## IX. REVIEWS

ASHTON,P.S., Crown characteristics of tropical trees. In Tomlinson & Zimmermann (ed.), Tropical Trees as Living Systems (1978) p. 591-615, 8 fig.

An important subject in relation to bioproduction. Approaches are through Leaf Area Index (the area of leaf surface above a unit area of ground) and Leaf Area Density (ditto per volume of space). Field work was done in Malaya by students; the simple methods are described. Macaranga gigantea is compared with Musanga cecropioides; other pioneer species are quite different, however. Two profile diagrams of secondary forest are given. Crowns are modified in competition, as reflected in LAI and LAD. Plagiotropic branching allows trees to broaden quickly. Light- or shade-preference is not clearly correlated to architectural model. Givnish & Vermey's prediction of variation in leaf shape, size, and inclination in lianas as a result of transpirational costs against photosynthetic gains, is discussed and clarified. Dipterocarps may change their model in maturity. — M.J.

DOYLE,J.A., Fossil evidence on the evolutionary origin of tropical trees and forests. In Tomlinson & Zimmermann (ed.), Tropical Trees as Living Systems (1978) p. 3-30, 3 fig.

Much progress was made in two decades. The late-Devonian Archaeopteris was one of the first forest-forming trees, an early example of plagiotropy, and bears on the differences between cycads and conifers. The Carboniferous swamp forests were tropical; they supported a variety of the modern architectural models, many of them in non-angiosperms. Gymnosperms were driven out of several ecological niches by angiosperms. The Cretaceous angiosperm flora was less rich and well-developed than formerly supposed.

The development of the modern tropical forest is approached through functional parallels drawn from pollen and macrofossil parts, in relation to the facies they were found in; dangers of misidentification are thus circumvented. The angiosperms were poorly adapted to cold, but shrubby or weedy pioneers which evolved one way into herbs and water plants, the other way into forest trees. The architectural models reflect multiple, opportunistic evolution. Pollen evidence suggests that insect-pollination (which allowed distance between individuals and less risk of attack) and carpel closure were established early; wind pollination came later. References 105. — M.J.

DRANSFIELD,J., Growth forms of rain forest palms. In Tomlinson & Zimmermann (ed.), Tropical Trees as Living Systems (1978) p. 247-268, 10 fig.

Of the c. 2700 palms known, 2000 are rain forest species. They come in four models: Holttum, Corner, Tomlinson, Schoute, and in four basic growth forms: trees canopy-high; shrubs; stemless; climbers. Hapaxanthic flowering, suckering, aerial branching, geotropic stems, stilt roots, climbing organs, rheophytes, distichous habit, and vegetative reproduction from inflorescences are examined. — M.J.

HALLÉ,F., Architectural variation at the specific level in tropical trees. In Tomlinson & Zimmermann (ed.), Tropical Trees as Living Systems (1978) p. 209-221, 5 fig.

While Muntingia under different conditions assumes a different habit but retains its model, the female Cycas has Corner's model, the male, Chamberlain's Mangifera indica and three others display Leeuwenberg's model in full sun (apical shoot aborted), Scarrone's in the shade. Architectural 'mutation' is described in several cases, some caused by damage. The mutant is not arbitrary, but a known model. — M.J.

JENÍK,J., Roots and root systems in tropical trees: morphologic and ecologic aspects. In Tomlinson & Zimmermann (ed.), Tropical Trees as Living Systems (1978) p. 323-349, 5 fig.

General considerations and discussion of main types culminate in no less than a (non-hierarchical) classification of root systems. Criteria are: 1) capability of the root axes for secondary thickening; 2) general structure of the root skeleton in adult specimens; 3) relations of terrestrial and aerial root subsystems; 4) changes of roots during the life span of a tree; 5) occurrence of 'abnormal' root forms assumed to represent genotypic adaptation; 6) occurrence of certain phenotypic modifications caused by the environment.

Recognized are 20 models with secondary thickening and 5 without. They are (rather cumbersomely) named with a binomial for a plant species, e.g. model Ficus benjamina; each is characterized in 4-5 lines, most are diagrammatically pictured. Author's experience is in Africa; I should not be surprised if in the Pandanaceae more models could be found than the one of P. candelabrum. References 88. Very interesting discussion! — M.J.

LÖFFLER,E., Geomorphology of Papua New Guinea, xvii + 195 p., 49 fig., 97 phot. (1977, ANU Press, Box 4, Canberra; distributed by Eurospan, 3 Henrietta Street, London WC2E 8LU, England). Cloth £ 13.50.

At the end of a 12-page article on Landforms in Ryan's Encyclopaedia of Papua and New Guinea (1972), Löffler writes about "The attraction they exercise, over tourist and scientist alike, by their variety, stupendous range and vast scale. Whilst they attract, however, they also present considerable physical difficulties to study and enjoyment, by virtue of steep untrafficable slopes, numerous fast flowing or flooding rivers, broad areas of swamp, and the dense, masking forest. It is little wonder that the humid tropics remain little-known geomorphologically, but study of their landforms and landforming processes is now under way, aided by modern use of aircraft and by remote sensing. Papua and New Guinea are likely to be important in this research, not only for purely scientific reasons but also as part of the coming development of the area, as a background to the knowledge of its soils and land-use potential."

This book is not in such flowering language, however, but an intelligent and well-readable synthesis it is, published in the same series as Paijmans's New Guinea Vegetation (*page 2873*). It is intended to be used together with A Geomorphological Map of PNG, available from CSIRO, Canberra.

