardly be called a first one, in view of the large amounts of work done by foresters in Indonesia, published in Tectona, the need for a good taxonomic account is now clearly greater than ever. Whitmore, who from Oxford, his base, for his study visited 21 localities all over the region, may have collected much material. Additional characters will probably be needed, from cuticle and pollen, and the diterpenes in the resin may differ with the species (p. 44).

Descriptive matter is scarce in the present paper, so are indications of the variability range beyond height and diameter. New is a chromosome count: 2n = 26. The longest chapter (13 pages of text) gives an account of occurrence, numbers, conditions, exploitation and rejuvenation, from West to East, island by island. Agathis occurs sporadically in Sumatra, Malaya, and the Philippines beyond Palawan. In Borneo, where Agathis occurs in heath forest, on ultrabasic soils, and most on sandy ridges in swamp forest, there must have been at least 30,000 hectares, now largely logged over. In this western part of its area it prefers a slightly seasonal climate, also in Celebes where it is mainly in the mountains which probably are less seasonal than the plains, but in the New Hebrides, for instance, they occur in everwet stations, and their seedlings have better pioneer qualities, useful to the forester. Rejuvenation in Malesia still seems to be elusive. Seedlings can only establish themselves where patches of humus remain; they do not survive felling for long due to competition and seem unable to invade the secondary vegetation on open ground, but "experiments in the late 1940's have shown that if damage at logging could be kept low (as with man-handling and rail extraction) then natural regeneration would grow up, but extraction by tractor caused heavy damage" (p. 9).

While in Borneo dimensions apparently are not wildly large, in New Guinea the trees reach 60 m, trunk 2 m Ø, with the limbs of the crown oblique (in Araucaria, they are horizontal). Easily spotted from a plane, maps were thus made by

J.F.U. Zieck, here published. The biggest stands may contain to 50,000 mature trees; occurrence may be associated with ultrabasic outcrops. Interesting data are also compiled from Queensland, New Caledonia, Fiji, New Zealand. The logging history on p. 18 seems futile in retrospect: export from Malaya ended in 1974, Borneo all but exhausted, in Celebes steady cutting, New Hebrides logged and depleted over many years, in Queensland most of the big trees gone, in New Zealand one million hectares in 150 years reduced to 7000. Regeneration is duly reported, but apparently there must be a delicate balance with the remaining canopy and secondary growth, if this is to succeed.

'Adequacy of current conservation measures' (i.e. ways to spare part of the older or younger trees, which vary from one place to another, are briefly discussed, and it is asserted that "there is no Agathis provenance which can compete with a dense, lush, fast growing stand of pioneer trees" (p. 19). Disappointing is that while stands are located and described with accuracy, measures towards conservation have only sketchily been indicated. I think this is a shortcoming — who would better be able to make detailed conservation proposals than Whitmore who visited all the places? On the other hand, this book contains a crucial contribution, the Population Size for Conservation, on p. 45, by D. R. M a r s h a l l of CSIRO, Canberra, who presents a calculated estimate, based on "a diffusely distributed, outbreeding rain forest tree which we wish to conserve in situ to maintain its genetic integrity and hence its ability continually to evolve". Taking into account average heterozygosity, and mutation rate, he concludes that 1,000 to 25,000 individuals are needed to make a viable population. For Agathis, some 5,000 per stand would seem adequate, but (p. 19) 10,000 is a safer number. This is a first reasoned answer to the question about the minimum size of a reserve of tropical lowland rain forest and a crucial thing to know.

Agathis is primarily valued as a many-purpose timber, also (in the Philippines where the trees are protected, in Celebes and in New Guinea) as a source of resin, known as Manila copal, for varnish, collected by digging up clumps from the soil and by tapping, 10-20 kg a year from a tree.

The chapters on Planted Agathis, the Species Compared (on silvicultural points), Pests and Diseases, and Products are less interesting to the botanist, but that on Propagation is, because it contains bits of ecology. Also interesting is a neat comparison of favourable and unfavourable features (p. 43-44), for the same reason. The reference list has about 150 items (the Dutch 'van' incorrectly under the V). The summarizing could have been better, and it is not always easy to piece all aspects together; fortunately the Index is quite

informative. Production, with 2 column print, is good, but the A4 format paper cover may induce cracking. Many interesting materials have been put together in this 'first look'; a worthy challenge to further study. — M.J.