The present features of New Guinea emerged as recently as the Upper Pliocene, result of a combination of catastrophes and uniform processes, both endogenic and exogenic, with climatic factors like glaciation and precipitation playing their part. New Guinea landscapes are geologically very youthful. These landscapes are discussed from several points of view. First, the 12 accepted 'structural regions' are briefly described. Second, 14 'geomorphological regions', largely the same as the former, are distinguished. Third, landform types are discussed; denudational, under which come fluvial, karst (with a new classification of 8 formations), and glacial erosion types, then volcanic, then depositional, under which come fluvial and coastal. In the latter section, the coastal dunes at Hood Bay (SE of Port Moresby) are of interest to the botanist, and an expert from e.g. Holland might be useful to solve Löffler's problem of parabolic dunes. A fourth approach is through the geomorphological processes, of weathering (predominantly chemical), fluvial erosion (the many V-valleys demonstrating the speed), landslides (an important factor is this geologically active island), slope wash (which unlike splash erosion is hardly reduced by leaf litter, as can be seen under Castanopsis and Pometia, p. 147), subcutaneous erosion (in limestone), also worm and termite activity. The last two chapters, on geomorphologic history, offer a retrospect and justification.

Strict confinement to the eastern half of New Guinea is a serious limitation of this book; not even Visser & Hermes's Geological Results of the Exploration for Oil in Netherlands New Guinea of 1962 has been used to make a comparison or a connection. It is also a great pity that nearly all of the fine photographs have been printed at about 2/3 their proper size, although the many clear block diagrams are a great help. The synopsis of contents is far too meagre, but this will, we hope, only encourage readers to search, and to read and think for themselves about this island of endless fascination. — M.J.

MAURY,G., Diptérocarpacées / du fruit à la plantule, 432 p. of text + 344 p. of illustrations (688 figures and photographs), diagrams (37), and tables (45). (1978, thesis, Toulouse), typescript in offset printing. Address: Mme. Dr. Géma Maury, Ecologie, Avenue du Petit Château, 91800 Brunoy, France.

This 3 inch work claims to be the first detailed palynological study of the family and also the first systematical one based on the ontogeny of reproductive characters, such as the fruits, the embryo, the germination and the seedlings, in a family of tropical trees (p. 383). Systematical it is; a taxonomic publication it is, in my opinion, not, for lack of a formal presentation — although taxonomic propositions are forwarded in it.

Its limits are twofold. First: in the material collected. Mrs. Maury worked for two years in Malaya, collecting or growing seedlings of 100 species, and collecting fruits of 200, from all groups. But while on p. 41 six botanists are acknowledged for identifications, no specimens have been named, which means, alas, that for the identity of the material used for this study we are dependent on good faith.

The second limit is in the characters used. While the anatomy of fruit, embryo, seedling and pollen is treated exhaustively, the characters of the tree are left out of consideration.

Within these limits, I think every scientific possibility has been pursued to an amount of detail and of taxonomic conclusions that makes the work to an example of 'le défaut de ses qualités'. The result is a source book, with 427 references and a huge amount of fact, but hardly augmenting our understanding of the Dipterocarpaceae. On page 77, for example, that taxa with a stiff pericarp have mainly retained an adaptation to wind dispersal, while those with a soft pericarp have specialized in adaptation to other agents: water and perhaps animals. That is all, and it does not enlighten us on the intriguing problems of dispersal in the family, for which wind is a very doubtful carrier. Nor has author applied her prodigious energies to comparisons on the characters studied of dipterocarps and other families, which might have yielded interesting ideas — but her work is eminently suitable to enable others to do so.

Systematical the work is. Of fruits, ripe embryos, seedlings and their leaf surface, material and methods are explained, a detailed description is given, with the features related to taxa, accompanied by fine, clear illustrations in a variety of magnifications. Those of the seedlings, 78 species, deserve special mention. Then the data are, character by character, listed by taxon, and also given in tabulated form. In summary, for each organ a hierarchical order of characters is given, and a key to the smallest groups for which they differ, so there is a key to fruits (p. 73), to embryo types (p. 103), one on cotyledons (p. 143), one on surface characters (p. 219) and on trichomes (p. 221), one on anatomical characters (p. 334), which must have been very laborious as an academic exercise, testifying to an immense diligence and tenacity.

At the end of each part, the emerging similarities and differences are compared with the taxonomic pattern, and of course under each some incompatibilities are observed. How to synthesize them? That takes much discussion on points of heterogeneity, which must be left unresolved because half the characters (those of the tree) were left out. Pushing the taxonomic considerations to the brink, it is proposed (but not actually done in accordance with taxonomic custom, fortunately) to establish under the Dipterocarpaceae two subfamilies: Imbricoideae and Valvoideae, and to create Monotaceae as a family next to it. In Stemonoporus two new groups are proposed: round-fruited and ovoid-fruited (not mentioned in the Summary), again under avoidance of branch, leaf, and flower characters.

I think that is consistency pursued too far. While it furnishes excellent materials, the taxonomic wisdom must come from others. — M.J.

NG,F.S.P., Strategies of establishment in Malayan forest trees. In Tomlinson & Zimmermann (ed.), Tropical Trees as Living Systems (1978) p. 129-162, 9 fig.

An interim report on seedlings work, on 200 species in 56 families (23 of them nomads, named on p. 159), for which are tabulated: germination mode and speed, early seedling morphology, and ditto size. Rapid-germinating species (65%) have a different strategy than those with dormancy;

remarkably enough, the seedlings heavily compete in the majority of the species. Four types of germination are distinguished: epigeal (64%), hypogeal (18%), semihypogeal (10%), and durian (8%). Small seedlings find more places to settle, large ones have more reserves to draw upon; 75% of author's species have seeds 1 cm or longer. — M.J.

OLDEMAN,R.A.A., Architecture and energy exchange of dicotyledonous trees in the forest. In Tomlinson & Zimmermann (ed.), Tropical Trees as Living Systems (1978) p. 535-560, 6 fig.

The forest is a dynamic system, the canopy constantly renewing itself. If canopy strata do exist at all, they are neither permanent nor preponderant. 'Energy' denotes nutrients as well as radiation, of which a tree as a system has an input and output. Reiteration enables forest trees to influence the balance between the two; even so, the balance changes during the life of a tree (diagrams given). Buttress formation, which requires a high metabolism, is an aspect of this process.

A model of the developing forest is designed. Sylvigenesis starts with a chaotic stage (the second growth), followed by maturity; during the process, the function of light intensity and air humidity changes. In the primary forest, sylvigenesis goes in cycles, from the gaps (called 'chablis' if caused by a fallen tree) to the mature phase to chablis, &c. Chablis increase with rigor of climate, from 15 to 33 per ha. In them, 'positive sylvigenesis' proceeds through at least four stages of succession, expressed in a species/area curve. The forest mosaic owes its configuration at any given moment to this balance between destruction and regrowth. — M.J.

PHILIPSON,W.R., Araliaceae: growth forms and shoot morphology. In Tomlinson & Zimmermann (ed.), Tropical Trees as Living Systems (1978) p. 269-284, 3 fig.

Both pachycaul and leptocaul elements occur. The leaves are strikingly diverse, and differences with juvenile ones remarkable. Two types of cataphylls are noted. Harmsiopanax, in habit like a tree senecio, is intermediate between the Araliaceae and Umbelliferae (a berry is the only constant character to distinguish the former) and may be close to a common stock of both. Seven known models occur in the family (figured and listed), plus two which are not conforming to any named model: Arthrophyllum diversifolium (slightly different from Leeuwenberg), and Pseudopanax anomalum of New Zealand (both figured in detail). A lack of detail in the terminology of buds is pointed out. Rather than Sattler's nonconformistic views on shoots, the classic concept of the shoot is adhered to. — M.J.

TOMLINSON,P.B. & M.H.ZIMMERMANN (ed.), Tropical Trees as Living Systems, xviii + 675 p., illus. (1978). Cambridge University Press. Price Sw.Fr. 110.

At this symposium held in 1976, 27 papers were delivered, followed by often extremely interesting discussions which add to the value of this fine book. For instance on p. 343-344 about the surface-volume ratio of

buttresses, which might tip the survival balance against them in an adverse climate. In the wake of Hallé & Oldeman, whose architectural models are met in nearly every chapter, further new ground is broken. Kira on p. 564 maintains the three canopy stories which on p. 536 Oldeman denied, but such dissensions do not distract from the great common outlook on the forest as a dynamic system which perpetually renews itself.

The headings are: Origins and Variation, 2 papers; Reproduction and Demography, 4 papers; Architecture and Construction, 7 papers; Roots, Leaves, and Abscission, 3 papers; Organizational Control, 6 papers; Community Interactions, 5 papers. A somewhat arbitrary selection has been made for separate mention in the Bibliography: see Ashton, who quantified the crowns in secondary forest; Doyle who reviews the ages past; Dransfield on palms; Hallé on the variation of models within species; Jeník who presents a classification of roots; Ng who tabulates new data on seedlings; Oldeman who works out a model of canopy decay and building; Philipson who in Araliaceae spots two undescribed models; Zimmermann who finds survival value in vessel diameter.

Other papers include some detailed case studies, e.g. on the composition of a forest in Mexico, or on Terminalia branching; general reviews on e.g. abscission; speculation on the adaptive significance of compound leaves, heavily debated; physiological work on growth control, largely beyond my understanding; and some further steps in fields whose authors are already famous, like shoot differentiation, seeding patterns, and the gap phase in the canopy. Exchange of genetic material and dispersal are absent as subjects; however, the book is rich and thick enough.

Production is first class, but summaries should have been given. There is an index, but I missed iteroparous on p. 91 (such an organism has more than one distinct reproductive bout during its lifespan), and semelparous on the same page (all in one bout).

Summing up: expensive but worth the money. — M.J.

UNESCO, Tropical forest ecosystems / A state of knowledge report prepared by UNESCO UNEP FAO, 683 p. (1978, UNESCO, 7 Place de Fontenoy, 75700 Paris, France, or local distributors). US$ 50.00.

The first copy was displayed during the Forestry Congress in Jakarta, October 1978. It is to be distributed widely in developing countries, also in a French and a Spanish edition. It is to be a tool for action, information and documentation, based on work of the last two decades; 2.4 kilograms, two-column print. The typography is fine, the translation from French authors blameless, printing errors minimal. The paper-cover is not strong, which seems a pity for a 4-years' editorial effort. The latest-incorporated publications date of 1976.

That no summaries are given, nor an all-round introduction, not even an index, is no doubt a challenge to the reviewers. Illustrations, other than a few graphs and diagrams, are absent; we can only hope that this will work as a challenge to the reader. He certainly must be tough, willing to cross lush and productive primary forest, but also much alang-alang riddled with dry data, and all sorts of blukar, indifferently described in United Nations prose. It is, in short, hard to detect one

level in the book, which means that for any given reader some parts are far too specialized, which prevents one from getting a grasp on the whole subject matter. This invokes the danger that the book will be cited like the Bible, in isolated passages; this is a danger (to the forest) in view of the great amount of ideas in it which favour exploitation. Besides, it neglects at least four important aspects of the subject. The first is the differences in altitude above sea level, especially those between the lowland forest below 300 (sometimes perhaps 500) m and higher, in composition, species richness and vegetation structure. The second is the minor forest products in their astounding variety, and their enormous role in the economy of forested countries. The third is evolution, and the dangers entailed in primary forest exploitation (to whatever degree) towards its disruption or deflection from its 60 million years' course. The fourth is education about the forest ecosystems. Insufficient emphasis is given on the values of the rain forest, which are so many more than just the supply of timber. Moreover, this book is far too complex and uneven to derive materials for education from. Wouldn't it have befitted the world's largest education organization to insert a chapter to supply them? It is, after all, a shame what mankind is doing to the tropical rain forest, too great a shame to speak about it in neutral words only. Failure to propagate knowledge and respect with regard to the forest at elementary level has no doubt contributed to the massive destructions of these marvels of creation.

But let us examine the contents. We find ourselves here in a bibliographical quandary. The book is divided into three parts: a physical part (ch. 1–14), a sociological part (ch. 15–21), and some case histories (eight chapters). Now the numbered chapters bear no author, only the unnumbered ones of the third part do. The authors of the numbered chapters are listed in Acknowledgements (p. 9-11, between the Preface and the Foreword). I think that this is not clear enough for making unambiguous references to them. To prevent confusion, we review all chapters here.

I. *Inventory and survey: International activities;* by R.G.FONTAINE & J.P. LANLY, p. 17-32.

World forest inventories have hitherto been inaccurate, and data collecting has been done from the exploitation point of view. Comprehensive large-scale maps are listed, but Küchler's 4-volume International Bibliography of Vegetation Maps (1965-1970) goes unmentioned. Side Looking Airborne Radar (SLAR) is considered the best technique of mapping. Non-primary forest sometimes obscures the considerations: "spontaneous growth of forest in the grasslands and tree savannas on the margins of the semi-deciduous forest of the Cameroon" (p. 26a). References 60.

II. *Tropical forests and the biosphere;* by A.BAUMGARTNER & E.F.BRUNIG, p. 33-60, 7 fig.

Land areas, climatic gradients, forest areas, destruction rates, all on a global scale. Forest functions (nice diagram of inputs and outputs on p. 44), climate for evergreen and deciduous forest, carbon cycles. Modifying the forest cover may affect albedo and climate, simplify the ecosystem. The flat quantifications will satisfy people who are impressed

by figures rather than by forests; yet numbers of species facing extinction are not given. References 148.

III. *Palaeogeography and palaeoclimatology;* by D.A.LIVINGSTONE & T.van der HAMMEN, p. 61-90, 2 maps.

Lake sediments are the richest pollen sources, especially for Africa: 10-20 million years of month-by-month record in Lake Tanganyika. The three rain forest regions are discussed, maps of Africa and South America give the main sites and vegetation outlines. Evidence shows considerable fluctuations of (rain)forest areas and altitudinal zones during the Ice Age. As for the Indo-Malesian-Pacific region, the best records are from Taiwan and Queensland, but comment is brief and not conclusive on history. Doubt is expressed of rain forests as a stable community, in view of the pollen record (p. 84a). This may be right, but I don't know if authors reckoned with species richness and proportional scarcity of individuals of one species; while one whole region of forest remains stable, composition in one place may change. Otherwise an outstanding paper. References 232.

IV. *Floristic composition and typology;* by R.LETOUZEY, p. 91-111.

Sets out with the advice to ask Herbaria for information on Floras. Author does not know that in the Flora of Java, vol. 2, p. (36), 23.4% of the 6534 species is cultivated. It is suggested that knowledge increases by numbers of described species (p. 93b) disregarding reductions to often about 1/3 through critical taxonomic work. Barringtonia has not 100 species (p. 100b) but 39 according to Payens's monograph in Blumea 15 (1967). Dipterocarpaceae (p. 99a) do occur in New Guinea. Regardless of such errors and the bad way they reflect on taxonomy, what is the usefulness of long lists of families, with rough distribution and a few scattered notes? One might expect them in a work on plant geography and then with an explanation of distributions here lacking.

'Forest types' dwells on confusions in terminology. Author fails to mention the excellent studies on forest composition by Poore (1968) and by Ashton (1969), with which all Malesian botanists are familiar. References 88.

V. *Organization;* by B.ROLLET, p. 112-142, 2 fig.

The two main parts of this chapter deal with Architecture and with Structure, involving much methodology.

Architecture is chiefly studied through profile diagrams; their construction, value, history (followed through 63 publications), and limitations are discussed. Perhaps 30 ha of the world's forest has thus been analyzed. Diameter at Breast Height (DBH) is the easiest, most widely available tree measurement (see also p. 201b for accuracy considerations); its value is examined. "Many lowland evergreen forests have no strata but rather a progressive decrease of stem number with height increase; for leaf masses there seems to be a maximum density at about halfway between the tops of the highest trees and the ground" (p. 119/120). Among lianas, 3 classes are distinguished, from light demanders to shade tolerant species.

Structure is a somewhat mathematics-infused part, mainly on diameter

distribution, but also to analyse species/area curves, of which theoretical implications are worked out. Amidst the theorizing, a practical warning: "The definition of commercial species is constantly changing either because of fashion or following an increase of the general demand, or the marketing of new abundant species, or through technical utilization (sawmilling, peeling, drying, impregnation, log protection)" (p. 128a).

While I don't understand everything (e.g. the passage on climber seedlings on p. 124a top, or why thermodynamics is suddenly invoked to explain rain forest diversity on poor soils), the paper seems outstanding. References 321, too many listed as 'major'.

VI. *Animal palaeogeography and autecology;* by G.H.ORIANS e.a., p. 143-160.

It is not clear why these subjects are taken together. There is some emphasis on fishes. Palaeogeography is briefly explained with the aid of continental drift. Many numbers of genera and species are mentioned. Invertebrates are almost too poorly known for consideration; butterflies and termites are recorded. The Ecology section, too, is very enumerative. References 147.

VII. *Animal populations;* by O.J.SEXTON, p. 160-179.

Species richness in the tropics is attributed to: time-based spatial heterogeneity, competition, predation, climatic stability, productivity. Population density may vary greatly; the case of a lizard is discussed. Dobzhansky's view that biotic factors in humid habitats prevail has led to a neglect of physical ones. His ideas about the interplay of the selective factors later worked out as r and K (reproduction rate, carrying capacity) are examined in the light of recent literature. Competition is similarly reviewed, mainly for birds, wherein it largely explains distribution. Animal interactions are discussed mainly among insects. Effects of human intervention occupy one page only. As a result of forest destruction, the remaining plots will biologically become islands, on which the Theory of Island Biogeography is applicable. References 204.

VIII. *The natural forest: plant biology, regeneration and tree growth;* by P.S.ASHTON e.a., p. 180-215.

Non-seasonal forests (10 pages) are discussed as well as seasonal ones (4 p.); tree growth rates are discussed (8 p.). Their measurements and fluctuation from dehydration and seasonal factors, with the references apart for each.

Contrary to common opinion it is held that the deciduous habit is primarily related to soil nutrient status rather than to climate. "If nutrient status is moderate or high there is a greater tendency towards deciduousness" (p. 193b).

Mature phase on the one hand and gap and building phase on the other are extensively discussed, followed by a remarkably well ordered itemized presentation of research needs.

With regard to land use, a clear and wise difference is made between forestry potential in the gap phase (management prospects good for fast-growing species) and in the mature canopy phase. The latter "which occupies 90% of the rain forest area, has no place in forest management for wood production. However, it has a vital place in resource development",

namely for watershed protection, as gene pool, and as control against which experiments must be checked (p. 205a). Outstanding paper. References 308.

IX. *Secondary successions;* by R.G.FONTAINE e.a., p. 216-232.

Little is known, author thinks, and sees 4 questions: i) How are successions recognized? Do they form a continuum? ii) What are the rates of change? iii) How are they influenced by the environment and by the disturbances? iv) Are there several end points of recovery? Personally I think all can be answered with available knowledge.

Modifications are discussed with disappointing superficiality, not mentioning Van Steenis's neat scheme presented to the Stockholm Botanical Congress in 1950. Nothing is said about effects of depletion except that selective logging "will deplete the forest of certain species and dimensions of trees, but ecologically it will not constitute a major disturbance of the system" (p. 219a). I find this passage of a shameful superficiality which will make the exploiters happy. To further demonstrate author's half-ignorance: he classifies fire as a biotic factor because mostly humans light it; in the Philippines Pinus insularis becomes dominant above 1000 m if fires are infrequent (p. 225), but he does not mention that it does so only in seasonally dry parts; for Indonesia, there are many excellent papers in Tectona, including the one by Kramer in 1926, mentioned but not cited. References 64.

X. *Gross and net primary production and growth parameters;* by F.B.GOLLEY, p. 233-248, 4 graphs.

Platitudes beside an allometric equation $[W_R] = 0.0264\ (D^2H)^{0.775}$, which appears to be presented in connection with the estimated root weight of three treelets. "The biggest of them was only 15.1 cm in its DBH and any bigger trees could not be dug up because of the enormous amount of labour needed" (p. 238a). Conclusion: "Production is a dynamic process and as such requires a number of measurements over appropriate time intervals for rigorous description" (p. 245a). References 84.

XI. *Secondary production;* by F.B.GOLLEY, p. 249-255, 2 graphs.

Contents: Introduction; Secondary production data; Research needs and priorities; Bibliography. References 42.

XII. *Water balance and soils;* by F.FOURNIER, p. 256-269.

A handful of facts, on throughfall, stemflow, interception, evapotranspiration, run-off and drainage, for quite different types of forest, but without connection, and one recalls Ashton's suggestion that "cooperative efforts through interdisciplinary studies are more likely to be productive, as shown by the El Verde study, than the rather traditional idea of having one research sylviculturist in a forestry department" (p. 205a).

The crucial subject Erosion is poorly treated in 2 pages. The 'Selective Bibliography' gives 111 items in five categories, with Buringh's Introduction, a nice small textbook, marked as a 'major reference', but Burnham's fine chapter in Whitmore's Rainforests of the Far East neglected.

XIII. *Decomposition and biogeochemical cycles;* by F.B.GOLLEY e.a., p. 270-285, of which 6½ pages are tables.

A few available data on litter production/decay rates are given. A simple model of nutrient pathways is produced, flows of N, P, K, Ca, Mg are analyzed. Paucity of data is emphasized, but nothing is said about D.H. Janzen's work on phenolics, which slow down decomposition on very poor soils. References 47.

XIV. *Pests and diseases in forests and plantations;* by B.GRAY, p. 286-314.

Concentrates on the years after the IUFRO-FAO Symposium of 1964. Witches' brooms can be caused by dwarf Loranthaceae, Mycoplasma-like Organisms (MLO), or rust-fungi, as appears from the introduction on pest and damage. Pest and disease problems are discussed for nursery, plantation, and natural forests. Control is more difficult than in temperate forests; biocides for control seem less desirable than hormones or (anti-)attractants and silvicultural approaches. An extensive and interesting comparison is made between plantations and forests, emphasizing that diversity creates stability. Nice, informative paper. References 251.

XV. *Demography;* by P.KUNSTADTER e.a., p. 319-350.

If fertility and mortality change at different rates, the population increases or decreases; this is what I understand as the gist of the "demographic transition theory, a unifying concept". There is no unique tropical condition affecting fertility - so whence the high birthrates? There are vague allusions to social, economic and cultural circumstances.

Three case histories are given, one about Amazonia (3 p., rather fragmentary), one about Sarawak (9 p. and incomprehensible to me), and one to Bangladesh (4 p.). On the latter, the text at times shows a real human concern in everyday terms: "Over the past 15 years economic growth has fallen behind population growth (...) The nation is being kept alive by increasing food imports (...) Rice production is c. 800 kg/ha - a low figure even by Asian standards" (p. 342b). The people "have simultaneously lowered their standard of living and death rate and maintained high fertility on a diet which has declined below physiologically established minimum standard".

Translated from what one might well call United Nations prose, the conclusion is that nobody is able to do something about these problems (p. 344b). References 182.

XVI. *Nutrition;* by J.G.V.A.DURNIN, p. 351-371.

Much space is used up in telling about the gaps in knowledge. The rest is spent on diet lists and amounts of 'intake' in various parts of the world. All cases are isolated; I looked in vain for relations with the biological substratum or with socio-cultural backgrounds. Problems are reduced to grams and calories; naturally, there is no trace of a vision which could help an agency in dealing with food problems. Give me Lester Brown, By Bread Alone (Pergamon 1974). References 97.

XVII. *Health and epidemiology;* by R.S.DESOWITZ, p. 372-403.

"Thoughtful scholars of epidemiology have discerned that the proper appreciation of disease can only be obtained by relating it to the total

environment" (opening sentence). This idea is worked out systematically, mostly from observations on aboriginal forest-dwellers, who "can serve as sentinels for the identification of the health hazards, inherent in the forest" (p. 373a). The stratification of the rain forest offers isolated ecological niches to vectors. Disturbance leads to vector movements which may (and do) endanger humans.

For the three main forest regions, health aspects in the hunter-gatherer are examined; many data are tabulated. Then the main diseases are discussed, 10 categories. Malaria is largely a man-made disease: most anopheline vectors prefer sunny spots to breed. Hence its expansions in newly deforested regions and in defoliated mangrove in Vietnam. After forest destruction, when reservoir animals have become scarce, their pathogens may move onto humans. Human populations below a minimum do not support certain diseases (200,000 for measles, 2000 for varicella, &c.).

These are only a few notes from a well-composed, most informative paper. It contains additions to a conservation philosophy as well. References 186.

XVIII. *Human adaptability and physical fitness;* by O.G.EDHOLM, p. 404-413.

Many figures from studies of body, growth, working capacity, heat tolerance, blood pressure in aboriginal forest dwellers, in the three rain forest regions. Results are much the same. Disease limits their health. Urbanization affects them badly. Not a word on their peculiar abilities in the forest: to beat a trail, to climb trees, to catch animals, to pick out plants for survival. This is all dreary quantification, very scientific, though. References 56.

XIX. *Populations, civilizations and human societies;* by G.SAUTTER e.a., p. 414-451.

There are two parts, each composed like a complete chapter. The reasoning is orderly, proceeds quietly. Many views are weighed against fact and the conclusions are that things are more difficult than we thought. And this is but the human half of the story.

Part 1 (20 p.), entitled Population Densities, deals with distribution, saturation, and current problems. Populations cluster like islands in more empty space. The great differences in density cannot be explained, author thinks, by ecological factors, including disease. As the primary demographic factor, he sees a level combination of population and its agricultural techniques; starting from a critical threshold, densities either diminish or increase almost beyond regulation, depending on further development of technology. More than soil fertility it is the working of the soil that matters. It is held that forest fringes impede crossing and promote lateral movements. References 85.

Part 2 (15 p.), entitled Civilizations and Societies, deals with forest-dwellers, their social evolution and transformation in relation to their theoretical environment. Food-gathering and swidden, the two fundamental ways of living in the forest area are extensively compared, with their constraints and possibilities; author concludes that the tropical forest is not an essential obstacle to social stratification. As he sees it, "the tropical forest environment only gives man two alternatives: to

dispose of it or to fit in it" (p. 446a). If forest-dwellers damage the forest, they do so under pressure from outside. A plea is made, in view of an inevitable 'development', to retain (in a modified form) the integration between these people and their forests. References 93.

The big question remains whether this, what seems a fine sociological vision finds a sound biological basis. Author takes it easy. He shows ignorance in the botanical sector by declaring (about swidden) that "if the rest period is sufficiently long (more than 10 years in the aseasonal tropics), the structure of the forest which regenerates is not very different from that of the original forest" (p. 441a). His words "that there are no true virgin tropical forests" (p. 440a) are unsubstantiated. His assertion that success in cultivation depends on man rather ignores the astounding differences in land capability, although it is in line with his most un-biological view on the equatorial forests as a uniform environment (p. 419b).

While, of course, not recommending wholesale destruction, author repeatedly informs us that transformation of the rain forests is inevitable. This matters less, we suspect, because no forest is virgin any more. I fear that such ideas will be welcomed by a variety of people who look for an excuse to exploit the rain forest, and who will help to make the inevitability a self-fulfilling prophecy. I may well belong to those conservationists who on page 440a receive a sneer in passing, but do feel inclined to prevent the inevitable, convinced as I am, on biological grounds, that if mankind let the 'inevitable' happen, evolution would be disrupted, which would be the ultimate ecological crime.

Papers like this, strong on the social side, weak on the biological side, demonstrate the need for biologists to participate in the decision-making about the future of the rain forests.

XX. *The types of utilization;* by R.G.FONTAINE e.a., p. 452-504, 2 fig.

Firewood and minor products are not discussed; otherwise, the subject seems to be well-covered: 4 p. on Biological limitations; 5 p. on Utilization without major modification; 5 p. on Plantation forests; 9 p. net on Shifting cultivation and other agri-silvicultural systems; 4½ p. on Weeds; 3½ p. on Impact of forestry operations.

Many subjects are discussed at some length and with clarity; main publications are cited with characteristics of contents and importance. Discussions are critical, e.g. of polycyclic felling, of plantation forest, of taungya, of biocides - although under cattle grazing no mention is made of the impossibility of regeneration because all seedlings are eaten or trampled. Wildlife receives much attention, although the idea that "shifting cultivation increases the potential of the wildlife habitats" (p. 461b) is untrue in this simple form: it may hold for big game, but not for true forest animals.

Whether "forest regrowth can be aided by interspersing swidden with forest reserves which serve as seed and moisture sources and windbreaks" (p. 477a) is not consistent with susceptibility to invasion by aggressive secondary species; besides, there is the risk of incidental felling. All told, the strip or corridor system seems of doubtful value.

The 493 references are arranged under 11 headings.

XXI. *Conservation and development;* by R.G.FONTAINE e.a., p. 505-553, 2 fig.

Naturally, this chapter must be read in connection with the former. To Planning and land use 4 pages are devoted; to Conservation, 7 p.; to Problems of forestry, 3 p.; Economics, 6 p.; to Planning and management, 15 p.

The value of land-use planning is justly underlined, in the light of Ecological Guidelines, Goals for development and for conservation must coincide. Values and objectives of conservation are enumerated, on 8 points. Parks are rather extensively discussed, and their under-representation in rain forest areas is justly noted. Examples are well-chosen (e.g. the reduction of Mt. Apo Park in Mindanao from 730 $km^2$ to 130 $km^2$ - strangely, we nowhere find a plea made for compensation: if the number of conserved square kilometres is reduced in one place, why are not reserves extended in another place?) Training schools for conservation personnel are discussed; conservation ex situ is given some attention (but actually involved are only two species of Pinus). Human and Institutional problems are given attention; under Economics, statistics are tabulated, a chart is given of factors in the policy-making (p. 534) and there are other materials for devising cost-benefit models; still more interesting are the considerations of uncertainty in the prediction. The case for retaining the moist tropical forests depends on doubts about the future. "The uncertainty may point to a need for caution, but it is hardly strong enough to justify a halt" (p. 542b). I think three strong points are here to be made. First: no species must go into extinction. Second: the onus of proof is on the exploiter. Third: independent biologists must have a say in the weighing.

In view of the words that "it is impossible to exaggerate the importance of uncertainty in forest management" (p. 542b), what about the final notes of confidence and optimism? "It is now possible to envisage a land-use policy for the development of the forest sector and medium- or long-term programmes specifying various operations in time and space, and guide-lines for large forest-units (ca. 1000 $km^2$) to be prepared" (p. 546a). Two questions remain. How about the continuation of evolution in the rain forest ecosystems? And how about the corruption and breach of faith, like the Endau-Rompin affair in Malaya, and the Sekundur logging in Indonesia? If provision were made for their answer (and attention paid to altitude, firewood and minor products), this and the foregoing chapter, perhaps combined with Ashton's, would make a fine and balanced introduction to a wise utilization of rain forest resources.

The 216 references come under 7 headings.

The following chapters, in Part III 'Some Regional Case Studies', are unnumbered, but signed. For reasons of exhaustion and mostly unfamiliarity on the reviewer's part, they are here mentioned but not reviewed.

F.BERNHARD-REVERSAT e.a., *Structure and functioning of evergreen rain forest ecosystems of the Ivory Coast;* p. 557-574, 7 fig.

R.CATINOT, *The forest ecosystems of Gabon: an overview;* p. 575-579.

R.M.LAWTON, *The management and regeneration of some Nigerian high forest ecosystems;* p. 580-588.

F.MALAISSE, *The Miombo ecosystem;* p. 589-606.

J.M.PIRES, *The forest ecosystems of the Brazilian Amazon: description, functioning and research needs;* p. 607-627, 7 fig.

S.K.SETH & O.N.KAUL, *The teak forests;* p. 628-640.

T.C.WHITMORE, *The forest ecosystems of Malaysia, Singapore and Brunei: description, functioning and research needs;* p. 641-653.

M.SCHMID, *The Melanesian forest ecosystems (New Caledonia, New Hebrides, Fiji Islands and Solomon Islands);* p. 654-683, 4 maps.

M. Jacobs

WOMERSLEY,J.S. (ed.), Handbooks of the flora of Papua New Guinea, volume I, xvii + 278 p., 115 fig. (1978, Melbourne), Prentice Hall International, 66 Wood Lane End, Hemel Hempstead, Herts. HP2 4RG, England. Price $ 38.10, cloth.

A brief introduction explains the position of New Guinea. N.M.U.Clunie contributed an 11-page chapter on Vegetation. An illustrated Glossary is given at the end. Production is very good.

The taxonomic part stands out by clear, not too long descriptions, followed by well-marked entries on Distribution, Ecology, Use, Vernacular names, and sometimes brief Notes. Like the other text, it is obvious that the keys have been carefully framed with an eye on usefulness. Species are in alphabetical order. Under the names, the first reference is always given, later references are too few; on the other hand, under Terminalia a list of published illustrations has been given. Novelties were not found; new taxa were apparently published in precursory papers.

The families written up are: Amaranthaceae (genera 10 and species 24), Combretaceae (4 and 38), Corynocarpaceae (1 and 1), Datiscaceae (2 and 2), Eupomatiaceae (1 and 1), Himantandraceae (1 and 1), Magnoliaceae (2 and 2), Meliaceae: Chisocheton (22), Myristicaceae (excl. Horsfieldia, 3 and 41), Ochnaceae (2 and 3), Polygonaceae (4 and 19).

As for taxonomic delimitation, we have the good fortune of a 'second opinion' on Chisocheton (author P.F. Stevens) from Dr. D. Mabberley, whose monograph is in the press. He also found the key good, and agrees with the delimitation of the species ceramicus, gliroides, longistipitatus, montanus, novobritannicus, pohlianus, sapindinus, sayeri, schoddei, stellatus, tenuis. The others would be reduced to 'entities' under lasiocarpus. It is up to the users to decide who is right.

The drawings are in general disappointing. Of the many flowering Chisochetons drawn, not a single dissection has been given. Leaves are drawn as cracked as they were dried. If details are drawn, they have not properly been lined up.

More important is the question about the strength of viability of such a project. That in a first volume two families are published incomplete gives rise to doubts. If difficulties to revise Horsfieldia, Dysoxylum, Aglaia now cannot be surmounted, how will the work fare? We hope for the best. — M.J.

ZIMMERMANN,M.H., Structural requirements for optimal water conduction in tree stems. In Tomlinson & Zimmermann (ed.), Tropical Trees as Living Systems (1978) 517-532, 3 fig.

Vessel length is functionally immaterial. What matters is safety against air bubbles which render a vessel useless. In narrow vessels this chance is small, and scalariform perforations may decrease it further. — M.J.

OLIVIER,R.C.D., On the ecology of the Asian Elephant, Elephas maximus Linn. / with particular reference to Malaya and Sri Lanka, 454 p. in 2 vol., offset (1978, Applied Biology, Pembroke Street, Cambridge CB2 3DX, England). Subscription price US$ 33.25 for the bound edition.

This thesis is the result of three years of field work; the author was also for a short period at Bohorok in N. Sumatra.

While elephants probably exerted a greater influence on the vegetation in Africa, to the botanist the Asian elephant is an interesting animal nevertheless, as it consumes at least 150 kilogrammes of vegetable matter daily and destroyes probably much more temporary by trampling and other means. Olivier compared broad vegetation types, the dry deciduous forests of Sri Lanka and the evergreen rainforests of Malaya; the latter divided as elephant habitats in primary and secondary ones, and these again into natural secondary and manmade secondary forest. Rainforests under human exploitation and under rejuvenation-schemes are reckoned among the man-made secondary forest. Such forms of human exploitation of the rainforest are not in themselves harmful regarding elephant survival when poison-girdling of certain tree species is omitted.

In rainforest areas the secondary forest has a greater amount of elephant food available. (These findings do not contradict old Dutch publications on Sumatran elephants and Sumatran vegetation - not directly mentioned in Olivier's study - such as: W.Groeneveldt, Een overzicht van de vaste trekwegen van olifanten in Zuid-Sumatra alsmede enige gegevens over rhinocerossen. Ned.Comm.Intern.Natuurbesch. Meded. no. 12. Map. Amsterdam 1938. - A survey of the traditional elephant trails of South Sumatra and some notes on rhino. Neth.Commission Internat.Nature Protect. Map. - And: C.G.G.J.van Steenis, Maleise vegetatieschetsen. Tijds.Kon.Ned.Aardr.Gen. 52 (1935) 25-67, col.vegetation map. - Ranges of several herds in Sumatra are of the same order as mentioned by Olivier, approximately 100 to 400 square kilometers.)

It is concluded that in general mosaic habitats in rainforest areas, such as floodplain and riverine situations are optimal for Asian elephants. Following especially Sumatran traditional elephant trails, one may confirm Olivier's findings in Malaya that the Asian elephant is heavily dependent on grass and otherwise may be called a palmivore.

Volume 2 (from p. 335) is of great interest for the botanist too, especially Appendix E, "Foodplants of the Elephant in Rainforests of Malaya and Sumatra" where methods of identification are given. On top of the 98 identified tree species for instance given there are a number of 36 cases known only by genus or a vernacular name, which may be rated a good score. A modern direct method of radiocollaring wild elephants contributed to this kind of knowledge too. Let us skip here for lack of space the woody climbers or lianas (akar), the palms, the pandans and the herbs, wild or cultivated, the grasses with bamboos included, the sedges.

Also the previously recorded genera of foodplants of elephants in Malaya and Sumatra, but not observed during Olivier's work.

My conclusion is that this thesis will remain a handbook for everyone who studies the Asian elephant. Such work will remain a necessity in the future too, as every herd of this versatile mammal has its own characteristics. An extract of Olivier's thesis was announced to be published in the journal Oryx, with emphasis on conservation of the Asian elephant and its habitats. — F.W. Rappard, The Hague.

LY-TIO-FANE,Madeleine, Pierre Sonnerat 1748-1814 / An Account of his Life and Work, xv + 157 p., 32 fig. (1976). Mauritius.

The author, a well-known expert on the French colonial history of Mauritius (Isle de France), the spice trade, etc., this time produced an extensive biography of the naturalist-explorer Sonnerat, followed by a Chronology. The 2nd chapter deals with the 'Predecessors of Sonnerat in the Mascarenes, notably with J.-B.Chr. Fusée Aublet and Ph. Commerson'. Sonnerat's published travel-stories pass in review. A Prospectus for a third work of three volumes was found in the papers of L.-A. de Jussieu. Notwithstanding an intensive search, no manuscript did turn up as yet.

Of interest for the Malesian area is Mlle Ly-Tio-Fane's find that Commerson bought part of Sonnerat's collections from the Philippines (cf. note 1, p. 67, l.c.). It will specifically refer to the zoological collections as the evidence was found in the Musée d'Histoire Naturelle in Paris, but that the botanical collections of the two Frenchmen were known to have been partly mixed was already stated in 1950 (Fl. Males. I, 1, p. 113, 494).

Special mention must be made of the numerous sources which were studied, and the beautifully reproduced illustrations. — M.J. van Steenis-Kruseman.